



# PROCEEDING BOOK

of

## INTERNATIONAL SYMPOSIUM FOR ENVIRONMENTAL SCIENCE AND ENGINEERING RESEARCH



# ISESER 2021



June 11-13, 2021 TIRANA



**ISESER**

**PROCEEDING BOOK**  
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**June 11-13, 2021 TIRANA**

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**O 1. EVALUATION OF ALLERGIC ASTHMA CAUSED BY POLLEN IN A GROUP POPULATION OF TIRANA**

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**ABSTRACT:** An allergic response occurs when immune system proteins (antibodies) mistakenly identify a harmless substance, such as tree pollen, as an invader. In an attempt to protect your body from the substance, antibodies bind to the allergen. The chemicals released by your immune system led to allergy signs and symptoms, such as nasal congestion, runny nose, itchy eyes or skin reactions. For some people, this same reaction also affects the lungs and airways, leading to asthma symptoms. The study of allergic asthma by immunological methods, and the determination of pollens as allergens is important in determining the diagnosis and avoiding, or treating, asthma. These allergens contact our body through the skin, airways and food. Pollen enters the lungs through the air and comes in contact with the mucous membranes of the nose, throat and bronchi. It has been noticed that the presence of allergens such as pollen in our country is very high, especially in Tirana. In the city of Tirana, there has been an increase in people with respiratory and food allergies, being very polluted by increased traffic, by malnutrition with fast and canned food, etc. Pollen determination methods have been applied in the city of Tirana. Individuals underwent the Alleisastreen test. It has been observed that in general the age group up to 10 years is always the most affected to any type of allergy. This test is very sensitive and determines the presence of pollen as an allergen, with a single test with a very high degree of sensitivity and the presence of the allergen. The group of individuals taken in the analysis were 100 of which 34 came out negative from the Alleisastreen test and 66 positive's cases. What is of interest in this study is that most of the population has a lack of information about allergies and pass it on as something normal. For the first time, pollen as a larynx and its connection with allergic asthma has been studied in the city of Tirana. Through biostatistical analyzes we have seen the association of allergic asthma in relation to their age group, gender and place of residence.

**Keywords:** Allergic asthma, pollen, pollution, Alleisastreen test, allergies, etc.

**INTRODUCTION**

Allergy is a disease which is related to immunological reactions, which are carried out in the body and as a result of an inflammation appear clinical signs such as: redness, swelling, itching, etc. It depends on several factors such as age, gender, lifestyle and genetic predispositions (2,4).

Asthma is a long-term inflammatory disease of the airways of the lungs(13,17). It is characterized by variable and recurring symptoms, reversible airflow obstruction, and easily triggered bronchospasms (10,11). Symptoms include episodes of wheezing, coughing, chest tightness, and shortness of breath (1,12). These may occur a few times a day or a few times per week (3,15) Depending on the person, asthma symptoms may become worse at night or with exercise (3).

Asthma is thought to be caused by a combination of genetic and environmental factors (4, 11). Environmental factors include exposure to air pollution and allergens (18,21). Other potential triggers include medications such as aspirin and beta blockers (14). Diagnosis is usually based on the pattern of symptoms, response to therapy over time, and spirometry lung function testing (15). Asthma is classified according to the frequency of symptoms, forced expiratory volume in one second (FEV1), and peak expiratory flow rate (18). It may also be classified as atopic or non-atopic, where atopy refers to a predisposition toward developing a type 1 hypersensitivity reaction (13,20).

In most cases it happens that some people who have skin irritations or redness, classify it as allergy or vice versa. All this comes because of not performing diagnostic tests and not being aware of these diseases (16,17).



**Fig 1.** Skin asthma alergy.



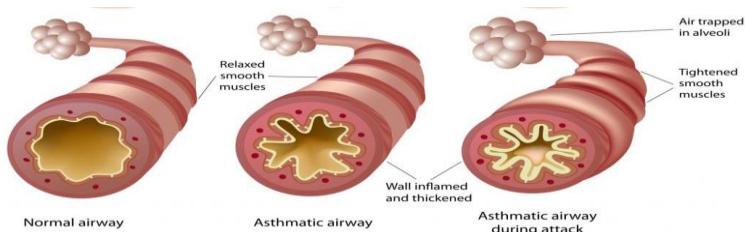
**Fig 2.** Asthma and pollen

Substances that cause allergies are numerous, but some are the most important: Pollen, food; dust; pollen; metals and cosmetic products.

Allergies and asthma often occur together.

The same substances that trigger your hay fever (allergic rhinitis) symptoms, such as pollen, dust mites and pet dander, may also cause asthma signs and symptoms. In some people, skin or food allergies can cause asthma symptoms. This is called allergic asthma or allergy-induced asthma (15). An allergic response occurs when immune system proteins (antibodies) mistakenly identify a harmless substance, such as tree pollen, as an invader. To protect your body from the substance, antibodies bind to the allergen (5,6).

The chemicals released by your immune system led to allergy signs and symptoms, such as nasal congestion, runny nose, itchy eyes or skin reactions. For some people, this same reaction also affects the lungs and airways, leading to asthma symptoms (20,21).



**Fig 3.** The influence of pollen in the respiratory airway in alergic asthma.

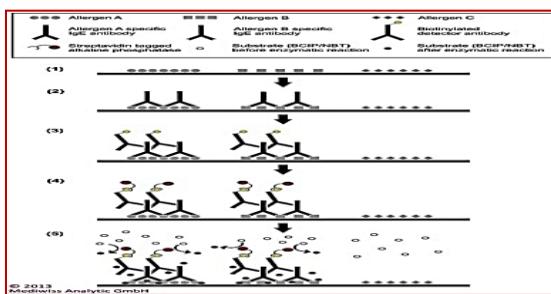
## MATERIALS AND METHODS

This work was carried out in the period January -November 2019. For the realization of this study, biological samples were collected and taken, which were collected according to the relevant procedures and stored according to appropriate conditions. During the period January -November 2019, 100 blood samples suspected of the presence of allergens were analyzed, where 59 came out positive and they received the appropriate treatment.

Two methods were used to achieve the objectives of our study:

(1) Alleisastreeen Technique (MEDWISS Analytic GmbH); (2) Surveys.

The AlleisaScreen test is a very simple test to use. It is a test that analyzes blood serum and is not applied directly to the skin thus avoiding side effects. This test measures the amount of IgE antibodies formed as a result of a suspected allergen using a series of allergens in its composition. There are 30 types of allergens on the panel, so with a single analysis we can detect a series of allergens, which affect us in different seasons and at different times of the year. It measures the amount of IgE with the unit of measurement iU/ml; as well as measuring food and inhaler allergens. The first step is to take the blood of a person who is suspected of having allergies. Once the blood is taken, the normal procedure for obtaining blood serum is performed. The procedure for assessing the present allergens is done by several methods: Improvio scanners, CubeScreen Reader or RapidReader. Concentration of IgE in our sample is done by dividing into several classes or ranks.



**Fig 4.** The scheme of action of pollen with IgE antibodies in a Allesiascreen test

## REALIZATION AND DISCUSSION

The observed data were presented in mean value and in standard deviation. Discrete data were presented in absolute value and in percentage. The data were presented by means of tables and graphs of different types, type diagrams and surface diagrams. SPSS statistical package is used for data analysis. After application of the Allelisascreen test, most patients tested positive for one or more pollens, with varying degrees of positivity.

**Table 1.** Comparison of age groups in relation to cases of allergies

Age Groups	No. of cases	Percentage	Cum.
1-10 years old	47	91%	91%
11-20 years old	12	7.5%	98.5%
< 20 years old	7	1.5%	100.00%
Total	66	100.00%	

In Table 1, in the three groups of age 1-10 years, 11-20 years and 21-30 years, an unequal number of patients with allergies is observed. The largest number of cases is observed in the first age group from 1-10 years, with 91% of cases, the second age group with 7.5% and the third age group with 1.5% of the sample.

**Table 2.** Allergic plants in the area of Tirana

No.	Types of plants that cause allergies.	Flowering period
<b>GYMNOSPERMAE</b>		
<b>F. Pinaceae</b>		
1.	<i>Pinus pinea</i> L.	April -May
2.	<i>Pinus sylvestris</i> L.	May-June
<b>ANGIOSPERMAE</b>		
<b>F. Aceraceae</b>		
3.	<i>Acer obtusatum</i> Kit.	April -May
<b>F. Amaranthaceae</b>		
4.	<i>Amaranthus retroflexus</i> L.	August - October
<b>F. Araliaceae</b>		
5.	<i>Hedera helix</i> L.	Septemeber- October
<b>F. Campanulaceae</b>		
6.	<i>Campanula rapunculus</i> L.	May - Septemeber
<b>F. Caprifoliaceae</b>		
7.	<i>Sambucus ebulus</i> L.	June - August
<b>F. Caryophyllaceae</b>		
8.	<i>Stellaria media</i> (L.) Vill.	Spring- Autumn
<b>F. Compositae</b>		
9.	<i>Artemisia absinthium</i> L.	June - Septemeber
10.	<i>Calendula arvensis</i> L.	March - April

No.	Types of plants that cause allergies.	Flowering period
11.	<i>Centaurea cyanus L.</i>	May - July
12.	<i>Chrysanthemum leucanthemum L.</i> <i>(Leucanthemum vulgare Lam.)</i>	May - August
13.	<i>Dahlia</i> sp	August - September



**Fig. 5. Gender *Cupressus L***  
***Cupressus sempervirens L***  
Geographical distribution in Europe:  
Southern Europe



**Fig. 6. Family Pinaceae**  
***Juniperus communis L subsp. *communis****.  
Geographical distribution in Europe:  
throughout Europe, mainly in the  
mountains to the south



**Fig. 7. *Thuja orientalis L***  
***Gender Thuja L***  
***(Biota orientalis Endl)***  
Geographical spread in Europe



**Fig. 8. Gender *Cedrus deodora* (D.Don) G. Don fil.**  
Geographical distribution in Europe:  
cultivated in Europe.

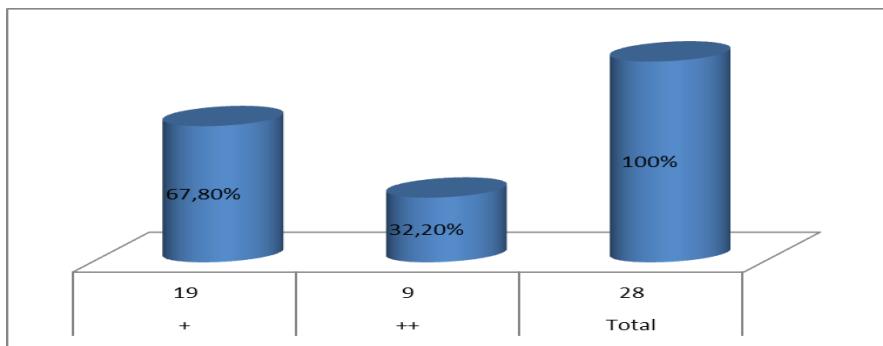


**Fig. 9. Gender *Pinus***  
Geographical distribution in Europe:  
cultivated in Europe.

In figures from 5 to 9 are presented the main tree which produced pollen, the causer of alergic asthma in Tirana.

In our study, the number of women who underwent Allesisastream surgery was higher than that of men (54% compared to 46% of men).

The age group most affected by any type of allergy is the first one, which includes infants and children. Even from a study the most affected age group is that of children with twice the cases of adults (11). This is due to the complete failure of the immune system and the signs of the appearance of these symptoms such as irritation, rash to asthma are more frequent and more evident in infants and children.



**Fig. 10.** Division of cases according to the degree of presence of the allergen.

From the graph above we see that in 67.8% of cases we have a mild allergy, which appears with slight irritation while in 32% of cases of the tested we have a high presence of allergens. + (low presence), ++ (high presence)

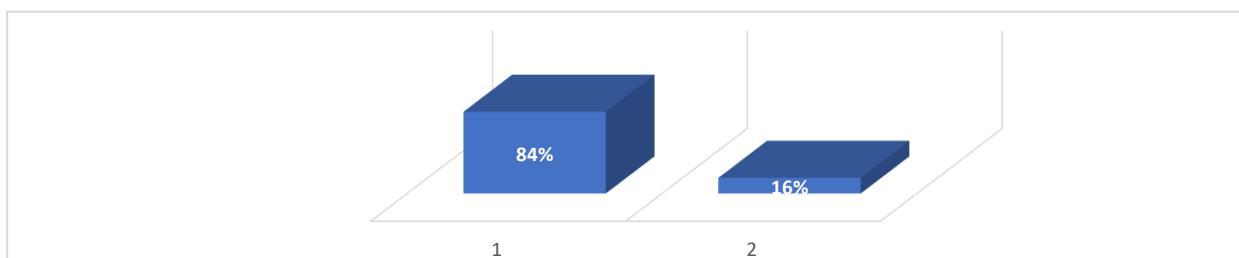
Allergic asthma is very common and out of 100 individuals taken for analysis 70 of them have come to perform a test related to allergic asthma. Out of 70 individuals analyzed, 38 were positive. Of the 38 individuals analyzed 8 are positive males and 30 are female. So, it is obvious that women are more affected by the surveys done. This also comes as a result of the care they have for themselves by not letting an irritation pass as a common symptom.

**Table 3.** The degree of positivity in allergen-positive patients

Alesiascreen test positivity rate Allergic Asthma	Number of positive cases	Percentage in the group
+	32	84%
++	6	16%
Total	38	

Each analysis performed has a degree of presence of the allergen. With a (+) we will denote the lowest degree of presence of the allergen, with two (+) we will denote the highest degree of the presence of the allergen. From the analyzes performed, our test manages to capture even the lowest degree of allergen, so we have divided them into several categories: not at all or little present [0.00-0.34 IU / ml], minimum limit [0.35-0.69 IU / ml], low presence [0.70-3.49 IU / ml] sensitive presence [3.50-17.49 IU / ml], high [17.5-49.9 IU / ml], very high [50.0-100.0 IU / ml]. But since in the tests performed the low presence and sensitive presence groups were dominant, I divided them into 2 large groups.

From the table above we have marked with (+) the low degree of allergic asthma and with (++) the high degree. 84% of cases are in the low rate, while 16% are in the high rate.



**Fig. 11.** The degree of positivity of cases with allergies.

From the graph above we see that the number of cases with a low rate of allergic asthma constitute the largest number with 32 cases (84%) and those with a high rate of allergies account for 6 cases (16%).

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To observe the relationship that exists between gender and allergic asthma, we will use a statistical test  $\chi^2$  since we have qualitative variables. In this test what is important is the significance value, which indicates the accuracy of the test.

**Table 4.** The  $\chi^2$  link between gender and allergic asthma cases

		Allergic asthma cases			
		Yes	No	Total	
Gender	Female	41	13	54	
	Male	25	21	46	
Total		66	34	100	
	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.154	1	.023		
Continuity Correction <sup>b</sup>	4.237	1	.040		
Likelihood Ratio	5.177	1	.023		
Fisher's Exact Test				.034	.020
Linear-by-Linear Association	5.103	1	.024		
N of Valid Cases	100				

Test value  $X^2_{(1)}=5.154$ ;  $p=0.023$

Since  $p < 0.05$ , then gender is related to allergic asthma.

In conclusion we can say:

From the analyzed data, the age group most affected by allergic asthma are children in 91% of cases. In our study the gender most affected by allergic asthma is the female, with 62% of cases with allergies. In 78% of cases patients suspected of allergic asthma have not undergone testing or treatment, leading to worsening of the condition and even asthma. The most common symptoms caused by the allergen are irritation, respiratory blockage, sneezing, redness.

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## O 2. STUDY OF SNOW DEPTH AND BIOCLIMATIC IMPACT

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**ABSTRACT:** One of the most important climatic elements in a certain area is snow. The amount and depth of snow matter, as they have an impact on the lives of plants and animals, as well as the components of the climate. The scientific techniques used at NOAA provide accuracy and estimates for large climatic zones. The impact of snow depth is related to the water balance, the passage of plant stages, the adaptability of living things, climate change, etc. Climate warming can reduce snowfall and cause earlier spring melts and shorter snow cover seasons. For instance, warmer air in Alaska has caused the snow to melt earlier each spring, lengthening the snow-free summer season. Seasonal snow is an important part of Earth's climate system. Snow cover helps regulate the temperature of the Earth's surface, and once that snow melts, the water helps fill rivers and reservoirs in many regions of the world, especially the western United States. In terms of area, snow cover is the largest single component of the cryosphere, covering an average of about 46 million square kilometres (about 17.8 million square miles) of Earth's surface each year. About 98 percent of the Earth's snow cover is located in the Northern Hemisphere. This study was conducted within the project: Evaluation of JPSS satellite and blended snow products, project NOAA, USA.

**Keywords:** *Study of snow depth, bioclimatic impact, ecosystems*

**Acknowledge:** Evaluation of JPSS satellite and blended snow products, project NOAA, USA

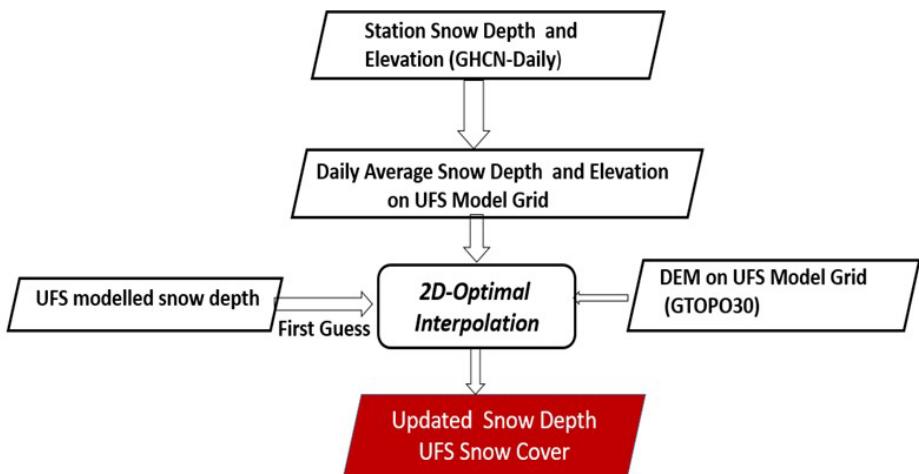
## INTRODUCTION

This study describes the application of the 2D-OI method over No1the1n Hemisphere using NOAA's operational Global Forecast System (GFS) modelled snow depth as first guess, and the station-measured snow depth observations during the winter season of 2016-2017. The layout of the paper is as follows: The next section describes the input/output and evaluation data and the specific application of the scheme, followed by a discussion of main results and conclusive remarks.

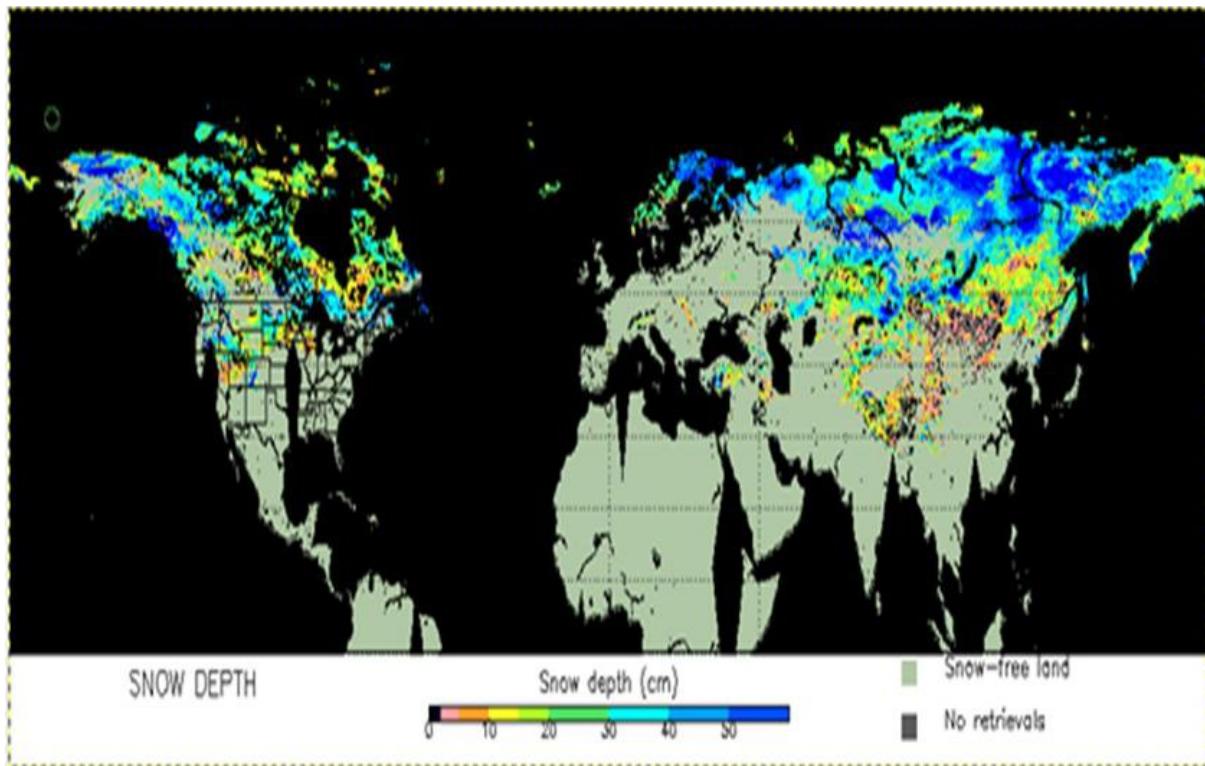
## MATERIAL AND METHODS

### *Bias Collection of Satellite-derived Snow Depth*

Snow depth at a grid point is estimated from updating a first guess snow depth, in this case the forecast from NOAA's Unified Forecast System (UFS), with an analysis snow depth increment, the latter computed as the weighted average of snow depth data increments at the surrounding stations. Weights are calculated using spatial correlation function  $s$  of snow depth with respect to horizontal distance and elevation difference between pairs of station data. E-folding scales for horizontal distance and elevation functions are fixed at 120 km and 800 m, respectively. For a detailed description of the method the reader is referred to Brasnett, 1999; Brown et al., 2010, de Rosnay et al., 2015, and Kongoli et al., 2009.



**Figure 1.** 2-Dimensional Optimal Interpolation (2D-OI) implementation scheme applied to NOAA's (by C. Congoli).



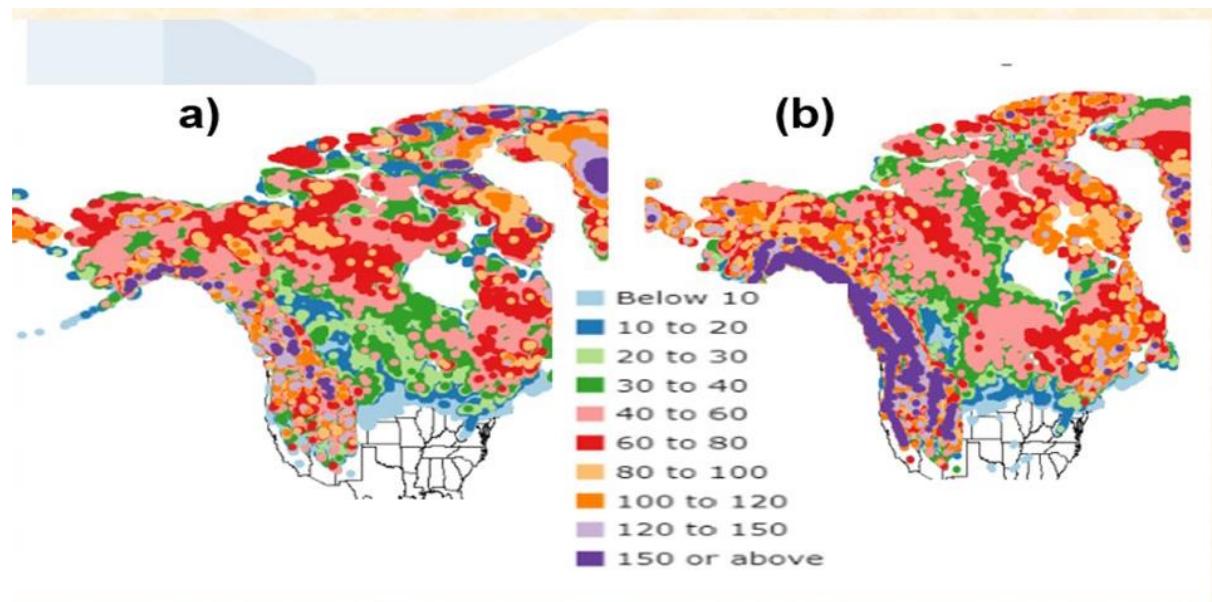
**Figure 2.** AMSR-2 Snow Depth before (top) and after (bottom) bias collection applied to in-situ data from GHCN-Daily using optimal interpolation (by C. Congoli)

## RESULTS

Visual inspection of the maps shows that the largest differences between the Global Forecast System-derived snow depth and the optimal interpolation-based snow depth are concentrated over Western US and Canada, in high mountain terrain. Blue coded areas denote high snow accumulations correctly estimated by the optimal interpolation-based snow depth analysis, whereas the forecast (UFS) makes large and consistent underestimations that increase as the snow season progresses. More importantly, as the season progresses from January to February GFS area coverage of snow accumulations decreases, which is not realistic, whereas the snow depth analysis correctly estimates increased accumulations in Western US.

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US and Canada. Average bias for the forecast snow depth over areas above 1000 m was - 22.0 cm, whereas the bias for the optimal interpolation-based analysis was relatively small (4.4 cm).



**Figure 3.** Map of Snow Depth Distribution (in cm) from the NCEP Global Forecast System (a) and from the 2-Dimensional Optimal Interpolation on February 1, 2017.

## **CONCLUSIONS**

The distribution of snow depth over the Northern Hemisphere is investigated by 2-Dimensional Optimal Interpolation applied to synoptic station snow depth measurements. The scheme uses snow depth derived from NOAA's Global Forecast System (GFS) as a first guess. The main finding of the study was that the technique significantly improves forecast snow depth, especially over mountain terrain, making it suitable for reliable snow assessments over these regions. The technique also improves estimations over remote poorly monitored areas due to the successful application of a large radius (600 km) and number of in-situ stations for interpolation (50).

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**O 3. IMPACT OF RAINWATER AND VALIDITY FOR DOMESTIC USE**

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**ABSTRACT:** Rainwater collection is an ancient practice in many countries and a relatively new concept in Albania. To get national attention, being Albania a country with hydric potential in the winter period, we must encourage part of the population to implement some of the sustainable practices such as the rainwater management approach. Given the economic potential of this green practice which will soon become a way of life, the need to preserve rainwater should be emphasized to illustrate the economic value, which is a long-term investment to save money, water, reduce local floods, longer life for the roads, and incrementation of the apartments financial value. The study is focused on the city of Durres, as the roads of the city are always flooding during storms in winter and has a limited amount of water available during summer, mainly due to serious losses of drinking water in the distribution system. We will present here a case study of rainwater management system design and cost analysis.

**Keywords:** Rainwater management system, hydric potential, water collection plant, green practice.

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**O 4. PRELIMINARY FINDINGS ON RARE EARTH ELEMENT GEOCHEMISTRY OF SOILS  
IN SOUTHERN KONYA (TURKEY)**

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**ABSTRACT:** The study area located in southern part of Konya (Turkey) is dominated by sedimentary rocks, ophiolitic rocks and volcanites. The topsoils (0-20 cm) show that it is dominated by calcite, quartz, dolomite, plagioclase and kaolinite. The ophiolitic soils located on ophiolitic units mainly comprise serpentinite, titanomagnetite, magnetite, chlorite, amphibole, hematite, goethite, talc, smectite, diopside, quartz, calcite, and Cr-rich minerals. The volcanic soils located on volcanic rocks mainly comprise feldspar, amphibole, jarosite, magnetite, mica/illite, kaolinite, quartz, and calcite. The sedimentary soils located on carbonate rocks mainly consist of calcite and dolomite. 65 investigated topsoil samples in southern Konya have 92.88 ppm (mg/kg) average REE amount. The average light rare earth element (LREE) concentration (84.81 ppm) in studied topsoils is higher than the average heavy rare earth element (HREE) concentration (8.07 ppm). The REE distribution patterns of the topsoils are similar to those of Post-Archean Australian Shale (PAAS), North American Shale Composite (NASC) and upper crust (UC).

**Keywords:** *REE, geochemistry, soil, southern Konya, Turkey.*

**O 5. ANTIBIOTIC POLLUTION IN THE ENVIRONMENT – SOIL RESISTOME**

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**ABSTRACT:** Environmental antibiotic pollution is a problem that is expected to gain more attention in the near future since antibiotic consumption is still increasing around the world. Antibiotic pollution is poorly regulated on a local and global scale, antibiotic molecules are increasingly found in terrestrial, freshwater, and marine environments. Fluoroquinolones are one of the most used classes of antibiotics. Enrofloxacin belongs to the class of fluoroquinolone antibiotics that have been intensively used for the treatment of bacterial infections in veterinary medicine. In the environment, enrofloxacin can undergo degradations by different processes including photolysis, biodegradation, and oxidation by mineral oxides but it is not sensitive to hydrolysis. Despite these degradation mechanisms, the environmental half-life time of enrofloxacin is very long. In this study, the effect of enrofloxacin on the function and structure of soil microbial communities was evaluated. In pots with different concentrations of enrofloxacin were planted: *Lactuca sativa* var. *crispa*, *Anethum graveolens*, *Thymus serpillum*, *Mentha piperita*, *Calendula officinalis*. Soil respiratory responses were inhibited at the high enrofloxacin concentrations in the soils and were increased at the lowest concentration (10 mg·kg<sup>-1</sup>). The maximum level of soil toxicity was 67.21% at the concentration of enrofloxacin 1000 mg·kg<sup>-1</sup>, in the control this parameter was 8.56%. The soil with a high concentration of antibiotics was characterized by a low content of nitrogen-fixing microorganisms and a high number of oligotrophic and spore-forming microbiota. Thirty-seven antibiotic-resistant bacterial isolates were cultured from the soil. All isolates were multi-drug resistant, of which greater than 64% were resistant to 9–12 antibiotics, comprising almost all classes of antibiotics. The antibiotic contamination of the soil causes negative changes in the microbial community, reduces the respiratory activity of the soil, and is one of the important factors in the formation of soil resistome.

Acknowledgment. This project was supported by the Slovak Academic Information Agency (SAIA), grant number 18032.

**Keywords:** *Antibiotic, soil, microbiome, resistance.*

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**O 6. MODERN DISTRIBUTION FEATURES OF THE MULTI-YEAR TEMPERATURE REGIME IN AZERBAIJAN LAND**

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**ABSTRACT:** The distribution of temperature regime in the territory of the Republic of Azerbaijan in 1961-2016 was studied, observation data of hydrometeorological stations operating in this period were used in this research study. As a result of mathematical, statistical and cartographic analysis, it has been again clarified that the temperature regime of the republic varies from north to south and from the plains to the highlands. In addition, multi-year average and seasonal indicators of temperature in different regions of the country were determined. The stations used in the analysis are located in the range of -25  $\div$  2218 m. In higher areas the determination of the abovementioned quantity is based on the variation of the vertical gradient. The study shows that the maximum values of the perennial average temperature are observed in the Kur-Araz plain in the range of 14.6-15.4 °C. The average perennial temperature decreases at higher elevations. The results of the study can be used in future research on climate regime and change, agriculture, tourism and the creation of other large-scale industries in the region.

**Keywords:** *Hypsometric features, transformation, convergence, climate types, climate change, interpolation, correlation, variation*

**INTRODUCTION**

It is known that the formation of the Earth's climate regime begins with the uneven heating of the Earth's surface by rays from the sun. On an uneven surface, all climatic parameters, including key elements and manifestations such as the pressure, the wind, the evaporation, and the precipitation, are distributed completely differently. [1,7,24]. Therefore, the climate regime is observed in different regions of the planet with different characteristics. Each region is characterized by its own climate. The physical-geographical position, the hypsometric features, the complexity of the relief of the territory of Azerbaijan Republic, located in the South Caucasus region, have led to the diversity of climatic regimes [1,2]. Therefore, 8 climate types out of 11, identified by V.P. Keppe exist in the territory of the republic [4,7].

The complexity of the relief and its location on the shores of the Caspian Sea, with a difference on 4494 m between the highest peak (Bazarduzu, 4466 m) and the lowest point (Caspian lowland, -28 m), play a key role in the formation of diversifying in the distribution of the climate [1,13]. Scientists such as A.M.Shikhlinsky, A.A.Madatzade, A.M.Eyyubov, G.A.Hajiyev, A.S.Mammadov, S.A.Safarov, S.H.Safarov, R.N.Mahmudov, N.Sh.Huseynov and others have been engaged in the research of the temperature regime in the territory of the republic [2, 8, 9, 13].

Nowadays, global climate changes, which is observing all over the Earth, is affecting the climate regime of all regions. The growing of climate change affects, time ranges of observations year by year makes necessary the conducting of new research in this area. Also, previous studies did not include a comprehensive research of the multi-annual temperature regime of the region.

**MATERIAL AND METHOD**

Generally, in the research work there has been used data from 58 hydrometeorological stations, functioning in Azerbaijan. The used observation data cover 34 main stations, which is covering 1961-2016 y.y., in particular, the 55-56-year observation ranges. Other station data are from different periods and have been used for general clarifications of neighboring stations.

By the method of mathematical averaging of the temperature observation data there has been obtained the temperature of mean monthly, seasonal and multi-year indicators. At the same time, the mean quantities of temperature fluctuations in 1991-2016 y.y. compared to 1961-1990 y.y. have been found.

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The variation, the intra-row correlation, the asymmetry coefficient, standard deviation, and statistical significance of ranges have been tested by Fisher and Student criteria [6]. In statistical analysis, the coefficients of the variation, the asymmetry, and the inter-row correlation of ranges have been determined with the help of SBSS, Stokstat programs. Tables, histograms and graphs from the obtained results have been developed in Microsoft Excell and the electronic map in the ArcGIS software.

The purpose of the work. The purpose of the research is to determine the distribution of the temperature regime in the territory of Azerbaijan over 1961-2016 y.y., to redefine the characteristics of vertical and horizontal zoning, also the clarification of the impact of global climate change on the mean temperature in 1991-2016 y.y. compared to 1961-1990 y.y. At the same time, the attention is paid to the impact of global climate indices on the region over multi-annual period. On mapping the results, certain regularities in the distribution of the mean annual temperature over the area are investigated.

Discussion of the research. Statistical clarifications have been made to verify the statistical significance of the observation data used over the analysis. The identified results are given in the table below (Table 1).

The mean square inclination, which characterizes the variability of the ranges, characterizes the spread or disintegration of a given ranges around the mathematical expectation (mean value) in the change of the parameter depending on the time [21]. The standard deviation of the analyzed ranges is around 0.65-0.97, which indicates the conformity to the reality of our observational data.

## **RESEARCH FINDINGS**

The purpose of the research is to determine the distribution of the temperature regime in the territory of Azerbaijan over 1961-2016 y.y., to redefine the characteristics of vertical and horizontal zoning, also the clarification of the impact of global climate change on the mean temperature in 1991-2016 y.y. compared to 1961-1990 y.y. At the same time, the attention is paid to the impact of global climate indices on the region over multi-annual period. On mapping the results, certain regularities in the distribution of the mean annual temperature over the area are investigated.

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The variation has been used to clarify the difference between the mean values for the two periods (1961-1990 y.y. , 1991-2016 y.y. ) over the 55-56 years under consideration [22]. As it can be seen from the table, the coefficient of the variation has been ranged from 0.01 to 0.17.

The statistical ranges are symmetric when the positive and negative values of the inclination of its members from the mean number have the same repetition (frequency). However, the ranges of hydrometeorological quantities are asymmetric [22]. The asymmetry coefficient of the ranges used has been distributed around  $-0.38 \div 0.39$

Over the calculation of the internal correlation, the ranges for 1961-2016 y.y. has been divided into two equal parts and positive or negative correlations of the repetition of the limits have been revealed. The internal correlation has been found around  $0.03 \div 0.54$ , and it indicates that the correlation between the two ranges is less.

**Table 1.** Statistical indicators of mean annual temperature of hydrometeorological stations for 1961-2016 y.y.

№	Station	n	S	C <sub>v</sub>	C <sub>s</sub>	r	t <sub>0</sub> , °C	A, °C	5%	
									Fisher	Student
1	Khachmaz	56	0,73	0,06	0,06	0,5	12,8	0,7	+	-
2	Guba	56	0,83	0,09	0,21	0,38	10,6	1,0	+	-
3	Kiriz	56	0,83	0,17	0,39	0,24	5,0	0,8	+	-
4	Altiaghaj	56	0,89	0,01	0,19	0,34	8,9	0,7	+	-

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5	Baku	56	0,65	0,06	0,20	0,04	14,8	0,2	+	+
6	Sumgayit	55	0,72	0,05	-0,10	0,18	14,6	0,6	+	-
7	Mashtagha	55	0,82	0,06	-0,10	0,41	14,4	0,8	+	-
8	Pirallahı	56	0,77	0,05	-0,14	0,47	14,7	0,7	+	-
9	Chilov	56	0,77	0,05	0,01	0,22	14,7	0,6	+	-
10	Neft Dashlari	56	0,69	0,05	0,02	0,46	14,8	0,6	+	-
11	Zagatala	56	0,84	0,07	0,11	0,34	13,2	0,8	+	-
12	Sheki	56	0,85	0,07	0,05	0,34	12,5	0,8	+	-
13	Gabala	56	0,95	0,08	0,11	0,54	11,6	1,1	+	-
14	Shemakha	56	0,89	0,08	0,27	0,1	11,4	-0,1	+	-
15	Maraza	56	0,8	0,07	-0,14	0,42	11,0	0,7	+	-
16	Mingechevir	56	0,83	0,06	0,09	0,41	15,4	0,7	+	-
17	Yevlakh	55	0,76	0,05	-0,07	0,27	15,2	0,6	+	-
18	Goychay	56	0,8	0,06	-0,21	0,48	15,0	0,9	+	-
19	Kurdemir	55	0,84	0,06	-0,1	0,4	15,3	0,9	+	-
20	Zerdab	55	0,80	0,06	-0,32	0,34	15,2	0,8	+	-
21	Beylegan	55	0,75	0,07	0,33	0,32	14,6	0,7	+	-
22	Jafarkhan	56	0,70	0,05	0,05	0,28	14,7	0,6	+	-
23	Hajigabul	55	0,77	0,05	-0,2	0,29	15,4	0,7	+	-
24	Bilesuvar	55	0,76	0,05	0,01	0,3	14,9	0,6	+	-
25	Neftchala	55	0,81	0,07	0,36	0,36	15,1	0,6	+	-
26	Lenkeran	56	0,77	0,06	-0,34	0,39	14,5	0,8	+	-
27	Yardimli	56	0,69	0,06	-0,06	0,22	12,1	0,1	+	+
28	Aghstafa	56	0,83	0,07	0,24	0,37	13,0	0,8	+	-
29	Gedebey	56	0,81	0,11	0,4	0,23	8,1	0,6	+	-
30	Shemkir	55	0,74	0,05	0,04	0,44	14,2	0,8	+	-
31	Ganja	55	0,70	0,06	0,13	0,48	13,8	0,9	+	-
32	Nakhchivan	56	0,96	0,08	-0,38	0,29	12,6	0,7	+	-
33	Ordubad	56	0,97	0,07	-0,23	0,31	13,8	0,6	+	-
34	Shahbuz	55	0,92	0,08	0,12	0,03	11,7	0,4	+	+

*n- number of ranges (years); S- mean square inclination; Cv- variation; Cs - asymmetry coefficient; r- autocorrelation; t<sub>0</sub>- mean annual temperature; A- temperature anomaly in 1991-2016 y.y. compared to 1961-1990 y.y. ;*

In the research there have been determine variabilities of the mean temperature in 1991-2016 y.y. compared to 1961-1990 y.y. The results show that the temperature in the country increased averagely 0.7 0C in 1991-2016 y.y. This quantity is between -0.1 0C and 1.1 0C at other stations. However, there is the low indicator in Shamakhi (-0.1 0C) and Yardimli (0.1 0C) stations, and we believe there are technical failures and non-professional measurements for many years.

The statistical significance of the ranges has been tested with a 5% and 10% assurance of the Fisher and Student criteria [6]. The statistical significance of Fisher's clarification gives a positive result at all stations. But in the Student criteria, negative results have been obtained at other stations than Baku, Yardimli and Shahbuz stations.

One of the main local reasons for the different distribution of climate regimes in the country is the hypsometric features of the relief. The complex orography of the country's territory plays a key role in

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the formation of the climate, the temperature regime of the air, as well as local air circulation (mountains-valleys, black-and-white winds, breezes, etc.) [9,11].

The mitigating effects of the Caspian Sea can always be felt in the coastal regions of the Republic of Azerbaijan. Thus, the sea in the coastal plains, islands and peninsulas softens the harsh characteristics of air masses from the north (cold), east (hot, dusty) and south (hot, dry) over the year. The above reasons cause both horizontal and vertical changes in temperature in the country.

The absolute heights of the stations used in the research are listed in the table (table 2). Stations belonging to natural regions are also indicated in parentheses. As can be seen from the table, Pirallahi (-25 m) is the lowest and Paragachay (2218 m) is the highest stations above the sea level compared to other stations.

On the north-eastern slope of the Greater Caucasus region (Khachmaz, Altiaghaj, Khaltan, Guba, Khinalig, Giriz) in 1961-2016 y.y., the mean annual temperature decreases from 12.8 0C (Khachmaz) to -5.0 0C (Kyrgyz) from the coastal plains to the mountain lands (table 1). Multi-annual temperature values are already reached below 0 0C in areas with glaciers and permafrost over the year (3000-3100 m). However, in the extensive research conducted by A.A. Madatzade and A.M.Shikhlinsky before us (1968), the mean annual temperature has been set at 12.2-4.7 0C for this area.

The mean seasonal distribution of the temperature is also different here. Thus, in winter it is 3.0 0C in the coastal plains, 0.4 0C in the lowlands (500-600 m), -0.8 0C in the 1000-1100 m zone of the middle mountain range, -3.4 0C at the height of 2000-2100 m. In the spring, it has been 10.6 0C at the coast, 9.4 0C in the lowlands, 8.0 0C in the middle mountain range of 1000-1100 m, 4.0-4.5 0C at the height of 2000-2100 m, and below 00C at the height of 2700-2800 m. In autumn, the mean seasonal temperature decreases to 13.9-14.4 0C, accordingly to 11.4 0C, 9.6 0C, 6.2-6.5 0C, and but above 3100-3200 m it consists of below 0 0C.

On the southern slope of the Greater Caucasus natural region (Alibey, Zagatala, Sheki, Oguz, Gabala, Shamakhi, Maraza) there are slightly different temperature regimes. Starting from the middle mountains (450-500 m) to the altitude of 1500-1600 m, the mean annual temperature decreases in the range of 13.2 0C (Zagatala) -6.3 0C (Alibey). It is likely that it receives values below 0 0C at an altitude of 2400-2500 m in accordance with the vertical change of the temperature (0.65 0C /100 m) (table 2). These indicators are observed between 12.5 0C and 5.7 0C in A.M.Shikhlinsky's research work.

On the southern slope of the Great Caucasus, it decreases to 1-3 0C in the foothill from 450 m to 700 m in the winter, and to 0.8 0C (0.5-1.0 0C) at 750-800 m at the south-eastern end. Already in the middle mountain lands, at an altitude of 1500-1600 m, this quantity is equal to -2.3 0C for the winter season (table 1). For the spring season, these values have been 13.9 0C, 12.3 0C, 11.1 0C, 9.6 0C, 4.7 0C and 26.0 0C, 23.6 0C, 22.8 0C, 22.3 0C, 15.3 0C, respectively. Also, in autumn it has been 15.8 0C, 14.0 0C, 13.1 0C, 11.6 0C, 7.4 0C.

The Absheron waters of the south-eastern end of the Great Caucasus region covers the peninsula of the same name (Sumgayit, Baku, Mashtagha, Alat) and several small islands (Pirallahi, Chilov, Neft Dashlari).

Due to the lack of large relief forms in the water area, strong winds sometimes have a speed of 25-30 m / s. Over this period, accidents occur in the infrastructure, farms, especially on platforms, built for the oil production [3,12].

The mean multi-annual temperature in the territory of the peninsula in 1961-2016 y.y. has been 14.7 0C (14.6-15.0 0C). These indicators are higher than those of A.M.Shikhlinsky (Baku, 14.2 0C).

The homogeneous of the relief does not enable the distribution of the vertical temperature gradient, and is characterized by 5-6 0C in winter, 11.3-12.3 0C in spring, 24-25 0C in summer and 16.4-17.2 0C in autumn. The sea area is 1.0 0C warmer in winter than in land, and 1-2 0C mild in summer. Temperatures continue to rise to the south of the province.

**Table 2.** Annual tendency of the temperature at hydrometeorological stations

Station	Period	H,m	To	Tos	Winter	Spring	Summer	Autumn
Khachmaz	1961-2016	27	12.8	12.2	2.8	10.9	23.6	13.9
Guba	1961-2016	550	10.6	9.8	0.4	9.4	21.4	11.4
Kiriz	1961-2016	2071	5.0	4.7	-3.5	4.0	13.3	6.2
Altiaghac	1961-2016	1099	8.9	8.1	-0.3	8.0	18.3	9.7

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Khınalıq	1991-2016	2049	5.5	-	-3.3	4.5	14.2	6.5
Khalstan	1991-2016	1104	8.8	-	-1.3	8.0	18.9	9.6
Baku	1961-2016	2	14.8	14.2	5.2	12.4	25.2	16.4
Sumgayıt	1961-2016	-20	14.6	-	5.1	12.1	24.8	16.3
Mashtagha	1961-2016	27	14.4	-	5.0	11.8	24.6	16.1
Pirallahi	1961-2016	-25	14.7	-	5.6	11.6	24.6	16.9
Chilov	1961-2016	-17	14.7	-	6.0	11.2	24.3	17.2
Neft Dashlari	1961-2016	-17	14.8	-	6.7	11.0	23.8	17.6
Alat	1961-2016	-18	15.0	-	5.1	12.7	25.6	16.6
Zagatala	1961-2016	487	13.2	12.5	2.9	12.3	23.6	14.0
Sheki	1961-2016	639	12.5	-	2.5	11.4	22.9	13.3
Gabala	1961-2016	679	11.6	-	1.2	10.4	22.2	12.6
Oghuz	1961-2016	582	12.6	-	2.3	11.4	23.2	13.4
Alibey	1961-2016	1540	6.3	5.7	-2.3	4.7	15.3	7.4
Maraza	1961-2016	775	11.0	10.1	0.5	9.4	22.1	11.8
Shamaxı	1961-2016	750	11.1	11	1.0	9.8	22.4	11.4
Mingechevir	1961-2016	93	15.4	14.8	4.8	13.7	26.5	16.5
Yevlakh	1961-2016	13	15.2	-	4.0	14.3	26.6	15.9
Goychay	1961-2016	107	15.0	-	4.2	13.9	26.0	15.8
Kurdemir	1961-2016	2	15.3	14.5	3.9	14.1	27.0	16.3
Zerdab	1961-2016	-5	15.2	-	4.2	14.1	26.3	16.0
Beylegan	1961-2016	62	14.6	-	3.9	13.5	25.6	15.4
Jafarkhan	1961-2016	-16	14.7	-	3.9	13.4	25.6	15.8
Hajigabul	1961-2016	-7	15.4	-	4.2	13.9	26.9	16.5
Bilesuvar	1961-2016	75	14.9	-	4.5	13.4	25.7	16.1
İmişli	1961-2016	-1	15.0	-	4.2	13.9	26.0	16.0
Salyan	1961-2016	-21	15.1	14.6	4.7	13.5	25.8	16.3
Neftchala	1961-2016	-24	15.1	-	5.4	13.0	25.2	16.8
Goytepe	1961-2016	2	14.8	-	4.7	13.0	25.3	16.1
Lenkaran	1961-2016	-20	14.5	14.1	5.0	12.7	24.3	15.9
Yardımlı	1961-2016	730	12.1	-	3.0	10.8	21.6	13.0
Lerik	1961-2016	1115	9.9	9.8	1.8	8.8	18.3	11.1
Kelvez	1992-2016	1567	8.8	-	-0.6	8.1	17.9	9.9
Astara	1961-2016	-23	15.0	-	6.2	12.8	24.5	16.6
Gedebey	1961-2016	1480	8.1	7.4	-1.0	7.0	17.0	9.3
Ganja	1961-2016	312	13.8	13.1	3.5	12.8	24.5	14.6
Aghstafa	1961-2016	331	13.0	-	2.2	12.1	23.8	13.9
Dashkesen	1961-2016	1655	7.4	6	-1.2	6.0	16.3	8.6
Shemkir	1961-2016	404	14.2	-	3.6	13.3	24.8	15.0
Jeyranchol	1961-2016	419	13.1	-	2.2	12.1	24.2	13.9
Nakhchivan	1961-2016	875	12.6	12.9	-0.9	12.2	25.2	14.1
Sherur	1961-2016	812	12.5	-	-1.1	12.4	24.8	13.9
Shahbuz	1961-2016	1205	11.7	11.2	-1.3	10.9	24.0	13.2
Ordubad	1961-2016	861	13.8	11.6	1.0	13.3	25.5	15.2
Paraghachay	1992-2016	2218	6.9	-	-4.3	5.1	17.7	9.0

H-absolute height of the station; To-multi-annual mean temperature; Tos- A.M.Shikhinsky's research results (1968).

Because the Kura mountain depression is surrounded by the physical and geographical region (Jeyranchol, Goychay, Mingachevir, Yevlakh, Kurdamir, Zardab, Imishli, Beylagan, Jafarkhan, Hajigabul, Neftchala, Salyan) from the north-east and south-west to the Great and Little Caucasus Mountains the influence of air masses from Iranian plateau from south, from the Caspian Sea from the

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southeast and the Jeyranchol plain from the northwest dominates. Humid air masses formed on the sea cannot penetrate the lowlands, although they affect the coastal areas [5].

The region is in the north-western highlands (Jeyranchol, 400-450 m) and the multi-annual mean temperature is 13.1 0C. The mean annual temperature at all stations of the Kur-Araz lowland over 1961-2016 y.y. has been 15.0 0C (14.6-15.4 0C). While the quantities calculated by A.M.Shikhlinsky for these areas (Salyan, Kurdamir, Mingachevir) have been 14.6 0C (14.6-14.80C), now this indicator has increased on 0.3 0C.

In Kur-Araz intermountain depression in winter, it is 2.2 0C in Jeyranchol plain, 12.1 0C in spring, 24.2 0C in summer, 13.9 0C in autumn, it has been observed in the range of 4-50C in winter, 13.3-13.80C in spring and 25.6-26.20C in all parts of Kura-Araz lowland, 15.9-16.40C in autumn. Seasonal estimates show that the maximum temperature is higher in the coastal areas for the winter, in the west of the province, in the central parts in the summer, and in the western and coastal parts in the autumn.

The multi-annual (1961-2016 y.y.) mean temperature of the Little Caucasus mountainous region (Aghstafa, Dashkasan, Gadabay, Shamkir, Ganja, Aghdam), located in the west of the Kura basin, is in the range of 130C-7.40C in the west from lowland (300-400 m) to medium highland (1450-1650 m). Considering the vertical gradient, at an altitude of about 2,900 m, this quantity is below 00C. In the research of A.M.Shikhlinsky, the mean temperature for these areas (Ganja, Gadabay, Dashkasan) is changed in the range of 6.0-13.10C. This is at least 0.70C lower than the current values.

Also, in this part of the region, it rises to 2.20C in winter at an altitude of 300-400 m, and to 3.50C in the east at the same altitude near the Kur-Araz lowland. Also, at an altitude of 1450-1650 m, this quantity decreases to -1.10C. In spring it varies between 13.00C, 14.00C, 6-70C, respectively. For summer, it decreases to 24-250C in all parts of the low mountain lands and 16-170C in the middle mountain. In autumn, it is 14-150C in the lowlands and 8.5-9.30C in the middle mountains.

In the eastern and south-eastern part of the Little Caucasus, the influence of hot and dry air masses from the south is felt over the year [4,12]. The mean annual temperature in the low mountain lands (150-200 m) is 14.50C (Tartar, 160 m), 150C in the southern part of the Araz region (Mincevan, 200 m), 130C in the low mountain lands (Aghdam 378 m, Fizuli 439 m), 120C in the lower parts of the middle mountains. (Khankendi, 827 m), as well as in the upper part of the middle mountain (Lachin, 1152 m) around 110C. The mean temperature for winter in the east and south-east of the region is 4.60C in the Arazboyu plain (100-200 m), 2.5-3.30C for the 350-450 m zone, 1-20C for the 800-850 m area, 10C for 1100-1200 m altitude. 10C. In spring, 13-140C in Arazboyu plain, 11.6-12.30C in the lowlands, 100C in the highlands of 800-850 m in the middle mountains, and 90C at 1100-1200 m. Summer is around 250C, 240C, 210C, 200C, respectively. In autumn, it decreases to around 150C, 14-14.50C, 12.30C, 11.70C. At an altitude of 3000 m, which is a permafrost zone of the Little Caucasus, the temperature is below 00C in all seasons.

In the west of the country there is Nakhchivan (Middle Araz) region (Nakhchivan, Sharur, Ordubad, Shahbuz, Paragachay), which has a complex hypsometry from the plains of the Araz (600 m) to the highest peak of the Zangazur-Daralayaz range of the Little Caucasus Mountains (Gapijig, 3904 m). The area surrounded by mountains plays a key role in the distribution of high-amplitude temperatures along the slopes of Arazboyu plain. In these areas with a continental climate, the country's maximum (+ 460C) and minimum (-440C) temperatures have been recorded in Julfa. The mean annual temperature in the Arazboyu plains in 1961-2016 y.y. has been 12-140C. In the highland zones of the middle mountain (2100-2200 m), this value decreases to 70C. The multi-annual mean temperature starts at an altitude of 3300 m and gets below 00C, where there is a permafrost zone here. According to A.M.Shikhlinsky (Nakhchivan, Ordubad, Shahbuz), while this is in the range of 12.20C in the Arazboyu and middle mountains now, it has now risen to 12.70C in those regions.

The mean seasonal temperature in the region varies between -0.9-1.00C in Arazboyu in winter, -1.3 - (-4.50C) in the middle mountains (1200-2200 m). Although it is 12.30C -13.30C in Arazboyu in spring, it decreases from 110C to -50C in the middle mountains. In summer, it decreases to 25-260C in Arazboyu and 180C at 2200-2300 m in the middle mountains. Only in summer, in July and August, short-term temperatures in the high mountain lands are higher than 00C, but the daily high temperature anomaly does not allow large-scale melting of the frost zone. In autumn, it is 14-15.20C in Arazboyu, 13.20C at 1200 m altitude in the middle mountains, 90C at 2100-2200 m altitude.

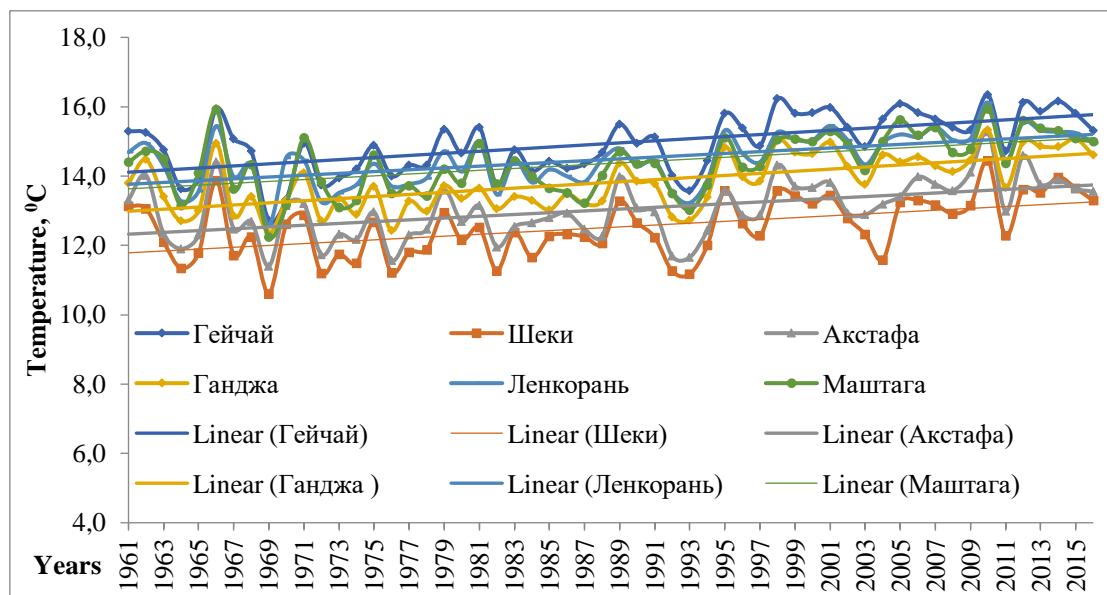
One of the regions of the Republic of Azerbaijan distinguished by the different climatic features is Lankaran natural region (Goytapa, Lankaran, Astara, Yardimli, Lerik, Kelvaz). The Talysh mountain

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ranges (Talysh, Peshtasar and Burovar), located to the west of the wide plains on the shores of the Caspian Sea, do not allow to pass the range of moist air masses, evaporating from the sea [10,11,12]. For this reason, the type of climate on the rainfall is evenly distributed has been widespread in the area. The mean multi-annual temperature decreases from 15.10C to 8.80C from the coastal plains to the altitude of 1500-1600 m highlands. There is no permafrost zone in the Talysh mountains, and the temperature here is above 00C all year round, except for the winter months. A.M.Shikhlynsky showed that the mean annual temperature for these areas (Lerik, Lankaran) has been 12.00C, while in 1961-2016 y.y. it has been 12.20C.

In Lankaran region, the temperature has been 4.5-6.20C in winter in the coastal lowland. It is around 30C in the lower part of the middle mountain (700-800 m), 1.80C in the middle part (1100-1200 m) and -1.00C in the upper part (1500-1600 m). In the spring it has been 12.7-13.00C, 10.80C, 8.80C, 80C respectively. In the summer months it varies around 24.3-25.30C, 21.60C, 18.30C, 180C, respectively. It is in the range of 15.9-16.60C, and 130C, 110C, 100C in autumn.

Changes in the mean annual temperature of several hydrometeorological stations with synchronous operation in the territory of the republic over 1961-2016 y.y. are given (Figure 1). If we pay attention, we can say that all stations change with the same trajectory. It can also be observed that over the multi-annual, the mean temperature in 1964, 1969, 1972, 1976, 1982, 1993, 2004, 2011 has been colder, and in 1966, 1971, 1995, 1998, and 2010, the mean temperature has been warmer than the multi-annual changes. From the trend curve, there has been an increase in the mean indicators of the temperature at all stations for multi-annual. Such growth has been sharp since the early 1990s (Figure 1). Over the research, there has been analysed that of which global circulation is most affected by the temperature quantities, observed in the territory of Azerbaijan in 1961-2016 y.y. [16,17, 18, 25, 26].



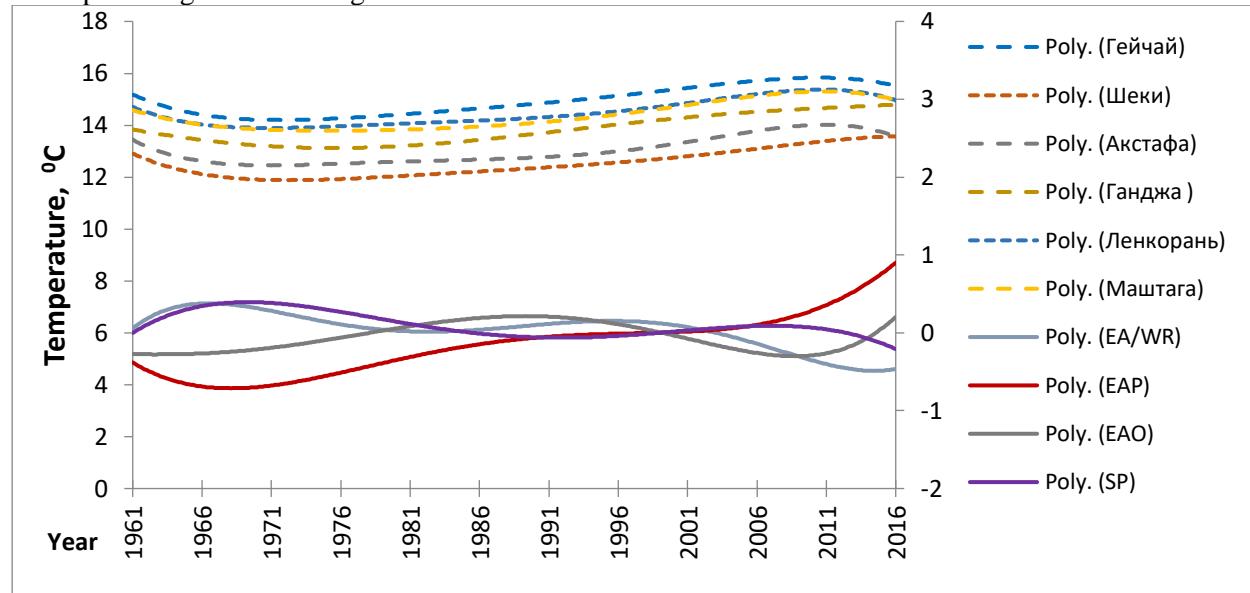
**Figure 1.** The variation of multi-annual mean temperature indicators

For this purpose, the 5-year polynomial of the West Russian / East Atlantic (east Atlantic / west Russian-EA / WR), Scandinavian (scandinavia pattern-SP), East Atlantic (east atlanti-EAP) and East Atlantic oscillation-EAO indices trends have been used [13,14,15,26].

The multi-annual temperature fluctuations of 1961-1965 y.y. have been mainly influenced by the West Russian and East Atlantic earthquakes. From 1963 to 1984, the Scandinavian indices, and again from 1984 to 2014, the West Russian and East Atlantic indices are dominated the country. In 2014-2016 y.y., the effects of the East Atlantic earthquake are dominated. The interdependence of these quantities has been tested by the correlation and regression analyses [20]. The correlation value between the global indices and the mean annual temperature of the analysed stations is higher than -0.7. In the analysis of the regression model, the quantities p and F do not exceed the critical values. The determination coefficient R satisfies the condition of the accepted quality model. The analysis shows that the country's climate, especially the temperature regime, varies depending on global earthquakes. It is no coincidence

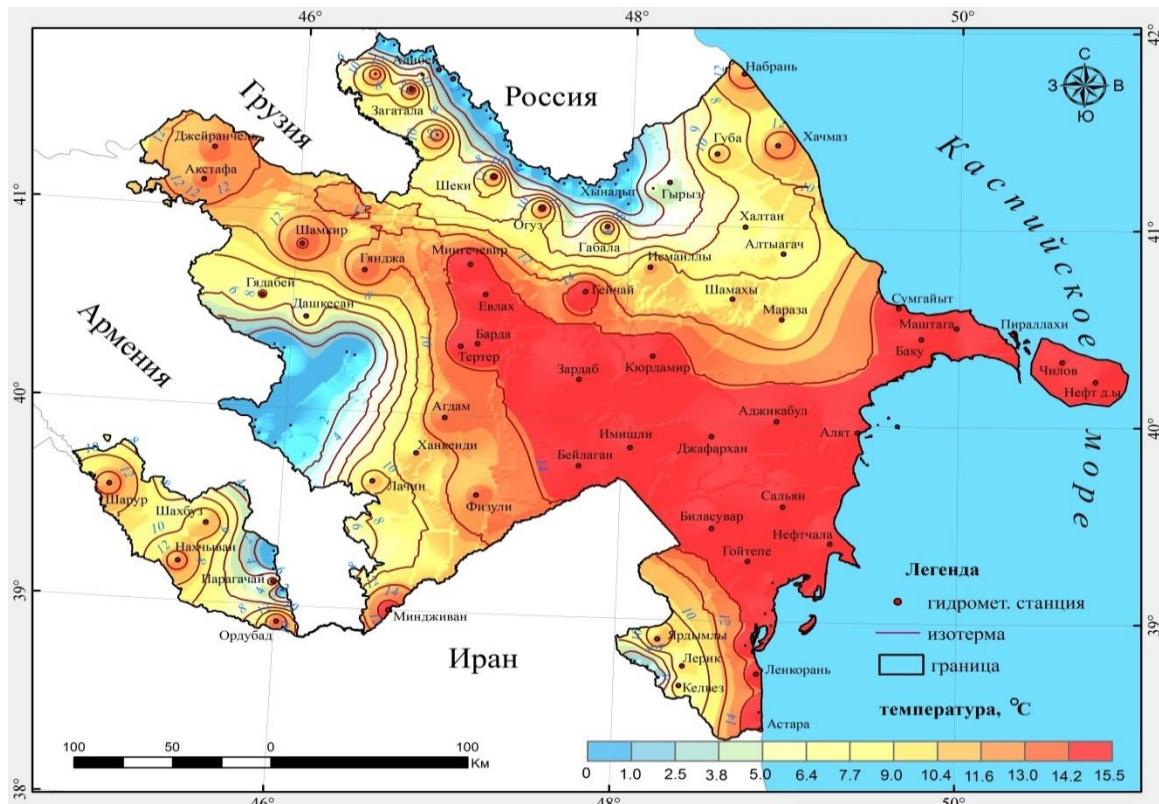
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that in 1991-2016, a temperature increases of 0.7-0.80C has been observed in the country. And it correspond to global warming indicators



**Figure 2.** The polynomial variation of mean multi-annual temperature and global indices

The distribution of the mean multi-annual temperature indicators in the research is given by the electronic cartographic presentation (Figure 3).



**Figure 3.** Mean annual temperature indicators for 1961-2016 y.y.

The presentation has been illustrated on using an empirical model of the interpolation in ArcGIS. As can be seen from the description, higher temperature quantities of the republic can be found in the Absheron Peninsula, coastal plains, Kur-Araz lowland and Jeyranchol plain, as well as in the Arazboyu

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of the Nakhchivan Autonomous Republic. From north to south, the temperature rises even more, and there is also a decrease in the distribution of the temperature regime as it rises.

## **CONCLUSIONS AND DISCUSSION**

There have been obtained a number of results over the research of the distribution of mean multi-temperature values in the territory of the Republic of Azerbaijan in 1961-2016 y.y. The results of the analysis are presented as follows:

1. There is an increase in the mean annual temperature trend in the country for the whole 55-year period from 1961 to 2016 y.
2. Based on previous research, the mean annual temperature in 1991-2016 y.y. increased by 0.7-0.80C compared to 1961-1990 y.y.
3. Over the year the sea has a 1-20C temperate effect (warm in winter, mild in summer) in coastal areas compared to other regions of the country, and the annual temperature amplitude in such areas is lower than in other areas.
4. The highest mean temperature in the country has been 15.0-15.40C in Kur-Araz lowland, Arazboyu, south of Lankaran province.
5. In 1961-2016 y.y., the territory of Azerbaijan has been mainly affected by global climate indices such as the western Russian / eastern Atlantic (west Russian / east Atlantic) and the Scandinavian pattern. The results obtained over the climate research can be used in the future formation of the economy in the country. In areas with high temperatures, global warming will accelerate its effects, and vulnerabilities such as salinization, erosion, and low groundwater levels will appear in these areas. In the middle and high mountainous areas, the annual amplitude is expected to increase. Breeze effects weak in coastal areas and the precipitation at sea continues to decline. Due to the harsh climate, it may be recommended to cultivate livestock and plant species that will withstand extreme temperatures in areas dominated by the agro-industry.

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**O 7. ECOLOGICAL CHARACTERIZATION OF THE SMALL LAKES IN ALBANIA**

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**ABSTRACT:** Small water bodies compared to larger lentic freshwater ecosystems, are characterized by a lower area/perimeter ratio that emphasizes the contribution of ecotonal zones to their metabolism and functioning, maximizing the importance of their role as biogeochemical reactors, the small water ecosystems are shallow (not more than 20 m deep) and small lentic water bodies ranging in area between 1 m<sup>2</sup> and several ha ( $\leq 10$  ha), including small lakes, pools, ponds, and wetlands, both perennial and temporary, with an artificial or natural origin. Due to the geographical position, geological settings and climatic conditions Albania is distinguished by water resource riches. The entire county watershed is 43 905 km<sup>2</sup>, while only 65% is within the national borders. Before 1960, wetlands covered more than 2300 km<sup>2</sup>, equal to about 8% of the Albanian territory. Large reclamations processes for agricultural purposes strongly reduced the total area of the wetlands since then to less than half. Nevertheless, more than 1300 aquatic sites are still scattered throughout the country: marine habitats, coastal lagoons, fluvial deltas, rivers, springs, lakes and ponds. Wetlands cover a total surface of 970 km<sup>2</sup>, equal to about 3% of the whole national territory. The lakes, the coastal lagoons and the reservoirs represent the largest part of these aquatic habitats. All these ecosystems are distinguished by significant diversity of sensitive habitats and species, which so far are understudied and remain extremely vulnerable due significant impact. The impacts are referred to agriculture, tourism development, including nutrient loading and contamination, facing a rapid increase of non-native species invasion and climate change.

**Keywords:** *Small Lakes, Ecology, Temperate, Mediterranean, Lagoons*

**INTRODUCTION**

Currently the vulnerability of the freshwater ecosystems is assessed through the fact that 29% of the species they host, are at risk of extinction - Red List of Threatened Species™ (n = 25 007) (IUCN, 2013). The most notable reasons of such a situation lies on the combination of pollution, unsustainable land use, overutilization of freshwater resources, anthropogenic disruption of hydrological habitat connectivity and introduction of alien species (Mantyka-Pringle et al., 2014). Similarly, to the global scale, these threats remain active within Albanian freshwater ecosystems including small water bodies (SWB). The climate change is assessed to significantly contribute to the biodiversity deterioration and the projections remains very unoptimistic (Markovic et al., 2014).

In general due to land use changes particularly before the 1990s, the standing water bodies including the small ones in Albania were subject of intensive anthropogenic influence, while both natural and human made ones constitute some 650 lentic freshwater environments within the country (Cullaj et al., 2005; Shumka and Miho, 2006; Shuka et al., 2009; Skarbøvik et al., 2012). They still are under the intensive human pressure mostly due to agriculture, tourism development, including nutrient loading and contamination, facing a rapid increase of non-native species invasion and climate change (Shumka et al., 2008). The subjects of this survey are the carstic lakes of Dumrea region, situated at the central part of Albania. The lakes spatial configuration is generally circular or oval, while their lengths vary from 15-20 m to 1400-1500 m. The largest surface has the Çestia lake with 96.8 ha, followed by Seferani lake with 87.5 ha, 65.5 ha Merhoja, Dega 37.4 ha, 27.4 ha Paraska and Belshi 26.9 ha (Naço et al., 2012). Total surface of all lakes of Dumrea is approximately 645 ha, thus constituting about 3% of the total area of the entire region. Stability of water volume in lakes depends mainly on rainfall regime and the relationship between the size of the watershed and the lake surface, with the exception of Belshi Lake, which has a watershed, 18 times greater than the surface of the lake (k = 18), other large lakes have this ratio small: k = 6.3 Çestia, k = 5.8 Seferaj, k = 5.3 Dega, k = 3.4 Merhoja. This is the reason why in the dry period of the year, some small lakes dry up, while in the big lakes, small amplitude of water level

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observed during the year. Area of the watershed for Çestia Lake is 5.5 km<sup>2</sup>, 4.7km<sup>2</sup> Seferaj, 2.1 km<sup>2</sup> Merhoja, 1.9 km<sup>2</sup> Paraska, 3.7 km<sup>2</sup> Belshi (Naço *et al.*, 2012). The dissolved oxygen content was oscillating from 5.8 – 7.15 mg/l respectively for Lake Dega and Seferani.

## MATERIAL AND METHODS

This contribution is based on different surveys covered in the period of 2014-2020. The morphometric features and associated ecological particularities of selected SWB of different origin were analyzed and presented in Table 1. The zooplankton data are based on collections made from 2014-2020 in the open part of the water bodies. Samples were collected with 5-L Ruttner sampler, filtered in situ through a sieve (45 µm mesh- size) or using a hand-held plankton net (45 µm mesh-size, mouth diameter, 30 cm), and preserved with 4% formaldehyde.

**Table1.** Main fetaures of Small Lake Bodies (SLB)

SWE	Origin/ type of SLB	Protected area (PA)	Area (m <sup>2</sup> )	Depth (Z <sub>max</sub> , m)	Macrophyte coverage (%)	Macrophyte type	Fish presence
Lake of Rajca	Artificial/ Reservoir	NP Shebenik-Jabllanica	1800	9	5	S	0
Lake of Dragan	Natural/ Glacial	NP Shebenik-Jabllanica	600	3	90	S	0
Lake i Zi (Black)	Natural/ Glacial	Nature Park Korab Korritnik	4800	11	35	S	1
Lake of Valamara	Natural/ Glacial		800	14	0	0	0
Lake of Pernaska	Natural Lake		324700	6	10	S	1
Reservoir of Poloska	Artificial/ Reservoir		72000	9	30	E	1
Lake of Dega	Natural Lake	Nature Monument	308600	4.5	85	S	1
Lake of Dorbi	Natural Lake		105400	5	20	E	1
Reservoir of Fushe Studa	Artificial/ Reservoir	National Park Shebenik - Jabllanica	245000	14	5	S	1
Lake of Dushku	Natural/ Glacial		224000	16	45	E	1
Reservoir of Pretusha/reservoir	Artificial/ Reservoir		351000	12	10	S	1

## RESULTS AND DISCUSSIONS

### *Zooplankton of the small lakes in Albania*

The most wide spread species among Cladocera were *Bosmina longirostris*, *Chydorus sphaericus* and *Daphnia longispina*, while other present species were *Chydorus sp.*, *Daphnia cucullata*, *Diaphanosoma brachyurum*, *Alona recrangula*, *Alona quadrangularis*, *Alonella nana*, *Alonella sp.*, *Moina micrura*, *Ceriodaphnia reticulata*, *Simocephalus vetulus*, *Leptodora kindti*. Among Copepoda, *Mesocyclops leuckarti* has been found to be one of the most spread species. Other copepod species include *Arctodiaptomus salinus*, *Acanthocyclops vernalis*, *Cyclops abyssorum*, *Eucyclops serrulatus*, *Macrocylops focus*, and *Thermocyclops crassus*.

Rotifers were present via following species: *Anuraeopsis fissa*, *Ascomorpha ecaudis*, *Asplanchna priodonta*, *Brachionus calyciflorus*, *Brachionus quadridentatus*, *Cephalodella gibba*, *Epiphantes senta*, *Filinia longiseta*, *Kellicottia longispina*, *Keratella cochlearis*, *Keratella quadrata*, *Lecane lunaris*, *Ploesoma hudsoni*, *Polyarthhra sp.*, *Synchaeta pectinata*, *Trichocerca similis*. They recorded significant spatial density variations between the two groups of lakes i.e. reservoirs vs. glacial lakes and this is affirmed by quantitative dominance of Rotifera vs. zooplankton comprising an important component at

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these ecosystems. Rotifers and Cladocera dominance has been confirmed also on the large Skadar/Shkodra Lake (Shumka *et al.*, 2018).

Zooplankton depicted differences in quantitative importance of species in relation to small lake type. So, in the glacial lakes of Valamara and Liqeni i Zi were dominated by Cyclopoida & Calanoida with *Cyclops abyssorum*, *Eucyclops serrulatus* and *Acanthocyclops vernalis*. The man-made reservoirs and totally covered with vegetation Lake Dragani were dominated by Rotifera and Cladocera. It is worth to mention the quantitative importance of *Mesocyclops leuckarti* > *Keratella cochlearis* > *Ascomorpha ovalis* in the reservoirs with less than 10% vegetation cover, while in the rest of them *Keratella cochlearis* > *Mesocyclops leuckarti* > *Ascomorpha ovalis* > *Asplanchna priodonta* > *Polyarthra vulgaris*.

**Table2.** List of fish species which are present in Albanian SWB, their common and scientific and names, distribution, ecological requirements and diet strategy

Family	Species	A - allothonus, I - invasive	Ecological requirements (L - limnophilic, R - rheophilic, E - eurytopic)	Diet strategy (inse - insects, inve - invertebrates, omni - omnivore, pisc - piscivore, herb - herbivore, zoopl - zooplankton)
Centrarchidae	Pumpkinseed <i>Lepomis gibbosus</i> (Linnaeus, 1758)	A, I	L	inse/inve
Cobitidae	Ohrid spined loach <i>Cobitis ohridana</i> (Karaman, 1928)		R	inse/inve
Cyprinidae	Common bream <i>Abramis brama</i> (Linnaeus, 1758)		E	inve/inse
Cyprinidae	Bleak <i>Alburnus scoranza</i> (Heckel&Kner, 1858)		E	inve/inse
Cyprinidae	Bighead Carp <i>Aristichthys nobilis</i> (Richardson, 1845)	A		zoopl/herb
Cyprinidae	Prespa barbell <i>Barbus prespensis</i> (Karaman, 1924)			omni
Cyprinidae	Crucian carp <i>Carassius carassius</i> (Linnaeus, 1758)		E	omni
Cyprinidae	Prussian carp <i>Carassius gibelio</i> (Bloch, 1782)	A, I	E	omni
Cyprinidae	Grass Carp <i>Ctenopharingodon idella</i> (Cuvier and Valenciennes, 1844)	A		herb/inve
Cyprinidae	Common Carp <i>Cyprinus carpio</i> (Linnaeus, 1758)			omni
Cyprinidae	Silver carp <i>Hypophthalmichthys molitrix</i> (Valenciennes, 1844)	A		zoopl
Cyprinidae	Albanian roach <i>Pachychilon pictum</i> (Heckel&Kner, 1858 )		R	omni
Cyprinidae	Stone moroko <i>Pseudorasbora parva</i> (Temminck & Schlegel, 1842)	A, I	E	zoopl/inve
Cyprinidae	European bitterling <i>Rhodeus amarus</i> (Bloch, 1782)		E	herb/inve
Cyprinidae	Rudd <i>Scardinius erythrophthalmus</i> (Linnaeus, 1758)			zoopl/herb
Cyprinidae	Chub <i>Squalius platyceps</i> (Zupančič, Marić, Naseka & Bogutskaya, 2010)			R
Percidae	European perch <i>Perca fluviatilis</i> (Linnaeus, 1758)		E	inse/inve/pisc
Percidae	Pikeperch <i>Sander lucioperca</i> (Linnaeus, 1758)		E	zoopl/pisc
Siluridae	Wels catfish <i>Silurus glanis</i> (Linnaeus, 1758)		E	pisc
Poeciliidae	Eastern mosquitofish <i>Gambusia holbrooki</i> (Girard, 1859)	A	E	inse

### Fish community of the SWB

The specific biogeography setting of Albanian freshwater ecosystems (including SWB), from one side makes quite complicated the current spatial analyses of its fish assemblage, while from the other side give advantage of having high diversity. In the “New Map of Biogeographic Units for Freshwater Biodiversity Conservation” (Abell *et al.*, 2008) is part of the Western Adriatic unite.

The fish species diversity of the small lakes of Albania has been heavily affected by human intervention and they depend on the river basin (Table 2). After the 1970s, there was an intensive intervention through aquaculture development and promoting mostly Chinese stocks that were used even in natural lakes (including Lake Dushku, a glacial one part of our study). Various river systems of Albania are reported to harbor more than 85 species of fish, with numerous non-native ones (Rakaj, 1995). The natives species includes *Alburnus scoranza*, *Barbus prespensis*, *Gobio* sp., *Pachychilon pictum*, *Squalius platyceps*, etc. Poljakov *et al.* (1958) provided information on the presence of only two introduced species, *Gambusia holbrooki* and *Cyprinus carpio*, Rakaj (1995) reported for Albania the presence of altogether a total of 20 non-native species. The ten-fold increase in the number of exotic species was due to the importing of species for aquaculture, especially East Asian cyprinids and several salmonids

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(Shumka et al., 2008). The most wide spread aliens include Stone moroko (*Pseudorasbora parva*), mosquito fish (*Gambusia holbrooki*); Prussian carp (*Carassius gibelio*), Asian cyprinids *Aristichthys nobilis*, *Hypophthalmichthys molitrix*, *Ctenopharyngodon idella*, *Parabramis pekinensis*, *Lepomis gibbosus*, *Oncorhynchus mykiss*, *Tinca tinca*, etc. Presence of non-native species as *Carassius gibelio*, *Esox lucius*, *Pseudorasbora parva*, *Gymnocephalus cernua*, *Ameiurus nebulosus*, *Lepomis gibbosus*, etc., are reported by Talevski et al. (2019) for the North Macedonian man-made water bodies.

### **Conservation challenges**

The Albanian small water ecosystems are facing numerous threats, pressure and activities mostly accelerated due to intensive human intervention and land use changes. With this regard the habitat loss is a dominating feature. Further on a significant threat is caused due to interventions in hydraulic regime of the lake including temperate and glacial ones, particularly before the 1990s. Along with habitat disturbance the biological invasion is one of causes of biodiversity decline along with climate changes.

## **CONCLUSIONS**

This assessment of selected SWB of Albanian with different origin and features revealed that these ecosystems are facing serious threats, pressure and activities mostly accelerated due to intensive human intervention and land use changes.

The proper protection and advancement of the SWB requires raising awareness about their ongoing innervations and their many beneficial functions to the human population. There is also a strong need for technical and political recognition of their importance for preserving a healthy and diverse aquatic environment.

Our findings from this assessment establish modest bases for improving current knowledge on SWBs in Albania through highlighting and syntheses of current data on their crucial role to supporting biodiversity and ecosystem services. Further on there is a need to stimulate interdisciplinary approaches and consider these valuable ecosystems within national support programs.

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**O 8. ASSESSMENT OF NATURAL CHARACTER, RIVERSCAPE AND VISUAL AMENITY  
OF THE TRANSBOUNDARY DOJRAN LAKE**

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**ABSTRACT:** The key elements considered for assessment of the naturalness of the lakes and rivers relate to the degree of intactness of the natural elements, patterns, processes, and extent of any physical land use changes or presence of different constructions. The natural character is essentially a measure of the naturalness or modifications of the natural elements, patterns and processes that comprise a water body. The current contribution is based on a process to assess the level of natural character that involves an understanding of the current systems and attributes that contribute to Lake Dojran ecosystem including abiotic, biotic and other factors. This assessment considered imputes data, such as river hydrology and morphology, aquatic and terrestrial ecology, water quality and landscape architecture. This approach is based on field visit carried out in end of March 2021 and further on a desktop review of relevant available data. The second component of this study includes the visual aspect of amenity as recreational values of the Lake Dojran in its full services. The effect of dramatic water level change/decrease (based on historical data of the period 1985-2000) on visual amenity values was correlated to offered recreation values. The survey analyses on the North Macedonian side of the lake revealed that <25% of the lake margins remained at the natural level, while the pressure from different sectors of human presence is steadily increasing.

**Keywords:** *Lake Dojran, Natural character, biotic factors, land use, water level.*

**INTRODUCTION**

Rivers and lakes are dynamic and complex features set within a broader landscape context (Boffa Miskell Limited, 2018). At the state they are, they provide a visual, ecological and recreational focus in a landscape as well as providing physical links throughout their catchments (Shumka, 2018). Rivers, lakes and their margins have natural character, amenity and landscape values that require consideration in water allocation decisions particularly relating to how changing river flows and lake levels can affect those values.

Following Abell *et al.*, (2008), Lake Dojran is part of the Vardar (422) freshwater eco-region at the wider European delineation. The lake is a shallow water body with the bottom laying at an elevation of 138 m a.s.l., while the highest recent absolute altitude above sea level of the water surface was 148 m (Bojovic *et al.*, 2016). The watershed and the lake itself are shared by two countries, Greece and North Macedonia (Figure 1).

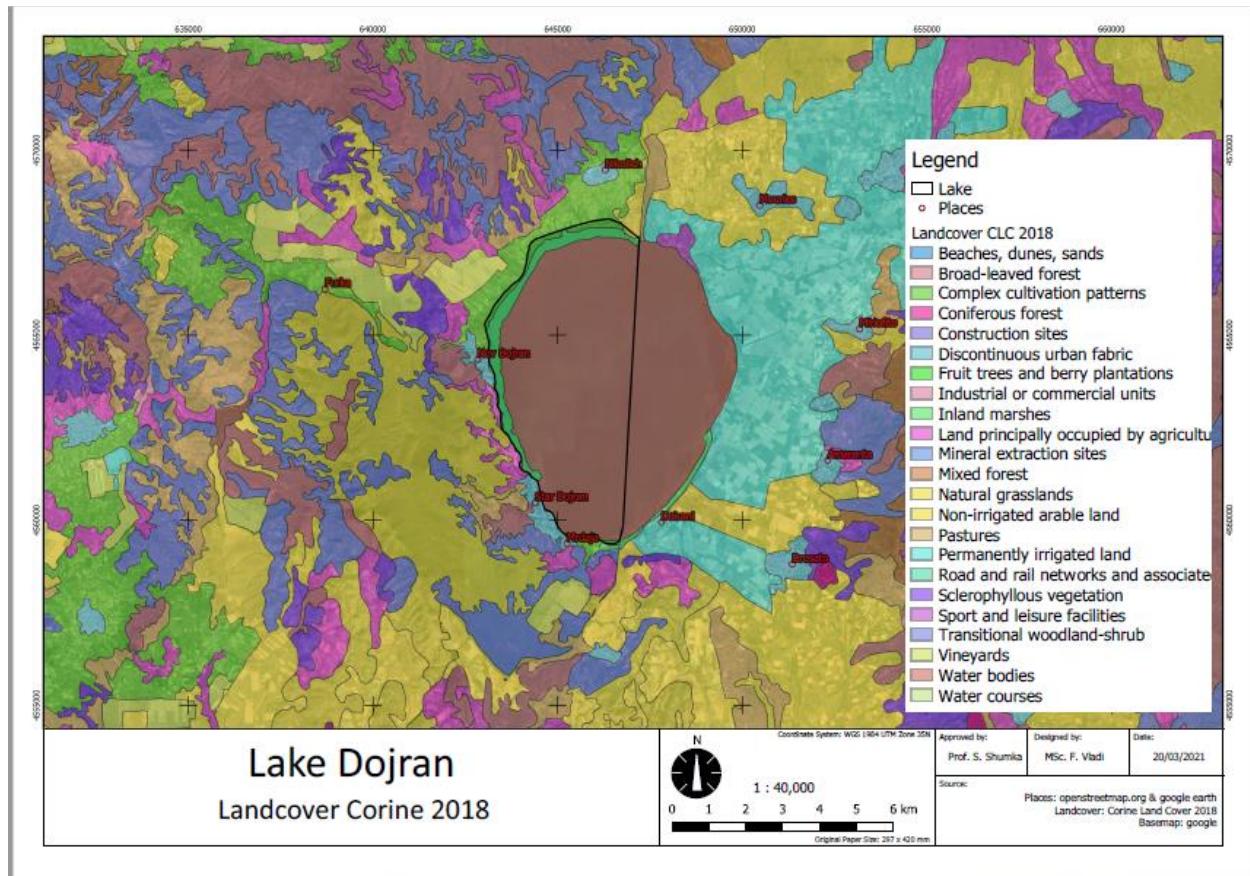
The lake was formed in a karstified basin created by a combination of Tertiary and tectonic activity. The sediments of the lake watershed are composed of mineral-rich ancient alluvial and limestone sediments. A minor part of the watershed on Macedonian side is composed of diluvia clay sediments (Popovska *et al.*, 2005; Popovska & Bonacci, 2008; Gesovska *et al.*, 2013). The northern and eastern belts of the watershed are rocky and covered with low forests and weeds (Figure 1). Forest and semi-natural areas, including agricultural land, cover most of the catchment. The lake is recharged from direct runoff, small rivers and groundwater and it does not have surface outflow (Sotiria & Petkovski, 2004).

The watershed within the Macedonian territory is characterized with a relatively large annual production of erosive material of about 29.000 m<sup>3</sup>/annually, out of which only 323 m<sup>3</sup>/annually is transported towards the lake.

The main water flows are situated on the Greek side and they include: Odza Suji (Breska River) with a waterbasin of 94.3 km<sup>2</sup>, carrying all the waters from the South slopes of the mountain Belasica, and the river Kavakalaris, with the water basin of 21 km<sup>2</sup>. On the Macedonian side, there are 26 smaller rivers,

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creeks and springs; the most important ones are: Crn Potok, Pazarli Dere, Suva Reka, and Derven Rama. The water volume is 262 million m<sup>3</sup> which corresponds to the average depth of 6.5 m (maximum depth).



**Figure1.** Lake Dojran, Corine land cover (state of 2018)

## MATERIAL AND METHODS

Assessment Methodology criteria for natural character: Each component of the lake has been assessed separately using a set of attributes that incorporate the abiotic and biotic factors specific Lake Dojran systems as below. The experiential component of natural character has been considered for the complete lake rather than for each component separately (Table 1; Table 3). The field data collection has been conducted in the period of 25<sup>th</sup> 29<sup>th</sup> March 2021.

### In this assessment:

*Active bed:* Includes varying lake shore extents for the typical range of lake levels. The landward extent of the active zone is often delineated where permanent terrestrial vegetation meets the bare gravel/rock substrate.

*Context:* Refers to the wider landscape context of the catchment adjacent to the lake, and considers the land use, landform and vegetation cover that contributes to the overall character of the lake.

*Margin:* Refers to the strip of land between the active bed and the wider landscape context, including the banks. River processes, patterns and influences will be evident in the margin, such as occasional flooding, historic banks and channel patterns. From locations within the lake margin the active bed is the visually dominant feature. The margin is typically narrow and may incorporate terraces, banks, abandoned riverbed, floodplains, river and tributary confluences and built infrastructure. Generally topographic features define the extent of the margin as they extend between the top and base of banks or terraces. Vegetation type boundaries can also define the margin extent, such as where riparian scrub or planting meets grazed pasture in the landscape context.

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**Table 1.** Assessment methodology criteria for natural character

<b>Lake components</b>	<b>Attribute groupings</b>	<b>Lake Natural Character Attributes</b>
Active bed	Abiotic	Flow regime characteristics and levels, managed or natural flows.
		River channel /lakebed substrate morphology including modifications/ structures e.g. boat ramps, dams, diversions
		Water Quality-if available indicator of ecological health
Margin	Biotic	Aquatic ecology, flora/fauna, habitat, pest species
	Abiotic	Modification and structures- buildings, quarries, bridges roads,
Context	Biotic	Terrestrial ecology, (also describe braided riverbeds) e.g. vegetation and bird habitat
	Abiotic and biotic	Land modification/land use / vegetation. Urban, agriculture
All (focus on active bed and margin)	Experimental	Views, sounds, sense of naturalness, wildness remoteness

A Five-Point scale was used to assign an overall level of natural character to each of the river/lake components.

**Table2.** The scale used to determine an overall level of natural characters for each of the river / lake components.

<b>Very High</b>	<b>High</b>	<b>Moderate</b>	<b>Low</b>	<b>Very Low</b>
Very High levels of natural character due to Very Low or no levels of modification	High levels of natural character due to Low levels of modification	Moderate levels of natural character due to moderate levels of modification	Low levels of natural character due to High levels of modification	Very Low levels of natural character due to Very High levels of modification

## **RESULTS AND DISCUSSIONS**

The shape of the lake is rather regular with a maximum length of 8.9 km and maximum width of 7.1 km. The volume of the lake at norm is 10.4 m<sup>3</sup>. The lake doesn't have surface outflow. The only natural outflow is the lake water surface evaporation. Total watershed area of the lake is 271.8 km<sup>2</sup> out of which 32% belongs to Macedonia. The water surface area of the lake at normal elevation is 42.2 km<sup>2</sup> out of which 63.6% belongs to Macedonia (Popovska *et al.*, 2005; Gesovska *et al.*, 2013).

In the period of 1990-2010 the Lake Dojran water level decreased seriously. This water declination together with the simultaneous water quality deterioration resulted in biodiversity diminishing and plankton reduction (Gesovska *et al.*, 2013).

The Lake Region represents one of the important centers of biodiversity for Western Balkan and SE Europe and has been also recognized internationally for its rich biodiversity and abundance of species, and thus has been proclaimed as an important area for the conservation of European species and habitats (Figure 2). Currently the Lake Dojran is part of different international networks and initiatives for the conservation and protection of nature, such as: the Emerald network of areas of special conservation interest (2002; Bern Convention), North Macedonian important plant areas (2004), the Balkan Green Belt (2004; IUCN), Ramsar site – Wetlands of International Importance (2008; Ramsar Convention), Important Bird Area (2010; BirdLife International), candidate Natura 2000 site (EU Birds and Habitat directives). Since 1977 Dojran Lake has been protected with national law and holds a protected status of a Monument of Nature (Official Gazette of SRM N° 45/1977, Official Gazette of NM N° 51/2011).

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Based on researches conducted so far, there are 16 species registered in Lake Dojran, while other authors reported a number of 24 species that do not have established real populations (Kostov et al, 2010). In the basin of Lake Dojran 8 fish species are Balkan endemics (out of 16 species that already have established populations in the Lake ecosystem. The endemics autochthonous fishes from Lake and its catchment area are: *Alburnus macedonicus* (Karaman, 1928), *Barbus macedonicus* (Karaman, 1928), *Chondrostoma vardarensis* (Karaman, 1928), *Pachylichon macedonicum* (Steindachner, 1892), *Rhodeus meridionalis* (Karaman, 1928), *Cobitis vardarensis* (Karaman, 1928), *Sabanejewia balcanica* (Karaman, 1928), *Gobio bulgaricus* (Drensky, 1926). Other species present in the lake include: *Cyprinus carpio* (Linnaeus, 1758), *Perca fluviatilis* (Linnaeus, 1758), *Rutilus rutilus* (Linnaeus, 1758), *Salaria fluviatilis* (Asso, 1801), *Scardinius erythrophthalmus* (Linnaeus, 1758) and *Tinca tinca* (Linnaeus, 1758).



**Figure 2.** Components of the active bed, margins and context

**Table 3.** Assessment of Natural character of the Lake Dojran

Natural Character_Lake Dojran		Degree of Natural Character
Active Bed	<ul style="list-style-type: none"> <li>The lake formed in a karstified basin created by a combination of Tertiary and tectonic activity.</li> <li>Heavily influenced by development of the intensive agriculture activities on both sides of the lake (North Macedonia and Greece).</li> <li>Water quality affected by various types of pollution, accelerated eutrophication.</li> <li>In the basin of Lake Dojran 8 fish species are Balkan endemics (out of 16 species that already have established populations in the Lake ecosystem.</li> <li>The lake is used as a feeding ground from the pelicans.</li> <li>Recent increase of population of alien and invasive fish and other species.</li> </ul>	Low Moderate

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	<ul style="list-style-type: none"> <li>The lake provides ground for recreational fishing activities that at the current circumstances are beyond its capacities.</li> <li>Modifications to the active bed include different structure constructed for tourism and recreational fishing, and agricultural activities.</li> <li>Large water quantity is used for the irrigation purposes on both sides of the lake (North Macedonia and Greece).</li> <li>There is a lack of waste water treatment facilities.</li> <li>There is a large number of boats, particularly during the fishing days.</li> <li>Scenic view notable, particular during spring time.</li> </ul>	
Margin	<ul style="list-style-type: none"> <li>The eastern lake margin remains actively uses (see Figure 1) for the agriculture purposes.</li> <li>Southern margins on both sides of the lake are heavily used for housing and tourism purposes.</li> </ul>	Low Moderate
Context	<ul style="list-style-type: none"> <li>Forest (both low and high forest stands) and semi-natural areas, including agricultural land, cover most of the catchment.</li> <li>The main water flows are situated on the Greek side and they include: Odza Suji (Breska River) carrying all the waters from the South slopes of the mountain Belasica, and the river Kavakalaris. On the North Macedonian side, there are 26 smaller rivers, creeks and springs; the most important ones are: Crn Potok, Pazarli Dere, Suva Reka, and Derven Rama.</li> <li>Grazing and hunting are also practiced within Context.</li> <li>Modifications are minor in proportion to the overall context of the lake.</li> </ul>	High
Experimental	<ul style="list-style-type: none"> <li>Highly scenic, relatively large-scale open landscape with wide and distant vistas.</li> <li>Unique combination of water and associated bird species of the lake and sloping gravel beaches.</li> <li>Presence of winds and waves contribute to a dynamic environment on windy days.</li> <li>After the dramatic water level drops of two decades ago, there are normal levels of modification</li> <li>Surrounding landscape is perceived to be of high natural character.</li> </ul>	Very High
<b>VISUAL AMENITY - Lake Dojran</b>		<b>Degree of Visual Amenity</b>
Nature of views, viewing audience	<ul style="list-style-type: none"> <li>Overall, beyond the urban and rural settlements landscape has a very high level of visual coherence.</li> <li>The unusual combination of water body (water surface) with surrounding mountains slopes it contains high visual and scenic values.</li> <li>The lake is intensively used, primarily in the summer, for fishing, boating and recreation. The surrounding mountainous landscape means other potential recreational activities.</li> <li>When lake levels were low, more of the shoreline was exposed which is considered unsightly by some.</li> </ul>	High

## **CONCLUSIONS**

Lake Dojran is a shared resource and no action can be taken by one country without impacting the resources and conditions in the other country. So, all further steps including monitoring and survey need to be coordinated among relevant authorities of North Macedonia and Greece.

In this conclusions section we propose 10 steps measures and actions for Lake Dojran conservation with intention improvement of management practices, protection of biodiversity of current and future potential impacts (Table 4). They are connected with building of capacities on both littoral countries in order to: To help conserve globally significant biological diversity and restore important habitat components; To enhance the transboundary cooperation in the Lake Dojran region; To reduce nutrient loads and pollutants to the lake; To increase the overall resilience of the lake ecosystem to the human impacts and climate conditions; To contribute at the local welfare, economic and social prosperity.

**Table 4.** Summary proposed measures and actions for the conservation of Dojran Lake

No	Measures	Actions
1.	Joint Body for Lake Management	Establishing Joint Lake Dojran Body (it should be composed by representatives of central and local authorities surrounding Lake Dojran, CSO from North Macedonia and Greece)
2.	Joint Agreement	Joint document/Agreement, signed between North Macedonia and Greece by relevant management authorities, in relation to Lake Dojran
3.	Harmonized monitoring program of water quality base don WFD	The monitoring program/protocols should be harmonized with regards to methods, locations and relevant authorities
4.	Improved Lake Data and Share	The Lake data statistics has to be improved, stored with similar approach and regularly shared/exchanged
5.	Joint Biodiversity Assessment	The Biodiversity assessments, surveys and whatever type of monitoring (including scientific ones) has to be integrated considering the lake itself as a unique ecosystem. This will increase the data reliability and serve as real bases for further actions.
6.	Conservation	<ul style="list-style-type: none"> <li>• Habitat conservation actions;</li> <li>• Action plan for habitat conservation;</li> <li>• Action plan for endemic species conservation;</li> <li>• Conservation action plans per fish species</li> </ul>
7.	Abatement plan for the non-native fish species	The abatement plan and any intervention should be done “science based” and jointly agreed by littoral countries (North Macedonia and Greece).
8.	Recreational fishing actions	Jointly agree on recreational fishing management, control of feeding sites, considering the negative impacts to the water quality in a situation of an accelerated lake eutrophication process.
9.	Joint Educational program	<ul style="list-style-type: none"> <li>• The joint program has to lead reducing environmental impacts of agriculture (pesticides, fertilizers, irrigation water, agricultural waste, support to agricultural associations); Increased awareness of the local communities on fish biodiversity values;</li> <li>• Altering local stakeholder’s reservations towards conservation; minimization of conflicts; establishment of cooperation; involvement of local stakeholders in the management issues of Dojran.</li> <li>• Establishment of Dojran centre for Nature and Human.</li> </ul>
10.	Joint Projects	A GEF Full size project would be one the adequate approaches towards integrated ecosystem management, with participation of both littoral countries.

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**O 9. BUILDING A HISTORICAL PLACE BRIDGE WITH THE CONCEPT OF CULTURAL LANDSCAPE; TILE ART AND MOSAICS**

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**ABSTRACT:** In this study, cultural landscape, which is a wide area on which the concept of cultural landscape was based, was briefly mentioned. The aim of the study was "by building a bridge between the concept of cultural landscape and historical space" It was to examine how the art that we encounter in our journey in history with our culture is reflected in nature, the buildings we use and life. By combining culture and art, which is the whole of material and spiritual values, it has been tried to make sense through visuals and examples based on tile art. The place and importance of glass mosaics, ceramic mosaics and materials used in the cultural landscape. They were emphasized in the study.

**Keywords:** *Landscape Classification, Cultural Landscape, Tile Art*

**INTRODUCTION**

Cultural landscape is defined by the International Union for Conservation of Nature (IUCN) as "geographical areas that contain cultural and natural resources and, in this context, wildlife and domestic animals, with a historical event and an event, or exhibiting various cultural and aesthetic values". The harmony of the elements created by nature and man in these areas; their historical, aesthetic, ethnological and anthropological value; Being able to represent the dominant natural elements, land use patterns and the textures of traditional life on behalf of the region are among the other qualities sought. Actually, all landscape areas have cultural elements. Because all these areas contain artifacts created by human hands. However, in order for an area to become a "cultural landscape" area, the combination of nature / human must produce important products over time and these products must be in harmony (Ağır, 2007, Atik et al., 2009; Gülgün et al., 2014)

Cultural landscape areas can be of three different types. The first of these includes man-made parks and gardens, and structures and / or building groups, most of which are public (Yazici et al., 2019a; Yazici et al., 2019b) The second subtitle of organically developed landscape areas are landscape areas with continuity. These areas have been functionalized by human beings for social or economic purposes since ancient times and have come to the present day by developing. Rural settlements that still preserve and maintain the natural and traditional aspects of the land around them and the harvesting from this land are also included in this category. The third type is defined as the auxiliary landscape area. These areas are completely natural formations integrated with religious, artistic or cultural motifs. "Crying Rock" (Niobe) near Manisa, which is a nature formation combined with a mythological motif, can be cited as an example of this type (Madran and Uysal, 2009; Yazici et al., 2018).

Thanks to the Cultural Landscape, important data such as historical artifacts, ruins, traditions, mythological and epic stories have been gained. The things done in line with the challenges and needs of the living conditions of the time has been learned and conveyed through the cultural landscape. We will deal with art branches such as tile, ceramic mosaic, glass mosaic, which are still widely used as landscape materials today. It shows us the artistic perspective of the period, the importance and origin of these art branches, which show the difference from region to region, of the cultural landscape. The past works of these aesthetically pleasing and meaningful art branches are tried to be preserved to this day. Today, these materials are used and loved in the landscape area under the guidance of the preserved works.

## **TILE ART**

The original word is Ottoman tile (It belongs to tile, tile work) and it is derived from the name China after the Chinese who introduced the art of porcelain to the world. As a result of baking the boards of various shapes by coloring and glazing, the protective transparent layer created by the melting glaze on the plate made of tile paste became the basis of the tile art and provided an unfading color to the architectural decoration used (TDV Encyclopedia of Islam). Tile is a glazed, waterproof layer or a plate that is formed as a result of fusing glass and ceramic together with fire (Url 1).



**Figure 1.** One of the first examples that comes to mind when tile is mentioned (Url 2)

The history of Turkish tile art; is traced back to the Karakhanids from the first Muslim Turkish states. This shows that the art of tile has a history of over a thousand years. Great Seljuks and Anatolian Seljuks used tiles frequently in architectural decorations, after the collapse of the Anatolian Seljuk State, a new era of tile art began with the foundation of the Ottoman Empire (Url 1). Tiles are used to cover surfaces such as walls, arches and domes, made by firing clay soils, usually colored and glazed plates; the items of use made of terracotta in closed or open forms such as glazed or unglazed bowls, plates, cups, vases are also called çini evânî or ceramics. The art of tile, which developed depending on the architecture, came to life with the Seljuks in Anatolia. In the Anatolian Seljuks, colored glazed brick as a building material and colored glazed tiles as decoration material were widespread and gained recognition in certain regions. While turquoise color was dominant in glazed bricks in the first years, XIII. From the second half of the century, alongside with turquoise, cobalt blue as well as aubergine purple also took its place. XIV. From the middle of the century XVII. Until the end of the century, the city of Iznik became the tile production center of the Ottoman Empire. The tiles produced in Iznik and its surroundings are generally red paste. XV. In the middle of the century, blue-white tiles with white hard paste emerged. XV. At the end of the century, with the influence of tile porcelains, white paste, mostly without lining, colorless transparent glazed, blue-white tiles were produced in Kütahya just as in Iznik.



**Figure 2.** Handcrafted tile art from the past to the present (Url 3)

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**Iznik Tile**

The first Ottoman period Iznik tiles can be seen in Bursa Yesil Mosque and tomb (1421), Bursa Muradiye Mosque (1426), Edirne Muradiye Mosque (1433) and Tiled Pavilion (1472). These are usually tiles produced with mosaic or glazed painting techniques.



(a) Iznik tiles (Url 4)

(b) Muradiye tiles (Url 5)



(c) Iznik pottery tulips (Url 6)

**Figure 3.** Examples of tile art

**Kütahya Tile**

While the first tile samples had started to be seen in Kütahya at the end of the 14th century, the real progress in tile started after the second half of the 16th century, when Iznik was at the peak of tile art. Especially in order to meet the tile needs of Istanbul, tile workshops were established in Kütahya, and with the decline of the Ottoman Empire, tile making in Iznik started to decline at the same pace. With the disappearance of the art of tile art in Iznik in the 18th century, Kütahya became the only place operating in this field. The most beautiful and last examples of tiling in the Ottoman Empire were made by Hafiz Mehmed Emin Efendi (Url 1).



(a) Kütahya ceramic coffee cup (Url 7)



(b) A visual of the famous Kütahya tiles (Url 8)

**Figure 4.** Kütahya Tile art samples



**Figure 5.** The tile vase, symbol of the city of Kütahya (Url 9)

## MOSAIC ART

The technique of creating a picture by bringing alongside small, different, three-dimensional pieces together on a surface and the resulting work is called "mosaic" (Hakan, 2003). Especially in Byzantine Art, Mosaic shows itself with the application of sacred scenes on the walls and daily life scenes on the floor. The subjects in Mosaic Art have varied in the following centuries and today, Mosaic has taken its place in our lives with different designs and applications. (TKHV - mosaic art). Mosaic art, as one of the fields of painting, is the arrangement of small three-dimensional and dissimilar pieces together to form a picture. Mosaic is a painting art that was first tried by the Sumerians five thousand years ago. There are two types of mosaic art from that period till today. One is to stick mosaic pieces on concrete, and the other is to stick small pieces to the floor with glue, (Bilgihanem- research).

### *Glass Mosaics*

Glass mosaic is a mesh wall covering product formed by gluing mosaic glasses in the same or different sizes on a 30x30 mesh. There are basically two different types of glass mosaic. These are solid and crystal glass mosaics. The reason for this distinction occurs due to the difference in the stages of production (Kaplan, 2019).



**Figure 6** Glass mosaic sample (Url 10)

### **Glass mosaic usage areas**

- You can easily apply glass mosaic on all walls of interior spaces.
- It is the most preferred wall decoration product among the kitchen countertops.
- It is the only product preferred in small pools or swimming pools.
- You can easily choose it for bathroom floors and walls.
- You can also use solid glass mosaics as bathroom flooring.
- It can be easily applied on walls exposed to high temperatures such as a bread oven, pita oven or pizza oven.

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- To make the walls of restaurants and cafes look cleaner and more aesthetic Glass mosaic can be preferred



**Figure 7.**Samples of glass mosaics (Url 11, Url 12; Url 13)

### **Glass Mosaic Technical Specifications**

- It has a wide selection of colors and models.
- With its stylish and aesthetic appearance it adds value to the place where it is applied
- Since it goes through a high degree of firing in its production, it is not affected by changes such as temperature differences, humidity and moisture.
- It is durable. It can remain in the applied area for years without damaging its structure.
- It is very simple to assemble. Due to its mesh, it can easily be cut and applied to corner places.

### **Ceramic mosaics**



**Figure 8.** Ceramic samples (Url 14; 15)

Mosaic is a leveling technique obtained by placing small pieces of different types side by side and embedding them in mortar. Stone, ceramic, wood as well as fabric, paper and colored glass pieces are also used in mosaic technique. In this context, mosaics can be classified according to the material used (Hakan, 2003).

Mosaic, which stands out as a permanent and decorative application in interior and exterior architecture, on objects, parks, squares and gardens, is a special art branch that has reached the present day as a result of a very old history, a deep culture and very different interpretations. Today, two methods are mainly used for the art of making mosaics:

- \* Immersing mosaic materials on cement-coated ground
- \* Laying Plaster between the glued parts.

As mosaic particles, a wide variety of materials, shapes and sizes, from ceramic to metal, from wood to glass, can be used together. Mosaic, can be used as a ground, floor decoration, wall decoration and

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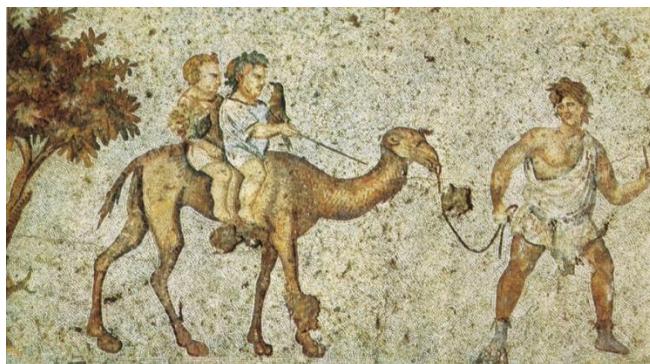
sometimes as a vase or plate decoration. In the past, while it was made from stone, marble and ceramic pieces, today small mosaic pieces of 1 cm called 'smalti' are produced only for use in mosaic art.

An example of the mosaic art from the past to the present can be given in Figure 10. This mosaic piece, which is said to be dating from 1700, was found in the excavations in Amasya city in our country. The person pictured in the mosaic is presumed to be a queen.



**Figure 9.** An example of mosaic art (Url, 16)

As can be seen in Figure 11, the work made with ceramic mosaic is a wall mosaic. The father figure taking his two children on a camel. It is currently located in the Istanbul Palace Mosaics Museum.



**Figure 10.** Mosaic art example (Url 16)



**Figure 11:** Example of mosaic in landscape Url 17

## **CONCLUSION**

Within the scope of this research, it can be concluded that the concept of landscape is very broad, as it can be explained by the topic of "building a bridge with the concept of cultural landscape". Information

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on materials is given in relation to landscape architecture. In addition, considering that culture, one of the elements that makes a nation a nation, sheds light on our past, its relevance to art is obvious. For example, the “tile vase”, which has become the symbol of our city Kütahya, will inform landscape architects about understanding culture, more precisely understanding it and keeping it alive. Within the scope of the course (material knowledge), glass, ceramics and many other materials are mentioned, and it is an important fact how the right material selection reflects aesthetically to the works, art and life.

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- Url 3: <https://www.salonantik.com/Content/images/news/6898ac34-a839-4d06-81a2-c4314ac38e27.jpg> (Erişim Tarihi: 29 Nisan 2020)
- Url 4: <https://i.pinimg.com/originals/a1/f1/54/a1f154a7a91abd6197e7d13191cc831d.jpg> (Erişim Tarihi: 29 Nisan 2020)
- Url 5: <https://gidivermek.com/wp-content/uploads/14-Selimiye-camii-kubbe.jpg> (Erişim Tarihi: 29 Nisan 2020)
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- Url 12: <http://cammozaikantalya.com/>
- Url 13: pinterest
- Url 14: <https://www.evabanyo.com.tr/ecm-s227-seramik-mozaik>
- Url 15: <https://www.evabanyo.com.tr/ecm-s234-seramik-mozaik>
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**O 10. THE EVALUATION OF THE ADVANTAGE-DISADVANTAGE AND DESIGN  
EFFECTS OF LIVE-LIVING MATERIALS**

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**ABSTRACT:** Natural and artificial materials are interrelated in landscape planning. The landscape architect has to plan harmonious and sustainable partnerships between landscape materials. In this study, the usage areas of living and non-living material which used in the example of City Park Aiolis City Memory and Memorial House located in Izmir Aliaga Yeni Neighborhood, were discussed in a multifaceted way. In the applications, advantages and disadvantages were examined and security problems arising from incompatibilities, lack of relationship and deficiencies were evaluated. In such landscaping works where living and non-living materials were used together, while considering the advantages of the materials. the compositions that they come together should be examined at every step without ignoring.

**Keywords:** *Live and non-living elements, Izmir, Artificial Materials, Landscape Design*

**INTRODUCTION**

Natural and artificial materials could not be considered independently from each other in landscape planning. On the contrary, the landscape architect has to plan the landscape materials harmoniously and sustainably. In addition, it is necessary to recognize artificial materials as well as natural materials and to establish their relations with each other. The correct fiction of these relationships; It enables them to recognize and use the planned and designed area correctly by the users and meet their expectations (Kurdoğlu et al., 2013; Akdemir et al., 2009). Reinforcement elements play an important role in the creation of the artificial environment as well as meeting the functional and aesthetic needs of people (Kuşku and Yılmaz, 2003). Urban equipment elements are products that provide communication between the urban life and social life style of human. The dimensions and shapes of the design components of the space and the reinforcement elements should show parallelism with the anatomical, physiological and psychological dimensions of the person who will use it (Özkan and Küçükerbaş, 1995; Nelischer, 1998; Yazici et al., 2018). Before deciding on the use of living or non-living material in landscape designs, area should be examined very well and the positive and negative aspects of both methods should be compared. After the decision is made, the most important step to be taken is the selection of living material and the possibilities of procurement, the legal aspect of the area and the social structure of the people around. Inanimate materials could provide efficacy as soon as they were finished, and the material could be easy to provide in general. The positive and negative aspects of living material were explained in below (Yavuzşefik and Uzun, 2005).

**Advantages of living material**

- It became old as much as inanimate material. In addition, its structure becomes more and more resilient, because it has the ability to repair some damage by itself, and over time, it creates a very complex, effective and robust structure by itself.
- Plant material creates a better ecological effect compared to inanimate material. It also creates a more positive result in terms of the visual effect of the landscape.
- Plant roots grasp to soil and penetrate between the cracks of the rock blocks, allowing the surface soil to be retained. They ensure the retention of the surface soil in areas under threat of erosion, as well as the retention of soil dragged from top to bottom for any reason in sloping areas.

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- Above-ground parts of plants reduce the impact force of shallow raindrops; By reducing the speed of flowing water, they distribute it and prevent surface flow.
  - By shading the soil on which it is located, it reduces its sensitivity to erosion by evaporation and protects the soil moisture.
  - It protects the mechanical structures, reduces their load and enables them to be effective in smaller sizes.

### **Disadvantages of living material**

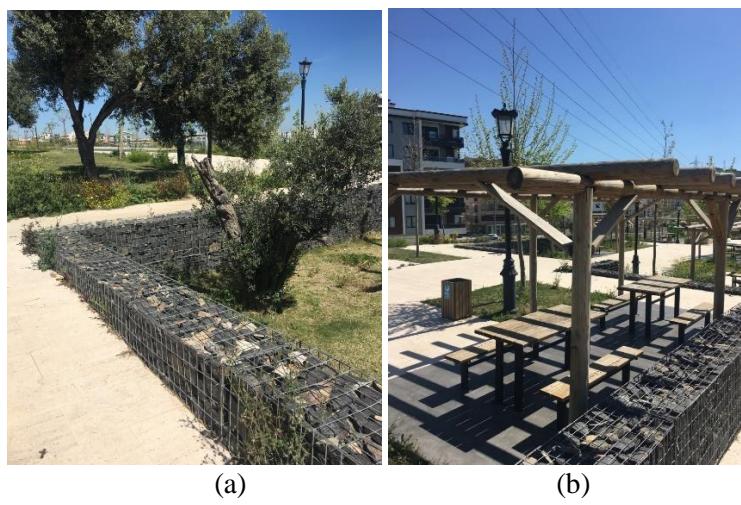
- Plants are the only possibility of living material; on the other hand, the possibilities of options are more in the applications of non-living materials. In addition, there are certain limitations of working in vegetative material such as soil structure, wind condition, planting and planting time of plants.
  - In order to work with live material to be effective, a few years should pass and regular maintenance work is required.
  - When working in live material, a larger area is usually needed (Yavuzsefik and Uzun, 2005).

## MATERIAL METHOD

In this study, living and non-living materials were examined with the original photographs and they were discussed. The study was supported by a literature search on living and non-living materials. The study area was İZMİR / Aliağa Yeni Mah. City Park Aiolis, Urban Memory and House of Memories.

## RESULTS

There was a gabion detail at the back entrance of the park in Figure 1, also there were picnic areas. The concept of sustainability, which had gained a significant place both in our country and in the world in recent years, was also of great importance for the construction industry. It is quite sufficient in terms of aesthetics, economics, durability and sustainability (Url 1). This detail, which was frequently used today, was in fact very compatible with the ecological system and nature, although the stones were inanimate materials. After all, landscape architects also bear the responsibility of developing an environment compatible with human beings.



**Figure 1.** Gabion detail (Original)

When the detail of the picnic area was examined, a wooden picnic table that was close to nature was used. Subsequently, a shading was considered and the shading element was made from the same wood. (Figure 1b) Creating spaces to meet the needs of the individual and establishing the continuity of these spaces (picnic plan is one of the duties of a landscape architect. Although the top cover elements look aesthetic, they were not functional in rainy and sunny weather.

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Some deterioration which was the wooden construction material was began to decay. Natural and artificial materials could not be considered independently of each other. For this reason, it is necessary to plan harmonious and sustainable partnerships between natural and artificial. In addition, Landscape architects are convicted of creating spaces where individual needs are met and ensuring the continuity of these spaces.



**Figure 2** Sculptural detailed fountain (Original)

People need the artificial environment as much as the natural environment. It was a fountain seen in Figure 3, but the tap part has not been made yet. Sculpture made of natural stone. Since it was close to the picnic area, it was highly developed in terms of functionality. Since water is the most basic need of living and human beings and it is alive, it is obvious that there is harmony with the living equipment element and the non-living equipment element. The living-non-living equipment elements were quite suitable in terms of both aesthetics and human-nature harmony in this campus area. The ergonomics and anthropometry used in the project overlap with these materials. The characteristics of used reinforcement elements (living and non-living) in this campus should be previously in the examination of the land (soil structure, climate, etc.). For example; In plants used as living materials, it should be known how tall and crown diameter the plant will make in the future.



**Figure 3.** Lighting element (Original)

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Undoubtedly, the most important element is the lighting element in inanimate materials. The lighting element is among the reinforcement elements connected to the infrastructure. Good lighting was important not only for our physical and mental health but also for our prestige (Turkey Ministry of National Education Art and Design: Lighting elements 2013, Ankara) and it was comfort. On a commercial basis, good lighting means good design. A good design brings cheapness and comfort. An architect uses economical, durable, portable, common materials to provide the basic needs of a person. Light was also one of the basic human needs. After examining the project area, a lighting element made in accordance with the standards. As seen in Figure 4, the park area was sufficient in terms of lighting. It was not compatible with nature because the material used was iron. Of course, it was not expected to use wood instead of iron, but using solar powered light could make this material more compatible with nature.



**Figure 4**

The elements of urban reinforcement areas and built for children's entertainment were generally plastic. However, plastic was not an element close to nature and compatible with nature. The most lifeless element in harmony with nature was wood. The one used in the city park in Figure 4. It was a wood-like plastic. Unlike the classical children's playgrounds, the children's play elements offered a different and innovative play opportunity for children, such as climbing, and there were also picnic and seating areas where their families will be very close.

Landscape architects generally prefer the most advantageous non-living material and the one closest to nature. In the simplest terms, living environments that bear the genetic heritage of nature, ie the effects of underground and aboveground dynamics; They create a living environment by minimizing the destruction of climate change, fossil fuels and natural resources. The advantage of plastic reinforcement elements is that it is more resistant to bad weather conditions than wood.

For example, iron will rust as it rains but wood can be worn out. Since the parents' trust concept overlaps with wood, generally wood or wood-like plastics are actively used. It is very important that game equipment is functional, aesthetic and ergonomic.



**Figure 5.** Bridge used in the children's area



**Figure 6.** Close-up view of the bridge floor

Falling and injuring children on uneven ground was inevitable. In such rugged areas, the concept of design and creativity comes into play. As seen in the park- in Figure 8, a bridge was considered and implemented and when we examine it closely, it was seen that the floor of the bridge was real wood and the ropes were seen on the sides, it was also very strong. The advantage of this lifeless but natural wood material that was hard and was broken easily.



**Figure 7.** Floor covering (Original)

It is very important to lay floors suitable for climatic conditions. It is very important that a ground is solid. Slate stone with grass joints is generally used. However, wood with grass joints was used here. The disadvantage of this inanimate element was that it has some distortions. Wood has a high confidence effect on people. As seen in Figure 7, the harmony of the natural element, the grass, and the wood, which was the most compatible with nature, was observed. Since wood was very easily deformed, it was better not to use it as a floor element. (Perker et al., 2006). Because one of the disadvantages of this inanimate material was that it was absorbed a lot of moisture and is less durable.



**Figure 8.** Floor covering (Original)



**Figure 9.** Art view with flooring and podium stone (Original)

There was an unusual situation in Figure 9. Instead of grass joint, wood was accompanied by a geological heritage. However, this element is made of stones that require polishing and maintenance, it was not useful and durable compared to many stones. the harmony of the 2 inanimate elements can be seen. After the harmony of wood and travertine.

As Podium stone is healthy and environmentally friendly, it does not contain any structure that will affect human health. It is among the most used stones in landscape works and decorations and takes the first place. Among the advantages of the pebble stone used in Figure 14; Pebble stone was easier and more economical than other materials in terms of easy obtaining, application, cleaning and durability. A building material; It should be durable, easy to process, easy to carry, aesthetically-especially colour-compatible with other materials. The reason why podium stone was so preferred was that it was available in different colours and allows for processing and pattern formation. The advantages of this inanimate material were quite high, for example, it does not require the use of another material as filling material in flooring. The annual rainfall and temperature statistics of the area to be applied first of the artificial stream shown in Figure 14 are checked.



**Figure 10.** Authentic breeze of the artificial stream with podium stone (Original)



**Figure 11.** Waterfall at the head of the artificial stream **Figure 12.** Shading and seating element

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Among the urban furniture elements, benches and seating elements are considered as accessories that need to be arranged together with their visual and functional features. Shading, which is one of the most important reinforcement elements. Although the seating elements in our country lack shading, they are generally not sufficient in terms of comfort.

However, as seen in this park, both the seating element was wooden and its height was generally suitable for TS 12576 standards and ergonomic use. So it is anthropometric and ergonomically suitable. Since the park was still new, deterioration was not started due to climatic factors. Although we said that inanimate elements were not very compatible with nature, the use of wood provides a great advantage when used as a seating element. A sitting member; It was very important that it was made of few parts, its maintenance was easy and long-lasting, and it was resistant to external conditions and physical factors (impacts). As seen in Figure 16, it was combined with a plant box in the park and again showed the harmony of the reinforcement element and the plant, the harmony of living material and inanimate material.



**Figure 13.** First view of sitting and shading after application (Url 2)

In the design of the benches, the seating sections are mostly planned as wooden. Wood to be used for this purpose should be suitable for external environmental conditions. Since İzmir is located in the Mediterranean climate zone, it has a warm climate.

Therefore, the materials used were important. Wood protective paints and varnishes were used to conserve the benches from atmospheric influences. For shading was creativity in this project. Because the shading of both the sitting and the ground were the same material it was very functional. If the lighting unit could be built at the edge of the shading place, it would be better in terms of both aesthetics and economy (Yazici and Temizel, 2020).



**Figure 14.** Appearance of Living Materials (Original)

## **CONCLUSION**

Living-non-living materials used in the area; Each of them has been tried to be implemented by making advantageous choices due to their usage areas, but when they come together, incompatibilities, lack of

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relation, and security problems arise due to their deficiencies. In such landscaping works where living and non-living materials were used together, while considering the advantages of the materials, the composition they come together should be examined at every step without ignoring. The selections to be made by considering the requirements and conditions will never be the only option. Problems with many such parameters will be suitable for his design; It is also the duty of landscape architects to analyze it in an ideal way, in balance and at an affordable cost.

In the consideration of park, the issues taken into consideration during the project and implementation phase were mentioned in the perspective of landscape architecture.

It was mentioned how the place and importance of all these issues. The effect of human beings, not only human beings but also the living things in nature, and how the living-non-living materials used adapt within the ecosystem. Again, these natural and artificial materials; It is discussed in terms of functionality, design, originality, and its advantages and disadvantages; The overlapping of these living-non-living materials, whose economical, ergonomic and anthropometric aspects were used, has been discussed.

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## **Internet Resources**

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- Url 2: <https://www.haberler.com/aliaga-en-buyuk-parkina-kavusuyor-11148457-haberi/> Erişim Tarihi 19.04.2020)

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**O 11. THE EFFECTS OF COLOR CHOOSING IN MATERIALS ON LANDSCAPE PROJECT DESIGNS**

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**ABSTRACT:** Colour types have psychological and visual effects on humans that cannot be ignored. In fact, it is one of the most effective elements of design. The colour element in landscape designs is a factor that should definitely be evaluated in terms of design. The phenomenon of colour, which is closer and more effective to our senses. Also, it is perceived even by people who do not react to other elements. It directs people towards the inner world thanks to the vibrations it creates spiritually. It is possible to saturate our aesthetic and harmonious desires unique to our own tastes with colours. Colours alone may not explain an element; but it is enough to express a feeling and a thought. Human beings are always in interaction with the environment and nature. In this context, the psychological, physical and biological needs of the human being must be met in the best way possible. At this point, the task falls to the designers. In this study, the place, importance of color in landscape architecture and its use in landscape designs were mentioned with examples.

**Keywords:** Colour and landscape relationship, Inanimate Materials

**INTRODUCTION**

While psychologists have been investigating what effect color has on the human psyche, a phenomenon that has been emphasized by people since ancient times, it is studied as light by physicists and in terms of aesthetics it is considered by designers as a part of the architectural whole (Gulgún et al., 2014; Ankaya et al., 2018; Yazıcı ve Temizel, 2020). Color is the effective expression that light hits on objects and the reflected rays created in our brains. In other words, colors are a phenomenon that exists with light and human eyes. Apart from the formal roles that colors assume when defining a space, there are also roles that cause that space to be perceived differently in psychological terms. With colors, it is possible to see objects warmer or colder, heavier or lighter, farther or closer. In addition, it gives personality to objects, defines, guides and warns (Alakuş, 2009; Öztań, 1996; Yazıcı et al., 2018). Colors are an important design element in landscape designs. However, the color element in landscape design is not only a design element related to the plant material, but also the basic features that make up the theme in many inanimate or structural elements (water, soil, rocks, wall and floor surfaces, reinforcement elements, etc.) that complement the design. When color harmony is realized with these basic elements, correct and positive effects will be created (Altınçekiç, 2000). Functionality is also important in the use of color. The colors used should be suitable for its purpose. Only in this way the space reaches its goal, gains its character, provides its aesthetic conditions and completes its function (Özdemir, 2007).

**THE RELATIONSHIP BETWEEN COLOR AND SPACE**

Colors make their effect felt with the texture, form and light used together of the materials used in the spaces. The concrete combination formed as a result of this turns into an aesthetic taste with psychological effects. Since colors have symbolic, formal and functional properties, they affect the visual and life comfort of the spaces. While choosing the color, it is important to know the dimensions of the space at the same time. Colors are preferred in line with the tasks the spaces will undertake, because colors can show the space narrow-wide, high-low.

Since colors have the feature of showing the building materials or objects in the space they are used in to be more larger-smaller, wider-narrower, lighter-heavier than they actually are, it is important that we

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use appropriate colors to create the desired effect. The preference of cold and light colors in spaces surrounded by narrow, boring and high walls creates a feeling of spaciousness on the users. The use of full-dark colors in large areas eliminates the negative effects of these spaces and creates a sense of narrowness, confidence and comfort on users. Likewise, contrast colors affect the sense of width when used horizontally in a space, and the sense of height when used vertically (Özçalık and Eskisarlı, 2019; Alper and Yılmaz, 2004).

All colors reveal the effect they have and the emotion they create depending on the colors used together, the effects of the environment and the ground. The most important situation in this relationship is harmony and contrast. The harmony of colors with each other strengthens the spatial effect by giving the individual feelings such as confidence and comfort. With the use of contrasting colors, colors increase each other's intensity and create the center of attention in the space and help draw attention to that point (Reekie, 1972).

Monochromaticity should be used in spaces that integrate with nature. The effect of this on users will be calmness, a sense of order, uniformity. Furthermore, the use of materials in their natural colors in these spaces is more harmonious and offers an aesthetic and reassuring effect on the users, (Spulmann, 1994). Colors play an important role in stimulating users in a space. On the other hand, they help in developing perspective and understanding the nature of a building. Colors such as white and gray have always been preferred by architects and designers; however, many architects acknowledge that the effects of these colors can now be gloomy and insulating. In this sense, in order to create more livable and harmonious spaces, new color selection approaches should be developed today. In the past decade, cities such as London and other European cities that are gray in general have had renewed identities with more modern and invigorating functions, with the use of bold colors in the façades and interiors. Many architects have considered this update to color as a revolution. Renzo Piano's Central Saint Giles building in London can be given as an example. However, depending on the materials used as the cultural and local values of the cities such as stone and limestone, some cities are defined by a unique natural color. In such a part of the city, the color of the material establishes the identity of the city.

## **THE PRINCIPLES OF USING COLORS IN LANDSCAPE DESIGNS**

The color element in landscape designs is not just a design element that contains plant material. Many non-living and structural elements (water, soil, floors, rocks, wall surfaces, reinforcement elements, etc.) that complete the design are also basic features. When used together with these basic elements, correct and positive color harmony will be seen. Color preference in the arrangement of a space is an important issue that needs to be addressed with knowledge and care. Otherwise, it may have negative effects on users. For this reason, it is useful to choose the color by evaluating the direction and angle of the light, cultural structure, social judgments, functionality, material selection and climate.

Because colors to be used in the spaces to be created will substantially affect the users, use of the space and its preference. Designers should take into account the fact that the color of the material and the color of light affect the visual perception together (Porter and Mikelied, 1976). The efficiency of the color present in the designs to be created increases in proportion to the appropriate color scheme. The principles of using colors in landscape design studies; it is possible to summarize it as defining the space, providing the relationship between function and form, creating a visual effect and facilitating visual perception. In the light of this general explanation, these principles can be listed as follows:

- Landscape design should not be considered as a structural activity only. The use of color should not be seen as an accessory or an extra case to be evaluated after design. While designs gain meaning with color and lighting, it should be taken into consideration that user qualifications and wishes should also be taken into account in coloring.
- Monochrome should be used in spaces that integrate with nature. The effect of this on users will be calmness, sense of order and uniformity. In addition, the use of the materials in these spaces in their natural colors is more harmonious and offers an aesthetic and reassuring effect on users.
- Using harmonious colors in natural and long-term use areas is relaxing, peaceful and reassuring on users, and it does not feel boring.
- Multi-color should be preferred in children's playgrounds and entertainment areas. The effect on users will be in the form of vitality and diversity.

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- Contrasting colors should be preferred when an interesting space is desired to be created. The effect is stimulating and exciting. Interesting features are added to the design with the correct use of contrasting colors (Spulmann, 1994).
- The preference of cold and light colors in spaces surrounded by narrow, boring and high walls creates a feeling of wideness and spaciousness on the users. The use of full-dark colors in large areas eliminates the negative effects of these spaces and creates a sense of narrowness, confidence and comfort on users.
- The use of neutral colors in spaces with transitional purposes increases the general characteristics of the space. It provides trust and harmony effect by protecting it (Aliçekiç, 2000; Çalışkan and Kılıç, 2014).

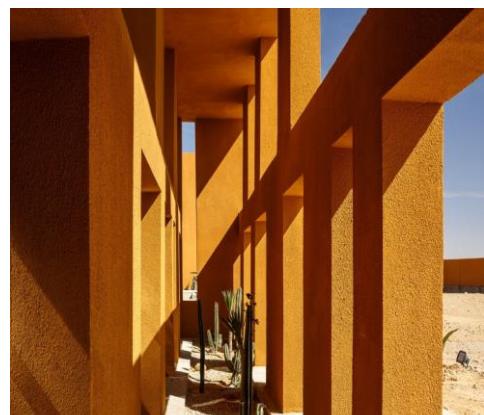
Brookes (2009), on the other hand, has addressed the color selection as follows.

- What kind of purpose the landscape area will serve should be decided. For example, if it is designed as a vibrant garden, warm colors (yellow, red and orange tones) should be preferred. However, if a more calm and serene garden is to be designed, cold or pastel colors should be preferred.
- In garden designs color has a strong effect like sound and odor elements. While choosing the color, factors such as the location of the garden, the state of being sunny, the building materials used should be taken into consideration. In fact, choosing colors by considering the color used in the building, if any creates a sense of unity between the building and the landscape.
- Another important point in color selection is to decide how the application area is designed and the choice made accordingly. For this reason, every preferred element from flooring materials used on walls and floors to reinforcement and plants should be considered as a whole since they will be used together.
- The light effect should also be calculated in the project area. The effects of colors on the perception of the space differ with the effect of the light at different times of the day. Since light colors reflect light, they create a bright and soft effect in the morning and evening, while they look pale in the noon hours when the light is strong. On the contrary, as dark colors absorb light, they look vibrant and attractive at noon, but may not be interesting in the morning and evening hours.
- Plants should not only be evaluated as green in landscape designs. It will be possible to achieve a beautiful harmony in designs with a composition to be created using various color tones.
- Also, knowing the blooming time of the plant varieties to be selected, the harmonious plant varieties can be selected and the best visual feast can be created in the gardens all year round.

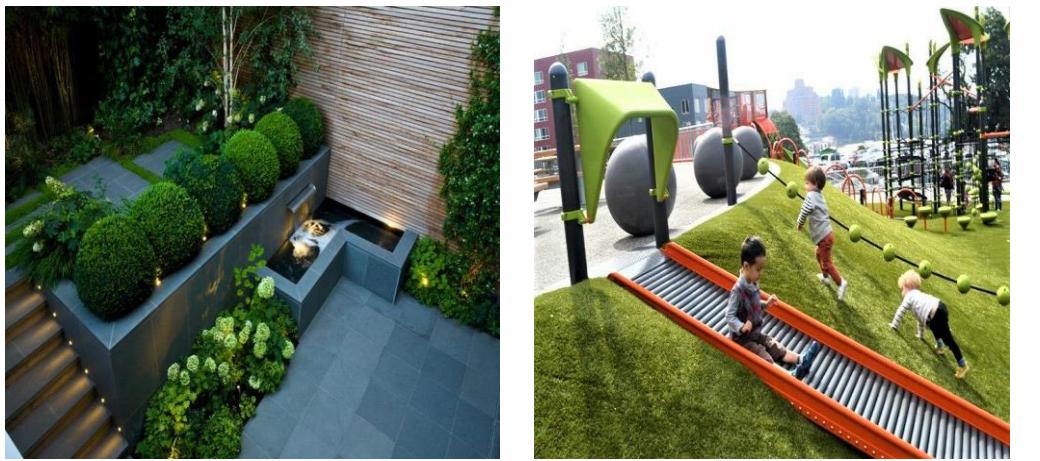
**The importance of color selection in herbal designs and materials**



a- Color selection in building material (Url 1)



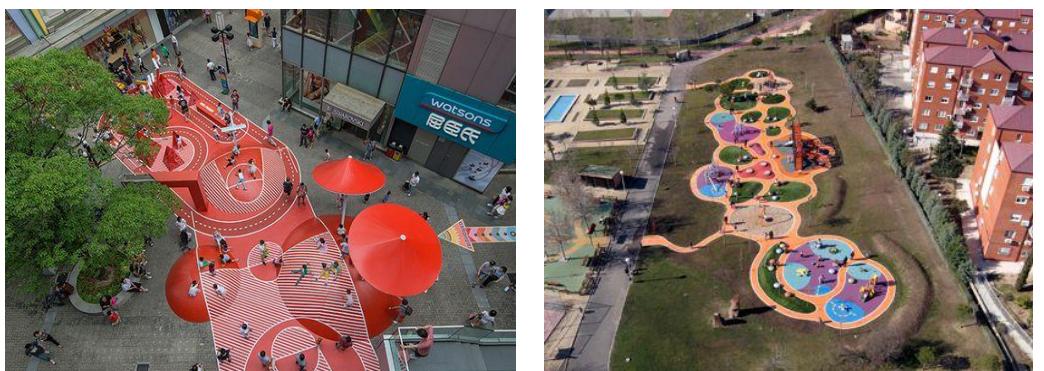
b- Color selection in building material (Url 2)



c- Building material and plant color harmony (Cool colors (Url 3))

d- Color selection in children's play element-Warm colors (Url 4)

**Figure 1.** Color effect in building materials



a-Url 5

b- Url 6



c-Url 7

d-Url 8



e-Url 9

f.Url 10

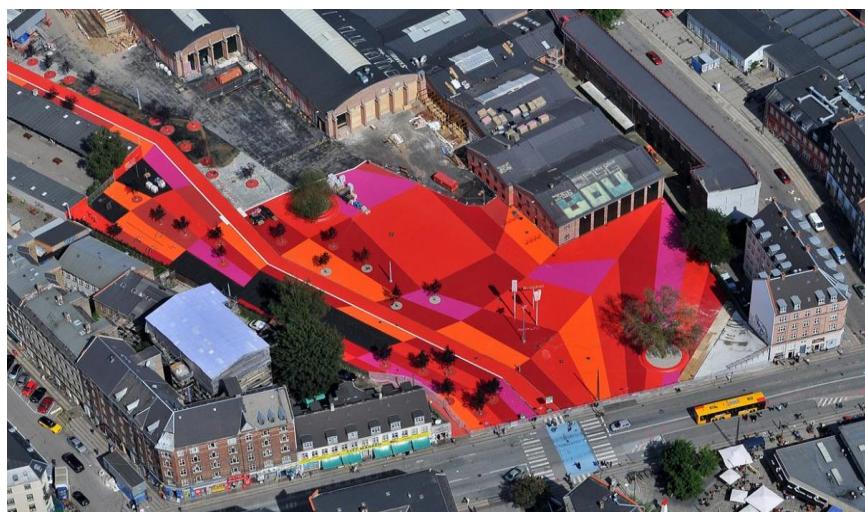


g-Url 11



h-Url 11

**Figure 2.** Examples of the relationship between landscape and color in Public Spaces



**Figure 3.** Superkilen a park design in Denmark (Url 12)



a-Url 13



b-Url 14



c-Url 15



d-Url 16

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e-Url 17



f-Url 18



a-Url 19



b-Url 20



c-Url 21



c-Url 22

**Figure 5.** Color effect on materials and color effect in plants



**Figure 6.** Expo 2016 Antalya

As seen in Figure 6, beautiful images emerge when the color of the shading element matches the planted flowers (Url 22).

## **CONCLUSION**

How the use of the concept of color in landscape design in terms of functionality and aesthetics in landscape architecture affects human beings and how it affects not only human beings but also living things on nature has been mentioned. Conceptually and psychologically the dimension of the functions of color has also been referred to as well.

Landscape architects should include suitable colors for the design and function while planning the functionality in the spaces they will create. This phenomenon, whose primary role in visual perception is indisputable, should be used with knowledge and care in the design process. Because color is a design element that directly affects the use of spaces and users.

Colors are included in landscape designs as well as in every aspect of our lives. Although choosing the right color seems easy for landscape architects, it is actually quite a challenging process. The correct color selection used in the material meets the aesthetics need in human life. For this reason, while choosing the appropriate materials in landscape project design; functional and aesthetic features are important. Colors; since the traditions and customs of societies carry different meanings and messages in their cultures, it is necessary to touch people in the right places and with the right effects. The colors to be included in a space should be of the type, tone and value appropriate to the function assigned to the space, it should be evaluated with a good analysis without ignoring the message to be conveyed to the user through color or the psychological effect desired to be reflected, and the color selection should be made accordingly. Design of attributes gained through color; it adds value and meaning to the design by influencing it with its aesthetics, form and dimension.

The methods to be applied in line with these principles make the designs more effective and more striking. When all information is taken into account, the colors to be used in their designs are of great importance for landscape architects.

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**O 12. EXAMPLES OF WALKWAY FOR VISUALLY IMPAIRED PERSON**

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**ABSTRACT:** Although steps have been taken to make life easier from the past to the present, special work has been carried out for the disabled in the last quarter century. In recent years, efforts have been made to create more comfortable movement areas for visually impaired individuals in Turkey. Landscape Architects have many duties in the social environment, sports fields, and public areas to remove the obstacles. Making designs that remove obstacles and controlling their applications are the most important points in projected areas. In the global world, by transforming technology and socialization into an advantage, analyzes can be made easily and new products can be designed for the comfort of individuals. comparing correct and wrong applications, projects that can create functional areas in usage areas will carry Landscape Architecture to a more important point and will pave the way for new responsibilities. Within the scope of this study, new products will be more efficient with the integration of developing technology into projects. By solving such obstacles, it will be able to expand the comfort areas of person with disabilities.

**Keywords:** Social environment, Landscape relationship, Comfort of individuals

## **INTRODUCTION**

### **Definition of Disability & Statistics**

*The concept of disability;* It is the state of people's body or mind being different from normal. In general, individuals with disabilities perform activities in a limited way and have difficulty interacting with the social life around them (Gülgün et al., 2014; Gülgün et al., 2018)

Types of disabilities can be diversified as seeing, movement, thinking, remembering, learning, communication, hearing, mental health and social relations.

According to the World Health Organization, disability has three dimensions:

- Impairment in a person's body structure or function, or mental functioning; examples of impairments include loss of a limb, loss of vision, or memory loss.
- Activity limitation, such as difficulty seeing, hearing, walking, or problem-solving.
- Participation restrictions in normal daily activities, such as working, engaging in social and recreational activities, and obtaining health care and preventive services (Url, 1).

There are currently more than 2 billion disabled people in the world, which is 37.5% of the world's population, and disability prevalence is higher for developing countries.

\* 1.3 billion people are affected by some form of blindness and visual impairment. This represents 17% of the world's population.

\* 466 million people have a disabling deafness and hearing loss. This represents 6% of the world's population.

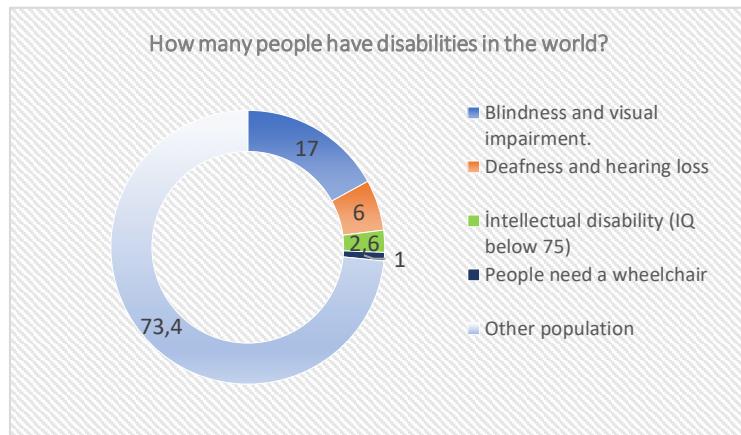
\* About 200 million people have an intellectual disability (IQ below 75). This represents 2.6% of the world's population.

\* 75 million people need a wheelchair on a daily basis. This represents 1% of the world's population.

These figures may remain an evolutionary average, but one thing is certain: the number of people affected by any form of disability represents a significant part of the world population, from adults to

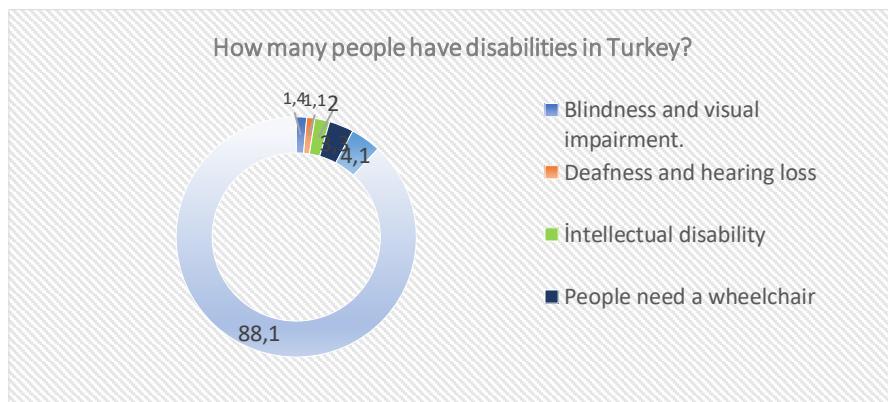
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children. It is also important to underline the fact that some people are multi-handicapped and have multiple disabilities (Url, 2).

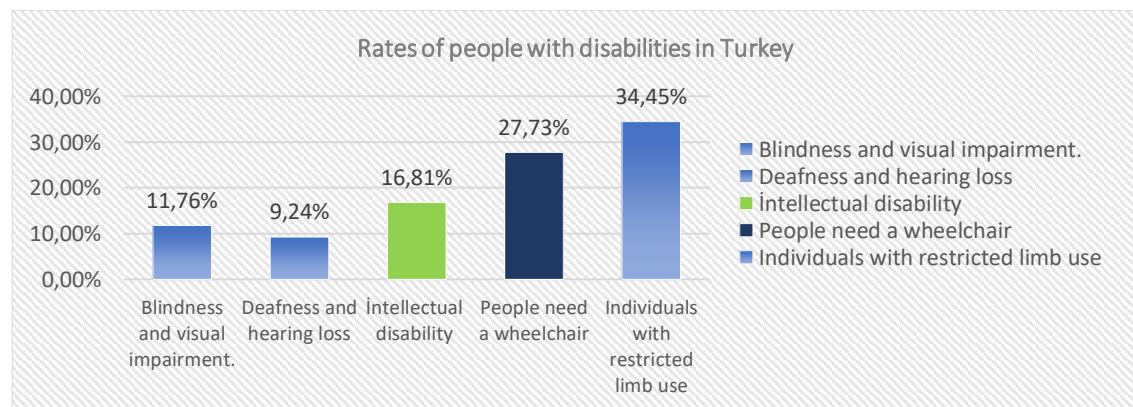


**Figure 1.** “A more accessible world!”

- \* 1,4 % of Turkey’s population is affected by some form of blindness and visual impairment.
- \* 1,1 % of Turkey’s population has disabling deafness and hearing loss.
- \* 2 % of the population has been people with an intellectual disability.
- \* 3,3 % of the population needs a wheelchair daily. This represents 1% of the world’s population ((Url 3;Url 4; Url 5).
- \* “individuals with restricted limb use” constitute %4,1 of the population.



**Figure 2.** Indicators related with disability and old age, 2019



**Figure 3.** Turkey Health Interview Survey, TÜİK, 2019

In this context, the number of visually impaired people is substantially high in the world and in Turkey.

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### **Who Is Visually Impaired and Who Is Not?**

Visually impaired people are not in need. They are not people who cannot meet their needs and they are not desperate. They are also not miraculous creatures, very different from other humans, possessing extraordinary abilities and hearing voices that others cannot hear.

“All the positive and negative traits that other people have” are present to them, too. In short, visually impaired individuals are human beings like everyone else.

According to "TÜİK" data, there are visually impaired individuals at a considerable degree in our country. The distribution ratios are detailed in the table below:

For the first time in Turkey, with the Decree Law No. 572 dated June 6, 1997 and the regulations made in the Zoning Legislation, it was aimed to make the built environment accessible to the disabled (Url 3).

**Table 1.** Respect for people with disabilities is respect for humanity

Görme sorunu olan bireylerin cinsiyet ve yaş grubuna göre dağılımı, 2008, 2010, 2012, 2014, 2016  
The percentage of individuals having vision problem by sex and age group, 2008, 2010, 2012, 2014, 2016

Yaş grubu Age group	2008			2010			2012			2014			2016		
	Toplam Total	Erkek Male	Kadın Female	Toplam Total	Erkek Male	Kadın Female	Toplam Total	Erkek Male	Kadın Female	Toplam Total	Erkek Male	Kadın Female	Toplam Total	Erkek Male	Kadın Female
<b>Toplam-Total</b>	<b>8,1</b>	<b>5,7</b>	<b>10,4</b>	<b>6,7</b>	<b>4,8</b>	<b>8,4</b>	<b>5,5</b>	<b>4,0</b>	<b>6,9</b>	<b>6,9</b>	<b>5,1</b>	<b>8,6</b>	<b>6,9</b>	<b>5,3</b>	<b>8,6</b>
15-24	1,6	1,6	1,6	1,3	1,0	1,5	1,2	1,3	1,0	1,7	1,5	1,9	1,6	1,6	1,6
25-34	2,1	1,1	3,2	2,2	1,5	2,9	1,6	0,9	2,4	1,7	1,3	2,0	1,4	1,3	1,4
35-44	3,7	2,2	5,3	3,0	1,3	4,7	2,2	1,6	2,8	3,7	2,1	5,4	3,3	2,1	4,4
45-54	12,7	9,1	16,4	8,9	6,7	11,2	6,9	5,0	8,8	10,3	7,7	13,0	9,4	7,8	11,1
55-64	19,4	13,5	24,8	13,7	12,2	15,0	9,5	6,8	12,0	13,2	10,6	15,6	13,3	9,4	17,0
65-74	23,7	17,5	29,0	21,6	14,8	26,7	18,3	13,8	22,0	17,6	15,1	19,8	18,5	16,4	20,2
75+	36,0	32,9	38,1	34,2	28,1	39,3	33,1	28,3	36,3	28,8	23,1	32,5	31,9	23,8	37,2

Kaynak: Türkiye Sağlık Araştırması

Source: Turkey Health Interview Survey

### **Common Problems Encountered by Disabled People in Social Areas**

In many cities with a high population in the globe and in our country, people with disabilities live and they face dozens of problems every day. There are many disability groups in societies and each one has its own specific struggles. In this presentation the materials which can be used to overcome the problems encountered by the visually impaired people will be submitted(Url 6).

### **APPLICATION SAMPLES FOR VISUALLY IMPAIRED PEOPLE**

There are many exemplary applications in the world for disabled people to be more comfortable in social areas and public areas. These sample applications may facilitate the lives of the visually impaired to some extent.

Staircase handrails usually are not considered to be a great navigation, however, if we use Braille Staircase Handrail, it would be really handy for visually impaired and blind people.

Using perceptible guide tracks at level crossings to ensure the safe passage of visually impaired pedestrians in traffic.



**Figure 5.**



**Figure 6.**

Using ramps in accordance with the standard to ensure safe passage in traffic in areas with elevation difference between the road and the pavement.



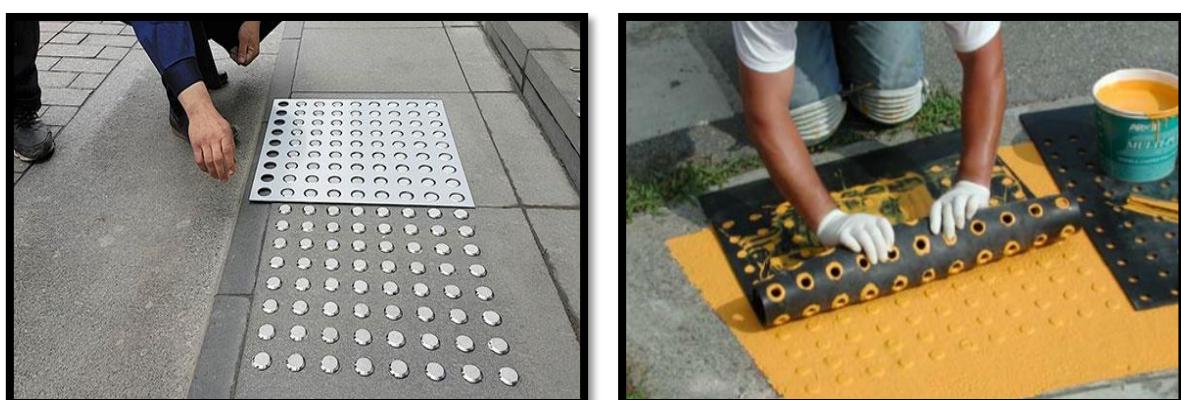
**Figure 7.** Usage forms have been developed with different designs in the world.

In today's modern world, many product designs have emerged with the advantage of technology and socialization. The alternative products for the visually impaired are used in different ways with direction signs, tracks, and special colors (Url 8).



**Figure 8.**

In many countries, an exemplary application has been carried out and the applications have been continuously developed, especially in order to enable the visually impaired individuals to reach from one place to another on the walking paths.



**Figure 9.**

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**SOME OF THE PRODUCTS DESIGNED AND APPLIED IN THE WORLD**

In many areas, we can see examples that suggest that the elaborations are observed at the time of use with correct or incorrect use. The material to be used in the visual impairment paths which detailed in projects should be selected well in a sustainable way and its use should be well observed. While designing sustainable areas in projects, it should never be forgotten that the area appeals to everyone in its current use (Yazici and Temizel, 2020; Ankaya et al., 2018).

*Remember that "Every person is a candidate for a disabled individual."*

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**O 13. THE IMPORTANCE OF GREEN AREAS FOR HUMAN HEALTH**

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**ABSTRACT:** Today, the effects of green areas on human health and psychology are known by most people and it is thought that green has a relaxing effect on people. Considering the history, the importance given to green in the past also stands out. Green areas have become more important in today's Covid 19 pandemic period. In this study, the psychological and physical effects of green areas on human health, their positive and negative aspects, as well as the effects of universal problems such as environmental pollution, which is increasing day by day, on human health in our country and in the world will be examined, and issues such as the studies on green areas in our country and the number of green areas per person will also be discussed.

**Keywords:** *Green areas, sustainable environment, urban areas, human psychology*

**INTRODUCTION**

Urban green areas are public spaces that determine the quality of the physical and social environment within the urban area, allow educational, cultural and recreational uses and are open to the use of all members of the society (Akay and Ocakçı 2003; Akça and Yazıcı, 2017).

Open and green areas are a long-term balance for various uses in a city's structure; are a living organism that creates various possibilities for versatile outdoor uses at the same time. This organism has long-term efficacy and validity for the period it is in, as well as for the future periods (Öztan 1991; Yazıcı and Gülgün, 2017; Yazıcı and Ünsal, 2019).



**Figure 1.** Uskudar, Istanbul (Url-1)

The idea that being in touch with nature helps to relax psychologically and reduces the stress of city life emerged with the beginning of urbanisation (Ulrich and Parsons, 1992). Research on the positive effects of nature on human psychology has shown an increasing development over the last 30 years. Researches conducted in recent years have begun to draw attention to the relationship between visual environmental quality and the physical health of people. Several studies in this field showed that watching the nature can positively affect the physical health of people (Gülgün et al., 2015; Temizel et al., 2017; Yazıcı and A.Sağlamer, 2019)

Within the context of this study, the effects of green areas on human health have been evaluated with its positive and negative sides in terms of psychological and physical aspects, the amount of green areas in

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Turkey and studies related to the improvement of green areas have been examined, and universal issues such as environmental pollution have been evaluated in terms of their effects on human health.

### **THE EFFECTS OF NATURAL LANDSCAPE ON PSYCHOLOGICAL AND PHYSICAL HEALTH OF PEOPLE**

Potential benefits of living with nature for urban people were researched by those who work on environmental psychology, and in many environmental literature, the view that being with nature has positive effects on human psychology has been widely accepted.

It is noted that in addition to being directly in touch with nature (active contact), people gain various benefits from nature only through seeing nature (passive contact), such as watching flowers in a park or looking at trees from a window, and even knowing that such areas are nearby and can be used when desired (Ulrich and Parson, 1992).

Starting to buy flowers and plants for their homes and gardens, engaging in nature-based activities and hobbies, and buying houses with gardens for themselves are all well-known indicators that people gain various benefits from being in touch with the nature when the income levels of people rise above the normal life standards (Beer, 1990). However, there are also studies trying to reveal scientific evidence on this subject conducted in the United States of America, most of the places that were found attractive for tourists were composed of natural areas (Kaplan, 1992), houses that were close to green areas and parks were more valuable, such places were less likely to change owners, and people living in places that lack green areas were disliked (Gold, 1980) was shown as evidence of how important urban natural areas were to people.

Although the importance of parks and green areas for people is mostly associated with recreational and social activities, it is stated that people can obtain significant psychological benefits from passive relationships with nature based on visual basis (Ulrich and Addoms, 1981).

### **RESEARCHES ON THE EFFECTS OF NATURAL AREAS ON HUMAN PSYCHOLOGY**

Researches on the positive effects of nature on human psychology has shown increased development over the past 30 years. One study, considered one of the first of such studies, analysed the psychological benefits people obtain from their house gardens (Kaplan, 1992). In the study, three different psychological effects were identified: active participation (such as working in the garden or walking), passive participation (such as watching the garden from the window) and intellectual participation (such as planning social activities by supporting the self-confidence of the people in various ways), and it is emphasised that the opportunity of working in the garden provides for individuals to express themselves. Studies on physiological responses to the visual environment also shown that natural areas, contrary to built-up areas, have a restorative and positive effects on the emotional states of people.

The study of environmental psychology also conducted a series of experiments to test the validity of the hypothesis that viewing nature and enjoying natural scenery has positive effects on people's psychological health. First (Ulrich, 1979), the effects of visual landscape on the emotional states of stressed students who completed a final exam were analysed. As a result of the research, it was observed that the stress level of the students watching natural scenery decreased while the students watching the urban landscapes became even more stressed than they were after the exam.

Ulrich, in his third research on this subject (Ulrich et al., 1991), measured the physiological and psychophysiological responses (heart rate, blood pressure, muscle tension, brain waves) of individuals watching natural landscapes, proved that watching natural scenery reduces stress on subjects and accelerates recovery from stressful situations, and showed that there is a complete consistency among the stress-measuring values that nature has healing effects.

Hartig et al. (1991) provided relatively stronger evidences that being in natural areas ease mental fatigue relief. In a study comparing three groups; who went on a nature trip, had a holiday in the city, and did not take a vacation, the groups were asked to correct mistakes on a reading, and as a result, it was determined that the group who went on a nature trip obtained the best score.

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### **URBAN GREEN AREA**

Open and green areas are a long-term balance for various uses in a city's structure; are a living organism that creates various possibilities for versatile outdoor uses at the same time. This organism has long-term efficacy and validity for the period it is in, as well as for the future periods (Öztan 1991). According to Yuen (1996), urban green areas are public spaces that determine the quality of the physical and social environment within the urban area, allow educational, cultural and recreational uses and are open to the use of all members of the society.



**Figure 2.** Karatay/Konya (Url 2)

### **Urban Green Area Approaches**

The conception of "green area" is defined in the dictionary as spaces reserved for recreational uses in urban areas.

"Modern society leaves the natural environment and lives in an artificial environment. It is necessary to adapt to the conditions of nature again." These words of Le Corbusier become more and more important each day in direct proportion to the increase in urban development (Yıldızçı 1982).

Le Corbusier, the famous urbanist-architect of our age, based his plans on three main principles, these are; the sun, spaciousness and green. He states that he found these principles in Istanbul, which he visited in 1911. Stating that the houses in Istanbul are surrounded by trees, the great master task about the attractive friendship between "human" and "nature" and says: "If we compare New York with Istanbul, we can say that one is a disaster and the other is a heaven on earth. Istanbul is an orchard; our cities are quarries." (Kortan 2017).

Le Corbusie defines the cities of today and tomorrow as follows: "The gigantic fact of tomorrow's metropolitans will thrive in a delightful greenery. This city must be entirely in green and spacious spaces. Even in the heart of business cities where skyscrapers raise their heads, the city must still remain green. Trees are the kings, nature-human connection must re-established, the city must be a giant park" (Yeşil, 2006).

Famous urbanist-architect M.V. Posokhin says "A city without water and vegetation is dead even if the architecture of its buildings are good", meaning, "an uninhabitable city" (Kortan 2017).

### **Functions of Urban Green Areas**

Open and green areas in the urban texture are of great importance in terms of urban ecology. Open and green areas provide equipment for sports, entertainment and recreation purposes, create a positive effect in ecological and microclimatic aspects, enable agricultural production and act as a buffer that prevents the overgrowth of the city. In the environment of cities, which is petrified, concrete, made up of steel and glass stacks, the green areas have the functions of improving the climate, shading, filtering dust, reducing the noise effect, providing recreation and responding positively to the physiological and psychological needs of the urban people with cultural activities.

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### **Psychological Functions of Green Areas**

Urban green areas are spaces where people can escape from the crowd, pollution, noise and monotonous lifestyle. These clean, calm and peaceful places are also of great importance in terms of human mental health. Green areas, which enable the relationship between nature and humans, provide both physical and psycho-hygienic benefits to city dwellers.

In addition to improving perception, green areas absorb, diffuse and cut high-frequency noise, and alleviate the negative pressures of noise pollution on human health when they are planned as green curtains and green belts (Aksoy, 2004).

### **Social Functions of Green Areas**

Green areas are regulated as spaces that are conducive to some social activities with their distribution in the city. They serve as a venue for social and political activities on certain days, and enable the people of the city to gather and meet up (Bayraktar 1973). Parks, squares, garden exhibitions, arboreums, sports fields, etc. Green areas, where recreative uses are important, are spaces that bring the people of the city together and ensure the establishment of social communication.

There are also spaces that contribute to the education of the public within the scope of green areas. The visits of children of primary school age to botanical gardens have now become a tradition. Activities in these areas, where educational lectures are held on subjects such as the importance and functions of love of nature, are reinforced with the necessary arrangements.

### **Recreational Functions of Green Areas**

Green areas provide organised outdoor space for recreational purposes. They provide all opportunities for active and passive recreational activities where people from all age groups can participate in entertainment, relaxation, play and sports activities.

Green areas offer the necessary equipment for sports, relaxation, recreation activities and promenade both in the city centre and the country. It also offers a landscape and a natural resource to the people of the city (Odabaş, 1990).

### **Green Open Areas in Turkey**

According to the regulations of the Ministry of Environment and Urbanisation, the amount of green area required per person in the city is at least  $15\text{ m}^2$  and the rate of “active green area” recommended by the World Health Organisation is at least  $9\text{ m}^2$  per person. Ministerial data showing that the average green area per capita in Turkey is  $6.2\text{ m}^2$ , shows that there is a  $10\text{ m}^2$  green area deficit in cities.

According to the Ministry of Environment and Urbanisation, active green areas are places such as parks, gardens, picnic sites, urban forests, which are generally open to public use while passive areas are places that the public do not always benefit from, such as cemeteries, forests and so on.

Green area planning in Turkey is made according to the construction legislations. In the legislation, the amount of green area per person was foreseen as  $7\text{ m}^2$ . The Ministry of Environment and Urbanisation, with the Spatial Planning Construction Regulation dated 14 June 2014, increased the amount of green area per person first to  $10\text{ m}^2$  first, then to  $15\text{ m}^2$ . With the regulation, the scope of the green areas was also determined: On neighbourhood scale; children’s playground, park, square, district sports areas, botanical parks, recreation areas and recreation uses, on city scale; zoo, urban forest, afforestation area, fair, show-ground and festival area, hippodrome.

### **Cities with the Lowest Percentage of Public Green Area;**

Tokyo; Population: 35 million Percentage of public green area: 7.5%

Bogota; Population: 7.2 million Percentage of public green area: 4.9%

Taipei; Population: 2.7 million Percentage of public green area: 3.4%

Istanbul; Population: 15 million Percentage of public green area: 2.2% (Irmak and Avcı, 2019).

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### CONCLUSION AND RECOMMENDATIONS

Since the earliest days of humanity, green areas have not only met the nutritional need of humans, but have also met people's needs for different levels of prosperity and well-being (WardThompson 2011). Frederick Law Olmsted, who was considered the first landscape architect about a hundred years ago, focused on the impact of green areas on human health. Today, especially in developed countries, politicians and public health experts take the impact of green areas on human health into consideration (Morris et al. 2006). In this study, the relationship between the amount of green area per person in Turkey and heart attack, natural deaths and suicide events was analysed and the effects of green areas on human health were evaluated comprehensively. As a result of the research; it has been concluded that as the amount of green area per person increases, the rate of heart attack, natural death and suicide incidents decreases. Therefore, this study emphasises that the effect of green areas on human physical and mental health should not be underestimated (Akpinar and Cankurt, 2015).

In this study, the relationship between the quality of urban green areas and the physical and mental health of adults was analysed. The effect of green areas on human health becomes more important each year and studies on this subject increases. In this context, important results were obtained in this study and it was concluded that;

- The distance of urban green areas from houses is one of the important factors in terms of physical activity and health,
- Large and open, visible green areas are positively associated with general health,
- The environmental cleaning and size of green areas are positively associated with people's stress level,
- Urban areas should be located at a maximum distance of 1000 m or 15 minutes from the houses of the people,
- Urban green areas should be well-kept and clean, also, large and visible green areas should be planned and their designs should be created accordingly.

It should be ensured that both green areas with ecological value and, open and green areas bearing social-cultural values in terms of community development and health are protected. An evaluation system that includes certain factors ranging from physical characteristics to socio-economic characteristics should be established in determining the priorities of investments to be made in open and green areas. This system will be a positive tool in increasing the quality of green areas, especially through the evaluation and management of green area potentials. In order for the cities of the future to become healthier places to live, more green areas are needed in cities. At this point, it should not be forgotten that green areas are the first step in establishing sustainable city administrations. It is now a scientifically proven fact that the lack of green areas threatens the lives of people. Because of this, necessary legal regulations should be made in order to protect green areas more strictly and necessary assistance should be provided to city administrators to meet green areas per capita.

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**O 14. THE USE OF ECOLOGICAL AND SUSTAINABLE MATERIALS IN LANDSCAPE DESIGNS**

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**ABSTRACT:** To create the ideal ecological design model is possible by following the constantly renewed ecological information and analysis. In line with this information and analysis, application-oriented eco-materials can be selected and even new ones can be developed. Since "Ecology" is a concept with many variables, techniques and materials differ for each ecological design application. Therefore, the most appropriate eco-material selection can be made in line with the criteria shaped according to the ecological design model, whose main principle is "minimum resource consumption and destruction with maximum benefit, sustainable design". It will be possible to choose the most suitable eco-material in line with the formed criteria. Sustainability could be summarized as "Meeting the needs of today without damaging the ability of future generations to meet their own needs". In this study, ecological and sustainable materials were mentioned and examples were given.

**Keywords:** Sustainable materials, Landscape inanimate

**INTRODUCTION**

One of the most important problems of the current century is the deterioration of the ecological balance that occurs in parallel with environmental pollution (Yazici et al., 2017). The survival of living things is possible with the sustainability of their living environments. Today, urbanization, which is rapidly increasing with industrialization and developing technology, causes damage to ecological balances and destruction of cultural and historical values. In this context, ecological criteria that should be applied in architectural designs for a sustainable future have been investigated (Yazici et al., 2018; Ankaya et al., 2018; Gülgün et al., 2014; ).

Man is a part of nature. Architectural design studies should be handled in a way that it ensure a healthy sustainability in the nature-human-society as a whole. Design, which includes ecological principles, defines the difficult task of adding spatial content to the relations of natural systems and social systems. "The basic basis of the concepts of environment, ecology and sustainability in planning is to create residential areas compatible with nature or to ensure the continuity of residential areas by making them compatible with nature. Bioecology, also known as bionomics or ecology, is a branch of science that examines the relationships between living things and the living and inanimate environment surrounding them (physical-chemical factors of the soil, climate, the topography and appearance of shelters, animal and plant competition). Nowadays, with the increasing human-nature relations and environmental problems gaining importance, the term ecology; is used in the field of science that supports the conservation of nature and its cycles with the use of renewable and harmless energy as well as the relationships of living species. Sustainability is related to basic human needs such as clean air, clean water, healthy and sufficient food, relationships with plants, animals and other people, protection, participation, creativity, freedom, love and beauty. The key element in ecological planning and building is sustainability.

**Evaluation Criteria of Landscape Designs in Terms of Sustainability**

Sustainability, one of the most important concepts of today, is a key concept that aims at high efficiency, which foresees the continuous functioning of any social, economic or ecological system without disturbing and consuming the resources used.

• **Effective Use of Microclimatic Data:** Climatic data such as insolation, wind directions, heat, radiation should be used in an efficient and energy-saving way in planning, urban design and architecture.

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- **Energy and Material Conservation:** Access to the central business area, internal circulation, lighting / heating / ventilation etc. of the central business areas. Arrangements should be made to ensure the minimum use of energy in the design of the microclimatic environment (at environmental / building scales).
- **Recovery of Energy and Waste:** Electricity, solar, natural gas etc. used in central business areas. Technologies related to recycling of energy should be used, wastes (solid / liquid waste, solid liquid biological wastes, etc.) should be separated on-site, and recycling technologies should be used.
- **Development of Energy and Material Resources:** Solar energy in the heating and illumination of buildings. Biomass energy, electricity, alcohol-powered environmentally friendly vehicles in central business areas; waste should be used for heating and fuel. Recyclable wastes, (paper, glass, metals, chemicals, etc.) should be recycled by establishing a separation facility, the existing building stock in the area should be used until its economic life is over, then the material should be utilized to the maximum extent.
- **Efficient Use of Topographic Data:** Infrastructure and superstructure problems arising from the land should be minimized. The geological structure, soil capability, and the fertile soils located in the building construction area should be evaluated by moving it into the green areas.
- **Efficient Use of Natural Resources:** Today, existing vegetation, streams, flora, fauna, etc. should be developed by utilizing natural resources. Green standards for central business areas per person should be increased as much as possible, and the rate of green in squares / areas / buildings should be kept at high proportion.
- **Evaluation of Vegetation:** Its the use of existing vegetation by improving it in planning, researching the plant species unique to the region, its use in parks, open and closed spaces.

Based on the above principles, we can examine landscape design projects under 6 headings in terms of sustainability.

These are;

- Water collection systems integration
- Use of renewable energy
- Use of natural resources and materials
- Plant selection
- Permaculture (natural garden)
- Streuobst method

## **ECOLOGICAL AND SUSTAINABLE BUILDING MATERIALS**

While evaluating whether the materials are ecological or not; Not only are they evaluated in terms of social, economic and practical aspects, there are also classifications in line with other features. The properties of materials that can be used in sustainable and ecological terms are given in Table 1.

**Table 1.** Eco-material usage in landscape application areas.

Material Name	Place of Use / Function	Natural / Artificial	Transformation / Reuse	Local / Foreign *
Compacted tile and stone powders	Flooring	Natural	Re-use	Local
Natural stone particles	Flooring	Natural	Re-use	Local
Concrete blocks	Flooring	Natural	Re-use	Local
Converted glass	Flooring	Natural	Transformation	Foreign
Compost	Soil improvement	Natural	Re-use	Local
Straw	Wall	Natural	-	Local
Adobe	Wall	Natural	-	Local
Irrigation heads	Irrigation	Artificial	-	Foreign
Rain and surface water tanks	Irrigation	Artificial	-	Foreign
Sun tunnel	Lighting	Artificial	-	Foreign
Sun sensor	Lighting	Artificial	-	Foreign

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solar panel	Energy production	Artificial	-	Foreign
Wind turbine	Energy production	Artificial	-	Foreign
Wind chimney	Energy-saving	Artificial	-	Local
Traverse	Reinforcement	Natural	Re-use	Foreign
Converted steel	Reinforcement, Fence	Artificial	Transformation	Foreign
Natural stone	Floor covering, Wall	Natural	-	Local
Wood composite	Floor covering, Fence, Reinforcement	Artificial	Transformation	Foreign
Nutshells	Ground covering, Soil improvement	Natural	Re-use	Local
Waste metal	Fence, Reinforcement	Artificial	Re-use	Local
Waste wood	Fence, Reinforcement, Wall	Natural	Re-use	Local
Natural Wood	Floor covering, Reinforcement, Wall, Fence	Natural	-	Local
Plant	Floor covering, Fence, Energy Design, Wall	Natural	-	Local
Rubble waste	Floor covering, Wall	Artificial	Re-use	Local
Wood chips	Soil improvement, Ground covering	Natural	Re-use	Local

## **Wood**

It has been used as a carrier element, window joinery, floor roof element and exterior cladding in buildings, and it continues to be used. Among the building materials, wood has always been among the preferred materials due to its advantages.

Wood does not cause adverse environmental effects throughout its life cycle. For this reason, wood joinery produced from environmentally friendly wood is one of the indispensable building materials preferred in building production.



**Figure 1.** Examples of the use of wood (Url 1)



**Figure 2** Examples of the use of wood (Url 2)



**Figure 3.** Examples of the use of wood (Url 3) **Figure 4.** Examples of the use of wood (Url 3)



Among the building materials, wood has always been among the preferred materials due to its advantages. In landscape applications wood is used for various purposes. The most common use is for reinforcement elements such as floor covering, Pergola, Fence, Gazebo, and bench (Figure 1; Figure 2; Figure 3; Figure 4).

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### **Straw bale**

It is a great insulation material. Straw can provide 3 times better insulation than other insulation materials. Heating and cooling costs can be saved by 75%. It is also a material that provides very good sound insulation. It does not harm the environment.



**Figure 5.** Examples of the use of hay bales (URL 4, Figure 5)

Production and transportation of materials such as cement and brick requires high energy. However, straw is a sustainable material that is produced by solar energy and can be obtained every year. It can easily be obtained from every place where grain is produced, it needs low energy for baling. It has no harm to the environment, it mixes with the soil when the buildings collapse. It can even be used as compost.



**Figure 6.** Examples of the use of straw bales (URL 6; Figure 7)

Moreover, utilizing straw bale as a building material alleviates the gas emission caused by burning unnecessary straw. It is economical. The cost of straw bale houses is very low. As it provides thermal insulation, it also reduces the cost of heating in the long run.

### **Sandstone**

It is called clastic sedimentary stones formed by combining sand grains with a diameter of 1 / 16-2mm with a natural cement.

It is a building material that is compatible with human nature and has a history of thousand years. Centuries ago buildings made of sandstone still stands today. While most building materials gain an ugly appearance after years, stones gain their own unique appearance and attain their true beauty. It is possible to reuse previously used stone material for a different purpose. This feature contributes to the protection of natural resources.



**Figure 7.** Sandstone (Url 8)

It is a building material that is compatible with human nature and has a history of thousands of years. Buildings made of sandstone centuries ago still stand today. In our country there are different colors and features of sandstone resources. The widespread use of sandstones as a carrier material in walls and columns, as coating material on interior and exterior surfaces, as flooring material on the floor will contribute to the creation of a healthy living environment and protection of the natural environment.



**Figure 8.** Use of sandstone in cultural assets (Url, 9; Url 10).

### **Plaster**

In this way, even though they absorb moisture, shrinkage, cracks like concrete and wood they do not change their size and shape. The acquisition, applying and maintenance of plaster and plaster element is easy and cheap.



**Figure 9.** Plaster (Url 11)

It enters the structure fully finished, does not require additional labor and expense. Since the plaster element contains very small gaps, it reflects by reducing the sound waves on it. In volumes where acoustics are important, it controls the sound transmission between the volumes well. Due to its construction and adhesion properties, plaster can be added to a different material as well as being a hydraulic binder. These are some of the building materials.

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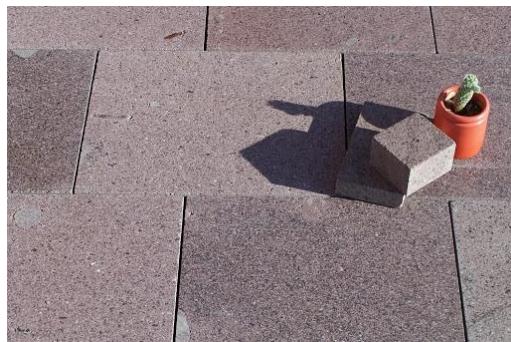
**Natural Stones**

Natural stone; is a natural product whose properties vary according to its type, and the way the minerals that makes it up are bonded. Natural stone differs from all construction materials with these features.



**Figure 10.** Cut stone (Url 12)

Natural stone is not a uniform industrial product and bears the traces of its formation process. Natural stone is almost ready in nature to be used as a building material. Energy is only required to quarry and process the stone, which is much less than for other building materials.



**Figure 11.** Cut stone (Url 13)



**Figure 12.** Natural stone (Url 14)



**Figure 13.** Natural stone (Url 15; Url 16)

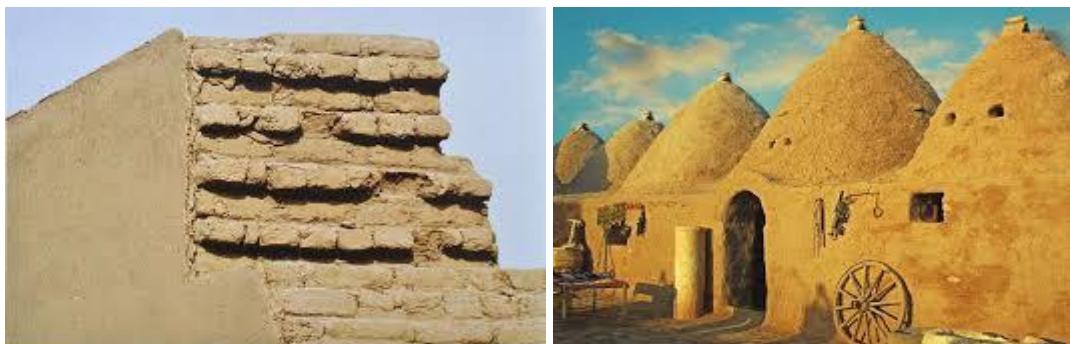


**Figure 14.** Natural stone (Url 17; Url 18)

## **Adobe**

Adobe is a natural and sustainable building material. In addition, adobe is a 100% recyclable and waste-free material.

The properties of adobe and brick's properties are similar. The adobe mortar, which is kneaded with water and shaped in molds by making use of the bindingness of clay as a raw material, is dried under the sun. After drying, a building material whose compressive strength is not as high as brick and that has low water resistance is obtained. The most important difference between adobe and brick is that it is dried with sunlight without consuming any energy, while brick is baked in an oven at 900 C.



**Figure 15.** Examples of using adobe (Url 19; Url 20)

The adobe structure keeps the humidity of the interior in balance by absorbing the moisture in the air due to the porous structure of the adobe paste. Adobe provides the protection of heat and moisture balance due to its heat retaining feature. It provides a more livable, clean and healthy bioclimatic comfort in the building.

The most important element of ecological landscape designs is planting design. Planting design includes vegetative applications in a landscape area. The most important point in this design is the selection of plant in vegetative applications. The area to be treated in plant selection and use of native plants of the region is extremely important. The use of natural plants will facilitate the adaptation to the area to be

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culturally created, and the plants that are easy to adapt will also contribute aesthetically to the visual presentation as they can show their natural development.



**Figure 16.** Examples of using adobe (Url 21)

## **Planting**



**Figure 17.** New Generation Green Roofs (Url 22)



**Figure 18.** Green Roof (Url 23).

## **CONCLUSION AND RECOMMENDATIONS**

Ecological pressures as a result of intensive housing need to be addressed at the land scale as well as the building scale. In ecological design decisions to be developed in this direction, buildings and outdoor

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spaces cannot be considered independently from each other. Natural and cultural landscape areas support and compensate the building in terms of reducing or preventing life-related environmental problems. The selection of eco-materials suitable for ecological design goals varies according to the location, quality and type of the landscape application area.

Techniques, tools and materials developed to reduce human-caused environmental impacts with the beneficial use of technology are increasing day by day. Creating the ideal ecological design model is possible with the continuous monitoring of ecological information and analysis. With the beneficial use of technology increasing day by day techniques, tools and materials are developed to reduce to reduce human-induced environmental impacts.

Creating the ideal ecological design model is possible with constantly updated ecological information and continuous monitoring of analysis. In line with the said information and analysis, application-oriented eco-materials can be selected and even new ones can be developed. The use of living materials as well as artificial materials in landscape architecture applications provides a great advantage in achieving ecological design goals. Plant material, offers many functional usage possibilities. It provides various ecological benefits such as energy efficiency, water efficiency, biocomfort, soil reclamation, erosion control, and biodiversity with vegetative design in accordance with ecological design criteria.

With the aim of reducing the energy used for cooling and heating in buildings, it is possible to provide climate control in all seasons with the energy efficient vegetal design to be made. Plant material not only provides biocomfort for human use, but also offers suitable climatic conditions and living spaces required by all living creatures living in that region. Thus, it contributes to the biological diversity targeted by ecological design. Since ecology is a concept with many variables, techniques and materials differ for each ecological design application. Therefore, its main principle is "to provide maximum benefit with minimum resource consumption and destruction, it will be possible to choose the most suitable eco-material in line with the criteria shaped according to the ecological design model, which is "sustainable design".

In order to reduce the percentage of the material in the formation of increasing environmental problems today, various decisions must be taken and implemented as a manufacturer, designer, user and the state. These are;

1. The production and use of local materials should be increased and their conditions should be reviewed in accordance with environmental principles.
2. Increasing the use of traditional materials regionally on the basis of resources (natural stone, forest or soil) and climatic conditions (such as adobe) should be encouraged.
3. A Green Building evaluation system should be developed nationally, based on all issues in building production. Material selection and usage principles should also be determined in accordance with climatic conditions and resources.
4. It should be ensured that the wastes generated in the process from the beginning to the end of the constructions are used as resources in the same or different buildings.
5. Every waste (plant, industry) must be the source of another production. Considering the regional annual production as a renewable resource, it should be encouraged to use plant wastes directly or indirectly in the production of building materials, and the production of these products should be started on an industrial scale. The prevention of environmental pollution caused by these plant wastes will benefit the country's economy in terms of economic support and energy use for the producer.
6. Regardless of the function, construction system, and form, designing each building to create a resource in the production of another building after completing its useful life will increase efficiency in energy use by reducing material production.
7. State policies should be revised in order to raise awareness of not only designers or material producers, but also the society and to have national and even international sanctions.
8. Legal arrangements should be made to encourage and encourage producers, designers and users to produce buildings in accordance with ecological criteria. Today, it is necessary to enter into a social organization in order to be in a livable environment and to be able to inherit a world that can be lived tomorrow.

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**O 15. THE MAJOR REASONS FOR THE EXTINCTION OF LAKES IN TURKEY -  
POSSIBLE ECONOMIC PROBLEMS AND SOLUTION PROPOSALS**

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**ABSTRACT:** In consequence of the effect of global warming, the absence of large rivers feeding lakes, evaporation, lack of rainfall and excessive hot days together with the increase in water demands because of evaporation, agricultural use, drinking and utility water and environmental reasons causes the lake level to decrease. This situation creates problems in terms of both ecology and economy, and the appearance of natural areas is also adversely affected. Within the scope of this study, the economic and ecological problems that our lakes are exposed to in general terms, the danger of extinction and the necessary measures to be taken to prevent these problems were discussed.

**Keywords:** Lakes, Economic problems, Measures

**INTRODUCTION**

Water is a necessary substance used in every phase of human life for the completion of people's vital needs such as nutrition, circulation, respiration, excretion and reproduction (Yazici, 2019; Yazici and Akça, 2019). Besides being a vital element contributing to the creation of natural habitats, the body of water is also a natural habitat in itself (Yazici and Aşur, 2018). As it is one of the most essential prerequisites for life, the presence and quality of the water in an environment are of utmost importance. 3/4 of the earth's surface is covered in water. However, approximately only 1% of the water is drinkable and 70% of this water is used in agriculture. In short, the drinkable water that plays a definitive role in the existence of life, is very limited on the face of the earth. This is the reason why the freshwater resources of all countries have started becoming more valuable than mineral deposits. Saline waters constitute approximately 1386 million km<sup>3</sup> (over 97.5%) of all water on earth. 70% of all freshwater is stored in ice caps or glaciers. 30% of it is under the surface of the earth. The fresh-surface water sources such as rivers and lakes only constitute around 93 100 km<sup>3</sup> which is around 1/700 of the 1% (UNC, 2014). With the addition of the indicated 14 billion m<sup>3</sup> of potential groundwater, Turkey's consumable surface water and groundwater total up to 112 billion m<sup>3</sup>, 44 billion m<sup>3</sup> of which is being used (General Directorate of State Hydraulic Works, 2015).

According to the data provided by the United Nations, 1,4 billion people do not have access to safe drinking water. 470 million people currently reside in regions that are suffering from water scarcity and this number is expected to increase 6 times in 2025. 250 million people each year contract water-borne epidemic diseases and approximately 10 million of them die as a result of water-related illnesses (Esenyel, 2001).

Wetlands are often located on the valley plains and bottomlands where industrial, urban, and agricultural development activities are the highest (Url,1). This situation leads to the change and destruction of wetlands. The destroying of wetlands leads to habitat destruction of natural life and the subsequent extinction of species. Wetlands are the world's biggest genetic reservoirs; it is estimated that they contain around 40% of all species and 12% of all animal species. Wetlands also prevent water floods and erosions by keeping the excess water and storing it after excessive precipitation. They help maintain the necessary water level for agricultural activities. Due to their increased biological activity, they also reduce nitrate and phosphate contamination.

Turkey, with its annual water consumption of 1555 m<sup>3</sup> per capita, is considered to be a country suffering from water shortage. 98% of the fresh surface water sources are lakes. There are over 100 natural lakes and 550 dam lakes in Turkey. Although the number of lakes in Turkey is high, the surface area that they

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cover is relatively small. Lakes are of high importance not only for the survival of wildlife, but also for their significance for human needs such as climate moderation, transportation, and irrigation. There is an increased production of organic matter in wetlands. Carbon enters the soil by transferring CO<sub>2</sub> from the atmosphere into the soil through plant residues and other organic solids. 1% increase of organic carbon in 1 hectare of agricultural land provided 100kg pure nitrogen, 15kg phosphorus, 15kg of pure sulphur, and contributed 850 tons to the water holding capacity of the soil in the first 15 cm, which was a finding that has to be explained to the farmers in a detailed way.

Way (Sultansazlığı Biocultural Project, 2012. General Directorate of Nature Conservation National Parks). Natural shore zones are transition zones between aquatic and terrestrial ecosystems, and are also important habitats for numerous plant and wildlife species. Furthermore, shore zones offer various natural, economic and aesthetic opportunities. They have multiple necessary functions in or near urban areas as they enable the creation of natural habitat for the flora and fauna of the city, offer some recreation opportunities to the citizens, and regulate urban ecology (Tülek, and Barış, 2014).

The lakes on the surface of the earth are the home of various species and serve as stops on migration routes.

## **THE REASONS FOR THE EXTINCTION OF LAKES**

### **Unplanned Water Infrastructure Projects**

In 2011, it was decided that there will be a total investment of 3.1 billion Turkish Liras made in the energy sector. According to this, the biggest investment will be made by the General Directorate of State Hydraulic Works (Devlet Su İşleri-DSI) with a billion Turkish Liras. It was announced that DSI will spend a billion liras for the completion of the dam and hydroelectric power plant (HEPP) projects. However, the hundreds of HEPP projects which have been planned and are under construction for almost all rivers in Turkey, from the easternmost to the westernmost of our country, from the Eastern Black Sea to Çoruh, from Küre to Köyceğiz, create numerous environmental and social problems. Our rivers and wetlands, which are a part of the hydrological system, have started vanishing due to the “transforming every single water source into energy” approach and because of faulty plans made without the consideration of water basins. Because of the dams/hydroelectric power plants installed on river tributaries connected to the wetland for various purposes such as energy, irrigation, flood protection and drinking water, the wetlands now lack sufficient water which is necessary for their survival. This consequence causes numerous problems concerning fish flow and threatens the biodiversity in and around the wetland (WWF, 2011).

### **The Excessive Use of Water in Agriculture**

On basis of sectoral water usage, 72% of the share is consumed by the agriculture sector in Turkey. However, in the agriculture sector, where a significant portion of the water is consumed, only 8% of the irrigable land is watered through pressurized irrigation (sprinkler and drip irrigation), and the remaining 92% is watered with the use of traditional surface irrigation methods (furrow, basin, and border irrigation). The groundwater-fed wetlands are shrinking due to the intense water withdrawal and the inefficient use of water for agricultural irrigation purposes. In specific, our wetlands in Central Anatolia such as Beyşehir Lake, Tuz Lake, Ereğli Reed Bed, Kulu Lake, Meke Lake, Seyfe Lake, Sultansazlığı, Akşehir - Eber Lakes, have all been among the most important wetlands to experience serious water-level declines due to the excessive and insensible agricultural irrigation (WWF, 2011).

### **Pollution**

The quality of the water is as important as the quantity of the water when it comes to the fulfillment of both the needs of human beings and the ecosystem. However, in the past and to this day, the funding, scientific research, and public interest in the water quality have been significantly less than the attention given to the quantity (World Water Assessment Programme, 2012). Wetlands are polluted with domestic, industrial and agricultural waste. Due to the decrease in the water quality, biological diversity has started disappearing and the local people whose livelihood depends on those areas are suffering.

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Eğirdir Lake, Bafa Lake, Tuz Lake, Gediz Delta, Uluabat Lake, Beyşehir Lake, Eber Lake, Burdur Lake, Göksu Delta, Sapanca Lake, Akyatan Lagoon are just a few of the wetlands in danger of pollution (WWF, 2011).

### **Illegal Hunting and Fishing**

The natural structure and balance of our wetlands are disturbed by the use of illegal methods of hunting and fishing during fish breeding seasons. Eğirdir Lake and Beyşehir Lake are some of the lakes that have been affected by poaching and unsustainable fishing practices (WWF, 2011).

### **Other Investments (highways, mines, etc.)**

In recent years, large scale-infrastructure projects and mining operations which will directly affect our wetlands, have been brought forth. Highways create the biggest problems. For instance, Uluabat Lake, which is considered to be one of the most important wetlands in Turkey, is currently highly affected by the Istanbul-Bursa-Izmir highway. The wetland is threatened because a significant part of the motorway will pass through the wetland buffer zone south of the lake, and viaducts will be built inside the lake (WWF, 2011),



**Figure 1.** Uluabat Lake, Turkey (Url 2)

### **Problems Concerning Management**

The primary institution responsible for the planning and managing of our country's water resources is the General Directorate of State Hydraulic Works. However, there are 18 more institutions alongside DSI that directly or indirectly also have a say in the planning, investment, monitoring, and inspection of our water resources. On the other hand, the distribution of authorities who are working on the water quality and quantity to different institutions, has also led to problems in practice (WWF, 2008).

### ***Amendment to the Regulation on the Conservation of Wetlands***

One of the most important and powerful legal tools developed for the protection of Turkey's wetlands, the Regulation on Protection of Wetlands, was amended and published in the Official Gazette on 26 August 2010. When the old and new regulations were compared, it was seen that the prioritisation of the "conservation" of wetlands was altered and the "utility" oriented regulations were made to create "loopholes". With the amendment made in the Regulation on the Protection of Wetlands, rivers were not included in the definition of wetlands. In addition to that, in the new Regulation, the provisions that have been made state that there will not be any protection zones created around rivers. The changes made on the Buffer Zone's borderlines -one of the protection zones defining the activities around wetlands- which in the old regulation were "at least 2500 metres" but were changed to the extremely ambiguous and open to abuse "not exceeding 2500" statement, will also pave the way for numerous

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projects (construction, energy and industrial investments) which will negatively affect the ecological, biological and hydraulic character of the wetlands. Consequently, the new Regulation threatens the future of wetlands by excluding the main arteries of the wetlands from protection status (WWF, 2011).

### ***The Draft Law on Conservation of Nature and Biological Diversity***

With the introduction of the Environment Chapter to the European Union accession period, it has been established that our country is required to adapt to the EU's nature protection legislation. In this context, the Draft Law on Conservation of Nature and Biological Diversity prepared by the Ministry of Environment and Forestry as a "requirement of the European Union accession period" does not reflect the Birds and Habitat Directives, which are two of the main directives of the EU on nature conservation. Within the Turkey Progress Report published by the European Commission on 9 November 2010, the draft was described as "worrying". The aforementioned draft removes the "Natural Site" status of 1261 Natural Sites in our country and paves the way for their destruction. However, numerous interferences that would harm nature, especially concerning HEPPs, have been prevented thanks to the protection boards of Natural Sites. If the Law on Conservation of Nature and Biological Diversity is enacted in its current form, this will lead to the irreversible destruction of our natural areas, which have been protected to this day (WWF, 2011).

### ***Renewable Energy Law***

The draft law aiming to encourage the use of renewable energy resources, which play a vital role in meeting the increasing energy needs and combating climate change, was accepted by the Grand National Assembly of Turkey on 29 December 2010, and it came into force. Albeit somewhat delayed, the encouragement of renewable energy investments on a legal basis, is a positive development for Turkey. Nonetheless, the changes made in Article 5 of the Law contain elements that may prove to be harmful to our natural habitats. The Law, aiming to promote renewable energy, allows investments even in areas that have been guaranteed to be protected by special legal regulations and international agreements, such as; national parks, natural parks, natural monuments and nature conservation areas, conservation forests, wildlife conservation and development areas, special environment protection zones, natural sites. The Renewable Energy Law in its current form, enacted by the Grand Turkish National Assembly, threatens the protected areas which constitute only 5% of our country's surface area. While the promotion of renewable energy is a very important step in combating climate change, the fact that the aforementioned law opens our protected natural areas to investment, creates a great discrepancy (WWF, 2011).

## **THE ECONOMIC NEGATIVE PROBLEMS THAT THE REASONS FOR THE EXTINCTION OF LAKES WILL CAUSE**

### **Production**

As it can be observed in Eğirdir and Beyşehir lakes, the food chain has been disrupted and the fish species diversity and numbers have been severely damaged due to the introduction of alien species into inland wetlands. For instance, 500-600 tons of fish used to be harvested from each of Eğirdir and Beyşehir lakes, but after the introduction of the sudak fish species into the waters, the figure dropped to 10-15 tons (Republic of Turkey Ministry of Forestry and Water Affairs, General Directorate of Nature Conservation and National Parks, 2013).

### **Reed**

Reeds and straws are not only used for the weaving of wicker and baskets, but are also valuable as insulation materials and in cellulose production in paper mills. For example, before the paper mill in Afyonkarahisar was closed, 4/5 of its cellulose needs were supplied by the reeds of Eber Lake. Before their drying out, over a million bundles of reeds were cut from Ereğli and Sultan Reed Beds. However, due to the drying out in these areas and reed bed declines, there has been a significant decrease in

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production (Republic of Turkey Ministry of Forestry and Water Affair, General Directorate of Nature Conservation and National Parks, 2013).

### **Tourism and Entertainment**

Lakes are ideal locations for birdwatching, photographing, fishing, hunting, hiking, and water sports, due to their beautiful scenery and wildlife. Every day, more and more people visit lakes and their surroundings to watch birds, take photos and paint. Even though lake tourism still attracts a lot of interest, the increasing number of drying lakes has affected it severely. Furthermore, the food chain has been disrupted and there has been a decrease in bird diversity due to the introduction of alien species in the lakes (Republic of Turkey Ministry of Forestry and Water Affair, General Directorate of Nature Conservation and National Parks, 2013).

### **PRECAUTIONS THAT NEED TO BE TAKEN TO PREVENT THE EXTINCTION OF LAKES**

In the past years, numerous lakes in Turkey have dried out both due to climate change and improper agricultural practices. The drying lakes are also creating numerous problems in relation to our ecosystems; while thousands of bird species are under serious threat, numerous fish species are going extinct in many regions. The drying of a lake three times the size of Van Lake in the past fifty years in Turkey, is a consequence of not only improper agricultural irrigation but also of wrong farming and energy policies. Many of our wetlands, especially our shallow lakes, have vanished or are on the verge of disappearing. Global climate change is contributing to the acceleration of this extinction (Url 3). The adverse conditions of our country's rivers are clearly indicated in Figure 1 (WWF, 2011).

**Table 1.** The Wetlands and Situations in Turkey

<b>Wetland</b>	<b>Status</b>
<b>Akşehir – Eber Lakes</b>	The lakes have significantly shrunk due to inefficient water usage. Fishing and reed harvesting practices, which were important sources of livelihood for the region, have almost come to an end.
<b>Akyatan Lagoon</b>	Due to the suspended solids coming from Ceyhan River, the biggest problem of the lagoon has become sedimentation.
<b>Bafa Lake</b>	The domestic, industrial and agricultural waste collected along the Great Menderes River has created a big pollution problem in the lake. The water level of the lake has been decreasing due to excessive agricultural water use.
<b>Beyşehir Lake</b>	It has shrunk by 75%, its current size is approximately 50.000 hectares. It is in danger of drying or pollution.
<b>Burdur Lake</b>	The water level of the lake has dropped by 10 metres in the past 27 years, and there is a 27% decrease in its volume.
<b>Delta of Great Menderes</b>	As a consequence of the use of the water that feeds the delta for agricultural irrigation, most of the time, no water reaches the delta. As for the water that reaches the delta, it creates pollution as it carries industrial wastes.
<b>Eğirdir Lake</b>	The water quality of Eğirdir Lake, which is Turkey's biggest freshwater lake, has been decreasing significantly due to agricultural pollutants.
<b>Ereğli Reed Bed</b>	85% of it has dried out and climate hardening has been observed in the region.
<b>Eşmekaya Reed Bed</b>	Has completely dried out.
<b>The Gediz Delta</b>	In danger of drying out due to water withdrawal for agricultural irrigation, and pollution because of untreated industrial and settlement wastes.
<b>Güvenç Lake</b>	It has been completely dried out.
<b>The Göksü Delta</b>	Intensive agricultural irrigation, excessive water withdrawal and uncontrolled well drilling pose serious threats for the area.
<b>Hotamış Reed Bed</b>	It has completely dried out.

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<b>İğneada Floodplain Forests and Lakes</b>	There is a water shortage due to the drought and transportation of the water from the streams that feed the area to Istanbul, and casual tourism and unplanned urbanization create pollution in the area.
<b>İznik Lake</b>	In danger of pollution due to the wastes reaching the lake from industrial facilities, settlements, and small olive oil factories in the surrounding area.
<b>Kulu Lake</b>	It has shrunk by 90% due to excessive groundwater abstraction. Water accumulation can be observed seasonally.

**Table 1.** The Wetlands and Situations in Turkey (cont.)

<b>Wetland</b>	<b>Status</b>
<b>Manyas Lake</b>	The water availability of the lake is under threat due to excessive water withdrawal for agricultural irrigation and a decrease in precipitation.
<b>Meke Lake</b>	In danger of drying out due to excessive groundwater abstraction.
<b>Sapanca Lake</b>	It is at the risk of pollution caused by the untreated wastewater coming from industrial facilities, settlements and agricultural fields.
<b>Seyfe Lake</b>	90% of the lake has dried out.
<b>Suğla Lake</b>	It has completely lost its natural lake feature. It was converted to a storage facility by the State Hydraulic Works (Devlet Su İşleri-DSI).
<b>Sultan Reed Bed</b>	The wetlands which used to be 90 thousand hectares 10 years ago have decreased to 1500 hectares, and the reed bed areas have decreased from 3200 hectares to 1000 hectares.
<b>Tuz Lake</b>	The lake which is responsible for 60% of Turkey's salt production and has highly important natural values has shrunk by 60% due to excessive groundwater abstraction for agricultural irrigation.
<b>Uluabat Lake</b>	In danger of pollution due to drying out, industrial activities, and use of agricultural fertilizers and pesticides. The highway that is planned to pass by the lakeside poses a new great threat to the existence of the lake.
<b>Yumurtalık Lagoons</b>	The area cannot be fed due to the dams created for energy, irrigation, flood protection and drinking water. Salinization can be observed.

The measures that we need to take to prevent the extinction of our lakes can be listed as follows;

- Determining the lake pollutants and activating wastewater treatment systems, completing the infrastructure of wastewater treatment facilities, reinforcing the necessary sanctions in this regard, conducting researches on the cleaning of the already existing pollution and the recreation of the lakes,
- Providing clean water intake from water resources suitable for the lake to ensure water circulation within the lake,
- Encouraging and supporting the farmers around the lake area to plant crops suitable for farming without water by changing the planting portfolio, because plants such as beet and corn consume a great amount of water,
- To explain the importance of wetlands to the people residing in the region, and raise awareness with educational training,
- To research for job opportunities for local people to increase their income from reed beds,
- Creating new production models to increase the income level of the locals by protecting the lake rather than consuming the lake's resources, creating projects to provide job opportunities in different fields,
- To work on the recreation of lakes and create promotion videos, documentaries, advertisements and spots to increase the attraction of tourists and to initiate bird watching tourism,
- To revise and make changes on the usage of the lake as a hunting area, to prohibit hunting in the lake for a certain period of time to help increase the population of game animals, and to increase the awareness of hunters on this issue,
- To take precautions to ensure the conservation and sustainability of the wildlife living around the lake,
- To take the necessary measures which will play a major role in the protection of the lakes, such as; preventing the illegal well-drilling of the underground resources feeding the lake for agricultural practices, not allowing agricultural land to be used in regions that have become arid

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due to lack of seasonal rainfall, and implementing practices to transform these areas back into wetlands (WWF, 2011).

## **CONCLUSION AND SUGGESTIONS**

To begin with, the country's approach towards water resources should be revised as Turkey is not a country rich in water. All segments of society need to understand that our water resources are a limited social and economic resource.

As mentioned in the WWF (2011) study; we need to take important steps to protect our water resources in multiple ways and use them economically. The most important steps are; to prepare the National Water Act. The National Water Act needs to be prepared on basis of the water's quality and quantity, basin level, and in relation to participation and "demand management". A National Water Database should be established. Our wetlands must be protected and the further destruction of existing areas should be prevented. The number of protected areas should be increased. The social and environmental impacts of water infrastructure projects must be taken into consideration and prior to the construction of new water infrastructure projects, the potential water saving possibilities through efficiency enhancement must also be calculated, aside from the natural capacity and values of water ecosystems. All planned projects should be taken into consideration within the scope of the Social and Environmental Impact Assessment, which takes into account probable climate change impacts and alternative development options. The use of illegal water should be stopped, necessary steps should be taken to prevent the use of illegal water in all sectors and to ensure the reuse of the water consumed, especially by the industry sector.

Necessary researches should be conducted for saltwater treatment and water transfer between basins. The rational management of our water resources should be adopted. The water issue of each basin must first be resolved within itself, and the most effective use of existing resources must be ensured.

There should be radical changes in agricultural policies and practices. Agriculture-water-environment policies should be compatible and complementary to one another (Yazıcı and Arslantaş, 2019). National and regional agricultural production planning should be made, the farmer registration system and agricultural data should be updated. The condition of "good agricultural practices" should be imposed on the providing of direct income support. A regional support system that takes into consideration criteria such as climate, soil and water structure, and biodiversity should be established, instead of a product-based support system. Government support should be provided for the producers who switch to environmentally friendly alternative products, and the alternative product suggestions should be developed on basis of using less water. Instead of the unplanned use of water for irrigation, sprinkler and drip irrigation systems which ensure more economical water use should be made widespread.

If the necessary precautions are not taken in Turkey, the possibility of encountering a great water shortage in the future is high. Taking into consideration the current status of our water resources, the growth rate of the country's population and our water consumption habits, it is likely that the water problem will grow significantly in the near future. The water demand is increasing in Turkey, just like the rest of the world. However, despite this, it cannot be said that the water resources are used efficiently. While technological advancements make our lives easier, they also often pose a serious threat to nature. Due to global warming, warmer and days without water await the world. Using and preserving our natural resources and water in the most efficient and economic way, has to become a habit so that these negative consequences affect us as little as possible.

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**O 16. THE IMPACT OF TECHNOLOGY ON THE ENVIRONMENT: A DISCOURSE IN ENVIRONMENTAL ETHICS**

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**ABSTRACT:** This paper as a philosophical study critically accessed the paradoxical ideology that while the impact of technology on the environment has been vastly negative, the same technology has been claimed to save our planet. This idea is maintained by WWF, who echoed the same sentiments that though the technology is a solution enabler it is also part of the problem. The term 'technology' itself refers to man's use and application of scientific knowledge for practical purposes, as well as the devices and the machinery developed as its result. Our current age termed 'technological age' which began in the mid-20th century is a period of rapid change, where technological developments are revolutionising the way we live, at the same time leading us further into the depths of catastrophe in the form of climate change and resource scarcity. It has been agreed among many authors that it is almost impossible for man to live without technology. From an ethical point of view, this work investigates the worldview and perceptions of people towards technological use. This work identifies the two-emerging worldview: the anthropocentric and non-anthropocentric worldview that drives technological initiation, development, and use. Against the popular notion that the non-anthropocentric worldview will help humans practically solved environmental issues. This work argues that both anthropocentric and non-anthropocentric worldviews are only within theoretical pursue with little practical relevance. This work argues in favour of 'anthropoholism' which is a fusion between the two worldviews for solution the environmental degradation and technological use.

**Keywords:** *Environment, Environmental Ethics, Anthropocentrism, Anthropoholism.*

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**O 17. FORECASTING AIR POLLUTANT INDEX (API) USING NONLINEAR AUTOREGRESSIVE (NAR) NEURAL NETWORK DURING COVID-19 PANDEMICS IN MALAYSIA**

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**ABSTRACT:** Coronavirus Disease 2019 (COVID-19) pandemics have emerged in Malaysia since 18 March 2020, which then the government has announced for Movement Control Order (MCO) as a method to curb the transmission in public. The air quality is expected to be good as most of the operations are closed. Thus, we evaluated and predicted the Air Pollutant Index (API) during the MCO in Malaysia for an overview of the air quality level during the pandemic. As the API is complex in the atmosphere, we used a nonlinear autoregressive (NAR) neural network model for the nonlinear dataset. Urban cities are generally having higher pollutants concentrations along with the urbanization process. High pollutant concentrations led to health problems, especially respiratory illness, either in the short or long term. We used the data from 18 March 2020 (the first day of Movement Control Order, MCO) until 31 December 2020. Results revealed the NAR model executed higher  $R^2$  for Kuala Terengganu (99.23%). The optimum NAR model architectures which are trained using the Levernberg-Marquardt training algorithm is 1:14:1 for Kuala Terengganu. NAR neural network is capable of modeling and forecasting nonlinear time series during the COVID-19 pandemic.

**Keywords:** COVID-19, Malaysia, Nonlinear Autoregressive, Movement Control Order, Levernberg-Marquardt

**INTRODUCTION**

Urban air quality has caused many respiratory diseases due to air pollutants interactions with humans (Duan et al. 2020). In line with that, the Air Pollutant Index (API) is used as a communication medium to evaluate the risk, especially towards sensitive groups such as the children and elderly in the ambient air. Urban air quality is associated with respiratory problems such as asthma and bronchiolitis in children (Ortega-Garcia et al. 2020) and the elderly (Karimi and Shokrinezhad, 2021). Malaysian Department of Environment publicly displayed the API for five categories. API of 0-50 is considered good, 51-100 is moderate, 101-200 is unhealthy, 201-300 is very unhealthy, and above 300 is hazardous (DOE, 2021). Malaysia recorded the number of confirmed cases since January 2020, and the cases are escalating until the Malaysian government announced the Movement Control Order (MCO) to be implemented starting 18 March 2020 (Aziz et al. 2020) as an early step to reduce the SARS-CoV-2 infections (Shah et al. 2020). During this time, only essential services are allowed to operate. The reduction of air pollutions has happened chiefly all around the world. Specifically, in Malaysia, Abdullah et al. (2020) found that the decrease in PM<sub>2.5</sub> is up to 58.4% during MCO (lockdown). Othman and Latif (2021) added that the concentrations of air pollutants are declining during the lockdown period. The world also witnessed the reduction of air pollutants in the atmosphere in Morocco (Khomsi et al. 2020), New York (Perera et al. 2021), and Iraq (Hashim et al. 2021). Machine learning and artificial intelligence had to get significant

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attention for air quality forecasting. The intelligence concept can capture the nonlinearity and complexity of the air pollutants in the atmosphere and vast data (Liu et al., 2021). Previously, the linear time series model for air pollutants was used to model linear time series (Zhang et al. 2018). API time series is known as the sequence of API on a time basis. On the other hand, nonlinear approaches, such as the nonlinear autoregressive (NAR) neural network, are a powerful tool for time series forecasting. Wu and Lin (2019) and Zhang et al. (2020) proved that neural network models could predict AQI in China. Janarthanan et al. (2021) further verified that the neural network is a compelling model for the prediction of AQI. Currently, Li et al. (2021) have successfully analyzed the time series of AQI before and during COVID-19 lockdown in Shanghai with human activities. The results can help in decision making and forecasting for the guidance of authority. This study aims to establish the NAR neural network models in an urban city during the MCO in Peninsular Malaysia.

## **MATERIALS AND METHODS**

The status of air quality in Malaysia is displayed on an hourly basis by the Malaysian Department of Environment (DOE) via the Air Pollutant Index (API). There are six criteria pollutants measured, including fine particulate matter ( $PM_{2.5}$ ), coarse particulate matter ( $PM_{10}$ ), sulphur dioxide ( $SO_2$ ), nitrogen dioxide ( $NO_2$ ), carbon monoxide (CO), and ground-level ozone ( $O_3$ ). Before the API execution, the sub-index for each criteria pollutants are calculated, and the maximum sub-index is considered the API, showing the status of air quality at that particular area. The monitoring was under the concession of DOE and Transwater Sdn. Bhd. covers urban, suburban, industrial, and background stations. The stations are known as Air Quality Monitoring Station (AQMS). In this study, we used the AQMS located in the urban area, as urban areas are known as the areas composed of high pollutants concentrations. The selected AQMS is Kuala Terengganu (East region). We collect the API data in this study at the website of DOE ([http://apims.doe.gov.my/public\\_v2/api\\_table.html](http://apims.doe.gov.my/public_v2/api_table.html)). We used the data from 18 March 2020 until 31 December 2020, as 18 March 2020 is the Movement Control Order (MCO) starting day in Malaysia. Artificial Intelligence (AI) is a subset of computer science that tends to develop several computer programs in demonstrating intelligibility. Artificial Neural Network (ANN) is one of the crucial groups under AI, commonly used for pattern recognition and function approximation (Cakir and Sita, 2020). ANN rapidly gives realistic solutions and also serves as a universal data estimation with no prior assumptions are made like traditional statistical prediction techniques (Mao et al., 2021). The generalization ability of ANN makes it very useful in function approximations whereby it able to learn from the previous pattern of information without supplying a mathematical model. The ideas of the development of ANN inspired by the human brain (Alonso-Montesinos et al., 2021). The brain-controlled the nervous system of a human, which is composed of massive neurons. Once a neuron communicates with another neuron, it set up a complex connection. The human brain structure, with its outstanding functions assembled to form mathematical and computational models to represent the real-world scenario. Nonlinear autoregressive (NAR) designed to forecast a time series of the past values. We used API data for the time series analysis. The data set is divided into three parts for training (70%), validation (15%), and testing (15%). We optimize the NAR model using the Levenberg-Marquardt (LM) training algorithm for all study areas. The best models for each study area are selected based on the coefficient of determination ( $R^2$ ). A value close to one indicates the model is adequate for API forecasting. We used MATLAB 2019b to establish NAR models. Equation 1 shows the NAR model.

$$y(t) = b_0 + b_1 y(t-1) + b_2 y(t-2) + \dots + b_n y(t-n) \quad (1)$$

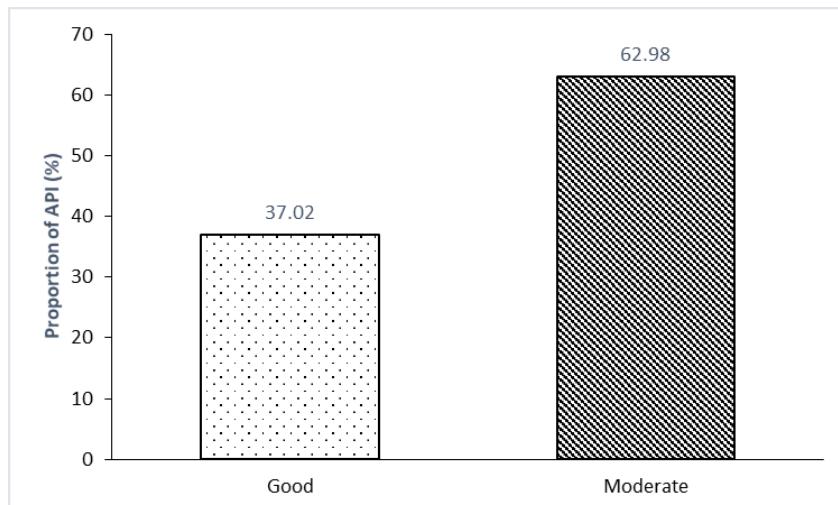
Where  $y(t)$  is the output at time  $t$ , and  $b$  is the coefficient.

## **RESULTS AND DISCUSSION**

Air Pollutant Index (API) was calculated based on the Pollution Standard Index (PSI), which the United States Environmental Protection Agency (USEPA) accepted the API at the international level (DOE, 2021). API reading generally represented by the concentration of particulate matter ( $PM_{2.5}$ ), which dominated among the criteria pollutants. API status has five categories, which are good (API:0-50), moderate (51-100), unhealthy (101-200), very unhealthy (201-300), and hazardous (>300). Figure 1

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shows the percentage of API indication status from 18 March 2020 until 31 December 2020. API indicators showed that the status was good and moderate during the MCO period. Kuala Terengganu showed a good status with 37.02%, while the rest was moderate level. The good and moderate status mainly due to several prohibitions of movement and gathering activities in Malaysian such as travelling abroad, visitors and tourist (tourism) and educational institutions, government and private agencies (except for essential services) closure indirectly reduce the air pollution (Abdullah et al., 2020; Leal and Hernandes., 2020). The implementation of MCO is changing based on the current situations and confirmed COVID-19 cases. The Malaysian government has implemented several restrictions such as Conditional Movement Control Order (CMCO), Recovery Movement Control Order (RMCO), Enhanced Movement Control Order (EMCO), and Semi-Enhanced Movement Control Order. Some relaxation of restrictions allows the non-essential services to operate; thus, no limitation on human mobility. Emissions of air pollutants in Malaysia have mainly come from stationary and mobile sources, deteriorating the air quality. That is the main reason for the variation of API between good and moderate levels during MCO in Malaysia.



**Figure 2.** The proportion of Air Pollution Index (API)

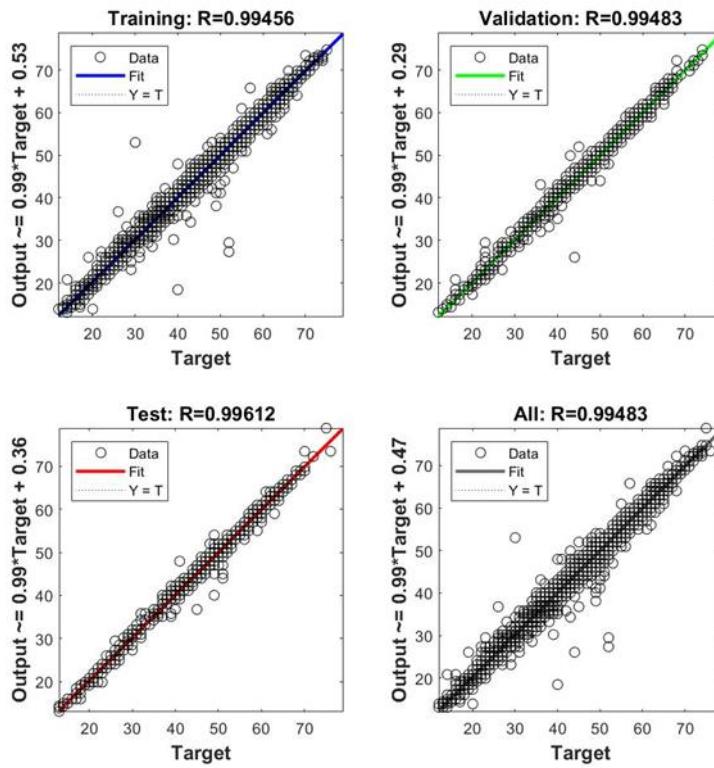
We develop the NAR models using trial and error method, added one neuron after another. The number of neurons tested is in the range of 1-15. We trained the NAR model with one hidden layer. Table 1 shows the evaluated results of the NAR model. The ranges of  $R^2$  during training (0.988553 - 0.991080), validation (0.984699 - 0.993351), and testing (0.983171 - 0.992255) for Kuala Terengganu. The bold signifies the best neuron number. The optimum neuron numbers for Kuala Terengganu is 14 ( $R^2 = 0.99226$ ). Thus, the NAR model explained the variance in the data set with the highest of 99.23% for Kuala Terengganu. Due to the complexity of urban areas, the nonlinearity of the API time-series dataset conclusively is deduced as the high accuracy measure. The NAR model is a compelling model that can capture nonlinear and complex data, as proven in previous studies. The trial and error method in determining the optimum neuron number in the hidden layer is important to avoid any over and less fitting of the NAR model. Optimizing the NAR model via the LM algorithm's adoption helps reduce the bias in the model during training, validation, and testing. LM algorithm is considered the fast convergence that helps train the dataset as it is a combination of gradient descent and the Gauss-Newton method for an optimal solution (Du and Stephanus, 2018).

Conclusively, the overall performance of the NAR model is in Figure 2. Several previous studies on different fields had successfully utilized the NAR model for time series forecasting. Saba and Elsheikh (2020) predicted the COVID-19 outbreak in Egypt and executed it with a high  $R^2$  of 0.999, using the Levernberg-Marquardt training algorithm. The COVID-19 prediction is also established by Khan and Gupta (2020), revealing a high  $R^2$  of 0.97 using the NAR model. Sunayana et al. (2021) successfully developed the NAR model for the monthly prediction of SWM with high accuracy in the waste management field. Figure 6 shows the regression equations for NAR models, and the equation used for time series forecasting is in Equation (2).

**Table 2.** Coefficient of Determination ( $R^2$ ) of NAR Model

Neuron Number	Training	Validate	Testing
1	0.97682	0.99176	0.98682
2	0.97909	0.99088	0.98885
3	0.97297	0.99082	0.98881
4	0.97524	0.99082	0.98913
5	0.98002	0.98925	0.98861
6	0.97881	0.98470	0.99040
7	0.97373	0.99289	0.99076
8	0.97127	0.98911	0.99154
9	0.97543	0.98859	0.98847
10	0.97721	0.98921	0.98317
11	0.97599	0.99335	0.99086
12	0.97780	0.99235	0.99212
13	0.97658	0.99233	0.99026
14	0.97119	0.98969	<b>0.99226</b>
15	0.97688	0.99034	0.99152

$$\text{Predicted}_{S4} = 0.99 (\text{Observed}_{S4}) + 0.36 \quad (2)$$



**Figure 2.** Performance of NAR models during training, validation, and testing

## CONCLUSION

This study used one of the time series models of the neural network, the nonlinear autoregressive (NAR), to capture the nonlinear and complexity of Air Pollutant Index (API) data. The NAR models established

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created explicitly for the API during the COVID-19 pandemic period in Malaysia. The proposed API NAR models showing their superiority by having high accuracy of up to 99% for prediction purposes. An accurate and robust NAR prediction model is necessary to promote public health, especially in urban areas where high pollutants exist. Adopting the NAR models for air quality management is in line with the Sustainable Development Goal-13 on Sustainable Cities and Communities, supporting the aspiration of United Nations 2030.

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**O 18. RECYCLING TECHNOLOGIES OF POLYMERIC MATERIALS FOR  
IMPROVEMENT OF THE ENVIRONMENTAL IMPACT IN ALBANIA**

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**ABSTRACT:** Management of polymeric waste is an important problem in the Republic of Albania due to their environmental impact. Most of the problems comes from polymeric materials that have been buried and burned in the landfill. During the last decade the percentage of the polymeric waste have been grown rapidly in the overall municipalities of Albania due to the increasement of the consumer usage of polymeric products. Based on it, our government recently have implemented the law for supporting recycling technologies and reducing the environmental impact that comes from polymeric materials waste management. Our research work will be focused will be focused on the state of art of the most implement recycling technologies for polymeric materials in the Republic of Albania.

**Keywords:** *Waste Management, Polymeric Materials, Environmental Impact*

## **INTRODUCTION**

Nowadays, management of the solid waste materials is an important problem moment in the Republic of Albania due to their environmental impact. Table 1 depict the composition of the solid waste management in Albania [instat].

**Table 1.** Composition of the solid waste in Albania

Materials	Composition (%)
Scrap Metals	5.7
Papers	9.3
Plastics	13.1
Glass	6.1
Others	65.8

Based on the above information's it has be seen that the most of the problems come from polymeric waste such as plastic materials with 13.1% composition. During the last decade the percentage of the polymeric waste have been grown rapidly in the overall municipalities of Albania due to the increasement of the consumer usage of polymeric products. According to the obtained data from INSTAT and the Ministry of Environment, plastic waste generation is increased by reaching 388,152 tonnes per year in the whole Republic of Albania [INSTAT 2021, Ministry of Environment 2021, Dhoska et al., 2019 and Dhoska et al., 2019]. Sources of plastic waste are beverages, household furniture, vehicle equipment, sports equipment, medical equipment, equipment for agriculture and industry etc as can be seen in the Figure 1 [INSTAT 2021]. Our government have implemented the law for supporting recycling technologies and reducing the environmental impact that comes from polymeric materials waste management.

Recycling of the plastic waste is a very important way for managing solid waste and has a very large impact on environmental protection. Compared to profitable recycling of materials, such as glass and metal, recycling plastic polymers is often more challenging due to its low cost. Furthermore, there are some private companies in Albanian such as EVEREST ltd and Future Plast ltd that have been focused on the recycling of plastic polymers. In the present paper we will be focused on the state of art of the most implement recycling technology for polymeric materials in the Republic of Albania



**Figure 1.** Sources of plastic waste

## RECYCLING TECHNOLOGIES

There are different recycling technologies that have been used in the private companies in the Republic of Albania. Most of them are as follows:

- Primary recycling
- Secondary recycling
- Tertiary recycling through chemical treatment;
- Energy recovery

### **Primary recycling**

Primary recycling has been carried out in the annexes of production plants of polymer products where scraps and plastic waste are shredded and added with fresh raw material for moulding processes.

### **Secondary recycling**

Secondary recycling uses post-use plastic waste which is pre-separated into different types of polymers or not. After the pre-separated, materials can be used directly as raw material (in the absence of fresh polymeric raw material) for the production of products with a limited field of use. Currently the most recyclable and reusable plastic materials are polyethylene-terephthalate (PETE), high density polyethylene (HDPE), low density polyethylene (LDPE) and Polypropylene (PP).

### **Tertiary recycling through chemical treatment**

Tertiary recycling has used chemical treatment of plastic scraps (waste) by obtaining some products such as monomers, oligomers, chemicals or fuels. The tertiary recycling method is sometimes presented as the only viable solution. The depolymerization (decomposition) of a polymer into its simple substances (monomers) has been elaborated for a long time as part of degradation studies.

### **Energy recovery**

Whenever separation and recycling are not feasible or when there is no promising market for recycled products another solution is based on recovering the calorific value of the polymers. As hydrocarbons, the energy content of polymers is twice as high as that of coal or paper and four times as high as that of general solid waste.

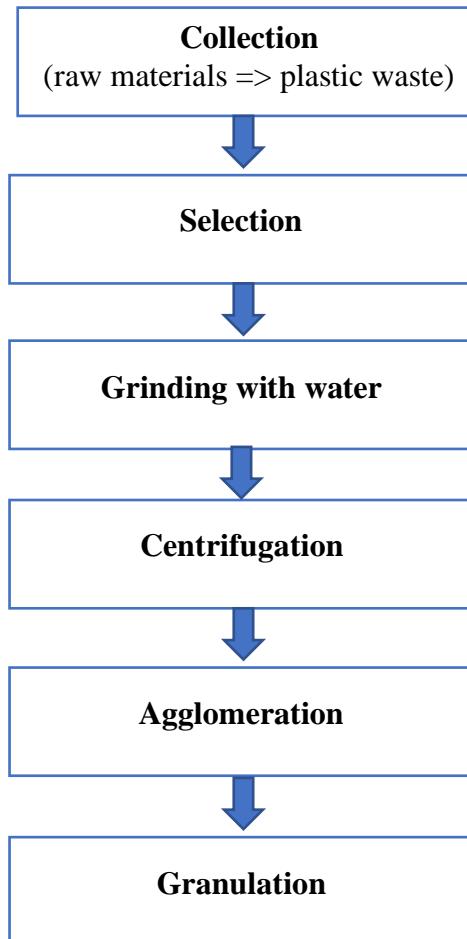
Despite some economic advantages, the idea of combustion is not accepted everywhere, the biggest problem is that of environmental hazards in general which are initiated during the combustion of toxic gases and heavy metal residues (acid rain), dioxins and chlorine chemicals such as polyvinyl chloride

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(PVC). Wherever incineration is used, plastics are usually not separated from general waste which reduces energy and also creates a greater amount of ash.

## **RECYCLING PROCESS**

Figure 2 depicts technological scheme for the recycling process of the polymeric plastic waste materials such as PETE and PP that has been used in most of the private companies in Albania.



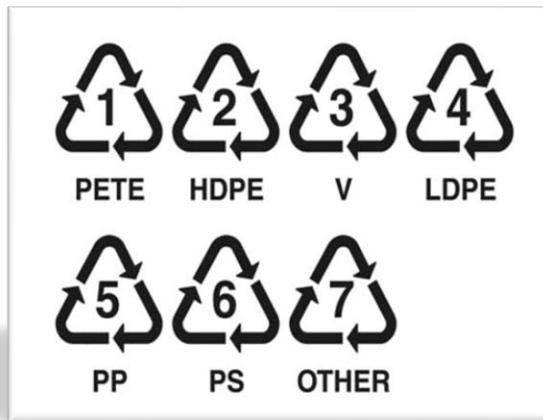
**Figure 2.** Technological schematic view of the recycling process of the plastic waste material

### **Collection**

Collection points in Albania over the years and with the awareness of the people are increasing. Collection is carried out at different points of plastic waste collection. There are 4 collection points in Tirana, other points are located in Vlora, Fier, Gjirokastra, etc.

### **Selection**

The selection is carried out in the recycling plant which is based on the composition of plastic waste in PETE and PP. The composition is identified by plastic codes as can be seen in the Figure 3.



**Figure 3.** Triangular symbols for recycling plastic materials

#### **Grinding with water**

It has been realized in a machine with 3400 rpm. The machines are not used at maximum capacity and in this case the supply is made at 440 kg per hour (even less). The grated pieces are in the order of 0.5-1 cm (with irregular shapes). Figure 4 shows grinding machine with water.



**Figure 4.** Grinding machine with water

#### **Centrifugation**

From the tub the washed material passes to the centrifuge at 4800 rpm. Water is eliminated during centrifugation. Through the conveyor of the centrifuge we have seen that PETE passes to the juicer where the complete removal of water and half-drying takes place while PP does not pass to the juicer. Figure 5 depict the final drying of the grinded material through centrifugal process.



**Figure 5.** Final drying of the grinded material

### **Agglomeration**

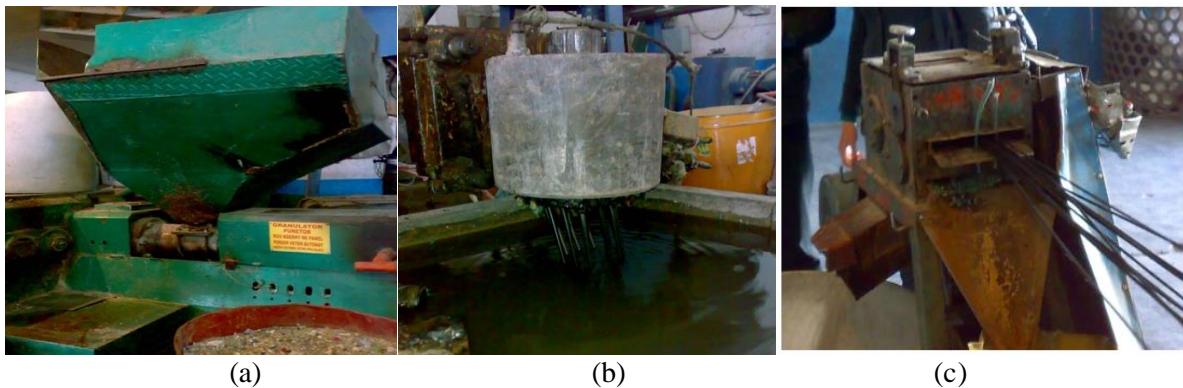
Agglomeration process has been realised in agglomeration machine as can be seen in the Figure 6. PETE has been passed to the agglomerate which makes the total drying at 4200 rpm and making the material workable. From the other side PP from centrifuge passes directly to the agglomerate. PP fails to hold water as much as PETE and it dries faster than PE.



**Figure 6.** Agglomeration device

### **Granulation**

Afterward, the material is inserted into the Granulator. The respective temperatures of the compounds are 180 – 245°C for PETE and 165 – 225°C for PP. Then the material passes through fillers and a water bath. Afterward, material obtained from the fillers is passed to the cutter and the material with the desired sizes is obtained with the dimensions that varied from 1 to 12 mm as can be seen in the Figure 7.



**Figure 7.** (a) Granulation (b) Pass the material through the fillers (c) Pass the material through the water bath into the cutter until the granules are obtained.

## CONCLUSION

In the present paper we have briefly described the current situation of the polymeric waste management in the Republic of Albania and the state of art of the recycling technologies in the private companies. Furthermore, we have shown the recycling process for PETE and PP waste management materials from private companies that operate in Albania. Through the help of the government and the implementation of the recycling technologies we will reduce an environmental impact in the Republic of Albania.

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**O 19. THE CHALLENGES OF MUNICIPAL SOLID WASTE MANAGEMENT IN ALBANIA  
AND IMPLEMENTATION OF WASTE INCINERATION**

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**ABSTRACT:** Despite years of efforts to improve the management of municipal solid waste (MSW) in Albania, this activity again poses a challenge for the country. The predominant method of waste disposal is landfilling, while in 2017 the construction of the first incinerator of MSW with energy recovery in Elbasan was completed and now is in operation. Incineration of MSW is a well-known method for waste disposal, but in Albania it is being applied in recent years. Currently, two other incinerators are under construction: in Tirana (the capital of Albania) and in Fier. Such a large number of incinerators and consequently small capacity, is associated with higher disposal costs per ton, and higher levelized cost of energy (LCOE), without exploiting and benefiting from economies of scale. LCOE for an incinerator with a treatment capacity of 120 tons/day, resulted 0.1013 USD / kWh and for another one of 300 tons/day, it resulted 0.0523 USD/kWh. In this paper I will address a general view of the current state of MSW management, the legal framework for this sector, objectives set for the period 2020 - 2035 and the estimation of LCOE for two incineration facilities.

**Keywords:** Municipal solid waste, Legal framework, Incineration

**INTRODUCTION**

Based on the legal framework in Albania, the municipalities are responsible for municipal solid waste (MSW) treatment and disposal as well as for the management of their treatment plants. Nearly 200 illegal and legal landfills of MSW were identified in 2018 throughout the country (Ministry of Tourism and Environment of Albania, 2020), and only 4 of them are landfills. Most landfills do not meet sanitary requirements. Elbasan region has solved waste management through incineration, where an incinerator and two landfills are in operation since 2017. Currently, two other incinerators are under construction, one to cover the Fier area and the other for the Tirana area. Another problem affecting waste management analyzes has been and continues to be the accuracy of a data system for the generation and collection of MSW, the data which are collected and managed by local government. The amount of solid waste generated per person for 2018 was 0.383 ton/capita/year and the quantity of inert waste of 0.079 ton/capita/year (INSTAT 2019), with an increasing trend from year to year.

Incineration of MSW with energy recovery is a disposal method which is generally applied in countries that have a sustainable MSW management system and in developed countries. Although Albania does not meet the first condition and is a developing country, those conditions have not been a prerequisite for the implementation of that method of disposing of MSW in our country. Implementation of MSW incineration with energy recovery is considered as an option for MSW disposal in the framework of integrated waste management in Albania (Ministry of Tourism and Environment of Albania, 2010). Generation of electricity from the incineration of MSW and the purchase of it by the Albanian Electro-energetic Corporation, regulated by the legal framework, creates opportunities to cover partly the significant cost of combustion disposal of MSW. Compared to the cost of generating electricity from other renewable and conventional sources, the cost of generating electricity from MSW incineration is of course higher, because the main goal in this case is the safe disposal of MSW, a significant reduction of their initial volume and reduction of landfill areas.

**LEGAL BASIS AND QUANTITATIVE DATA FOR MSW IN ALBANIA**

**Legal basis**

In recent years Albania has made considerable progress in developing the regulatory framework of the waste management sector in line with European Union policies. However, implementation at the

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regional or local level and the achievement of predetermined objectives is still lagging behind the goals of improving urban infrastructure and related services in order to guarantee a healthy environment and improving the living conditions of population. The key point between planning and implementation is the financial aspect (Ministry of Infrastructure and Energy of Albania, 2020). During the 8-year period (2011-2019), the Albanian Government provided in the field of waste management: an increasing budget for preparation and updating the legal basis; greater investments in infrastructure; as well as the increase in expenditures dedicated to improve the MSW management, especially the extension of the waste collection service throughout the country (Ministry of Tourism and Environment of Albania, 2020).

The National Environment Management Plan for the period 2013 - 2020 in our country [MEFWA, 2010] set some targets for integrated management of MSW (Law no. 10463, 22.09.2011 "Integrated waste management", amended), such as:

1. Disposal of waste sent into landfills up to 45%;
2. Recycling of urban waste up to 55%;
3. Preparation of regional waste management plans and the development of regional landfills.
4. Separate collection of certain fractions of SW.

But how much have those targets been pursued and achieved? I referred to the National Plan of Integrated Waste Management 2020-2035 [Ministry of Tourism and Environment of Albania, 2020]:

*Referring to objective 2:* in 2018, [INSTAT, 2018], reported that in Albania are recycled about 245,040 tons waste/year, or as much as 18.5% of the total municipal solid waste (including non-urban ones that accompany household solid waste (household and other similar) and the level of recycling in Albania was 10% vs. 45% set as target. There are discrepancies for the figures in the various documents for the same issue!

*Referring to objective 3:* during the period 2010-2020, regional solid waste management plans have been drafted and approved, but the waste collection system was extended to only 65.7 % of Albania area, as presented in Table 1 (INSTAT, 2018):

**Table 1.** Basic data on municipal waste management, 2018 (INSTAT, 2018)

Total	Country	Population	Generated MSW (t/year)	Generation of other waste (t/year)	Country's covering with MSW collection (%)	Collected MSW (t/year)	Solid waste that is sent to dumpsites and landfills (t/year)	Solid waste that is sent to dumpsites and landfills (%)	Solid waste that is not collected (t/year)	Solid waste that is not collected (%)
2,866,537			1,523,226	198,185	65.7	1,325,071	1,012,517	66.5	4979	0.3

*Referring to the objective 4:* Currently in Albania there is no separate waste collection, regardless of the objectives set from time to time for that.

## **Municipal solid waste disposal in Albania**

Based on the legal framework in Albania, municipalities are responsible for waste management as well as for their treatment facilities.

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The main method of waste disposal is sending it to landfills, uncontrolled and controlled. Nearly 200 illegal and legal landfills of MSW were identified throughout the country in 2018 (Ministry of Tourism and Environment of Albania, 2020), and only 4 of them are landfills: Bakaj (Saranda), Bushat (Shkodra), Maliq (Korca) and Sharra (Tirana). Most landfills do not meet sanitary requirements. It is reported that during 2018 in those landfills were deposited about 923,316 tons/year (or 60.61% of the waste in total), which are calculated as the amount generated in the country, of which only 401,755 tons/year (or 26.37% of them) are disposed of in sanitary landfills, while the rest or 13.01% of household solid waste is disposed of in a completely uncontrolled way.

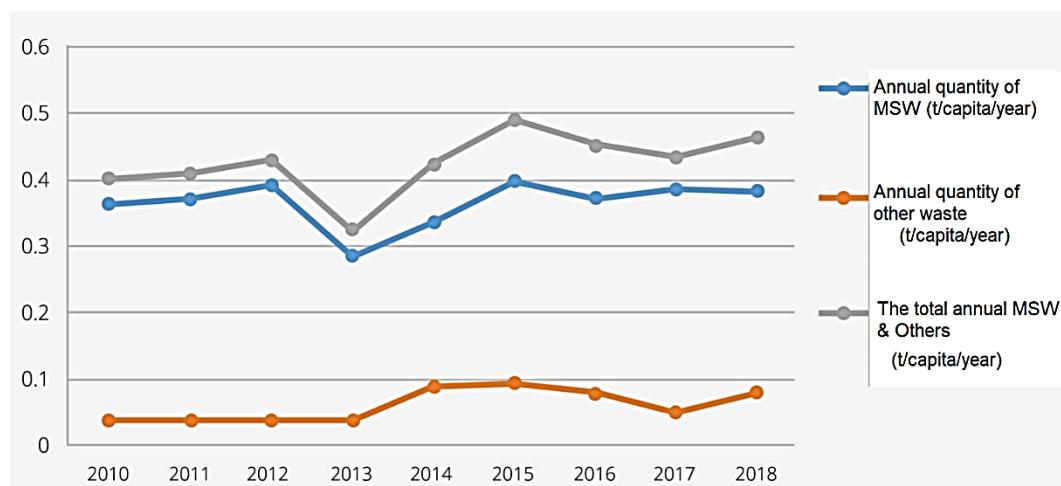
### **Recycling of MSW**

Albania has a developed and active recycling industry. There are 32 private recycling companies that operate in Albania. Due to the lack of raw materials, this industry has used only 26.8% of processing capacity or 133,592 tons/year, which accounts for around 10% of the total municipal solid waste (including non-urban ones that accompany household solid waste (family and other similar) (INSTAT, 2018). For that reason some of the companies have reduced their activity, some have closed, while some others are planning to relocate their facilities to other locations.

### **The data of generation, collection and disposal of MSW**

Due to inaccuracy of data on MSW generation and disposal by the local government and inconsistencies of data for the sector reported by various institutions, such as INSTAT, the National Environment Agency and the Ministry of Infrastructure and Energy, among the three main goals of the National Integrated Waste Management Plan 2020-2035 (Ministry of Tourism and Environment of Albania, 2020) in terms of creating an accurate database for the MSW generation and disposal is also: *Approach and review of the strategic document with the requirements of Decision of the Council of Ministers (DCM no. 290, 11.3.2020, "The creation of the state database of the integrated planning information system (SIP/IPSIS), to ensure compliance with the IPSIS System".*

Household solid waste generation (divided into household and other solid waste, which is considered as inert waste collected together with household waste and similar with it) is estimated 0.383 ton/capita in 2018, and 0.079 ton/capita year for inert waste collected together with solid waste from households (INSTAT, 2018).



**Figure 1.** Annual average waste generation kg/capita/year, 2010 - 2018 (INSTAT, 2018)

Based on INSTAT data for the period 2010-2018 (Fig. 1), it can be seen there is an increasing trend for solid waste generation per capita per year, which requires the improvement of MSW management. There are 4 landfills in Albania: Bakaj (Saranda), Bushat (Shkodra), Maliq (Korca) and Sharra (Tirana), while most landfills do not meet sanitary requirements. Elbasan region has solved waste management using incineration method, where an incinerator and two landfills are in operation since 2017. Currently,

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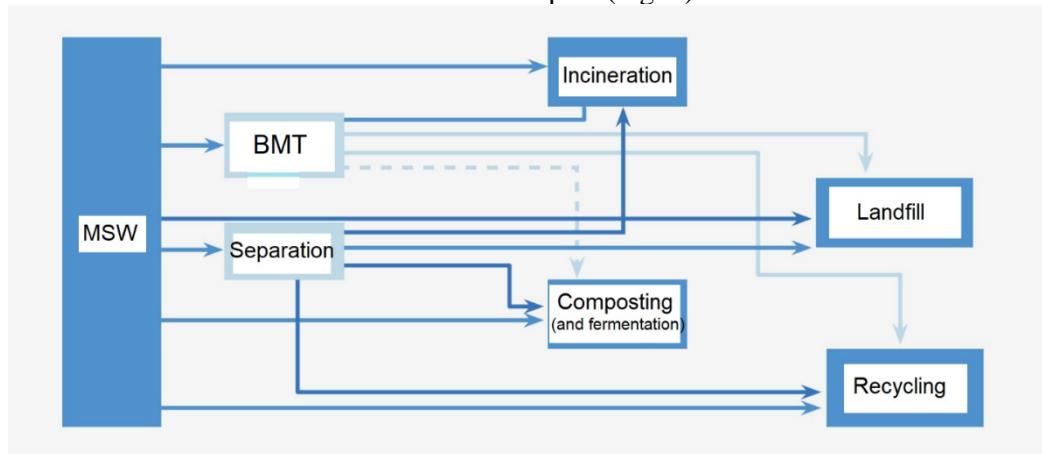
two other incinerators are under construction, one to cover Fier area region and the other for Tirana area region.



**Figure 2.** Locations of incinerators in Albania: Elbasan, Tirana and Fier

### **Integrated management of MSW in Albania**

An innovation in solid waste management, according to the strategic policy document, is that the integrated waste management will be performed on the basis of Waste Management Areas, defined on the basis of the principles of proximity and affordability and not only on the basis of counties or prefectures (Ministry of Tourism and Environment of Albania, 2020). According to the plan, the integrated municipal waste management will guarantee the collection of waste throughout the country and their integrated management in accordance with the minimum basic standards. The main treatment options for household solid waste are defined in that plan (Fig. 3):



**Figure 3.** The main treatment options for household solid waste

- BMT - Biological Mechanical Treatment

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The concept of waste management will be based on a system with four levels of treatment:

- Waste collection and transport (including separate collection at source)
- Pre-treatment (via transfer stations, material recovery facilities, mechanical and biological treatment).
- Recovery (through recycling centers for various waste streams, composting, and capture of gas generated by composting).
- Final treatment (landfill or incinerators, with and without effective energy recovery)

### **Separate collection of MSW**

In general, the amount of household solid waste increases in parallel with the economic growth of the country. Only the separation at the source and the separate collection of special solid waste streams can result in a reduction of the amount of waste, which are destined to be sent to landfills.

Separation of waste at source and separate collection of MSW is carried out gradually through separate collection systems (including door-to-door systems and public road containers, bags or other accessories). Further efforts will be focused to promote the separate collection of recyclable materials in urban areas and the separate management of organic waste in rural areas, like decentralized composting and home composting.

### **Objectives of the national action plan for MSW 2020-2035**

Four strategic goals of the national integrated waste management strategy and national action plan 2020-2035 (Ministry of Tourism and Environment of Albania, 2020) are:

- 1) To improve waste management by meeting key planning principles and legal requirements;
- 2) Improving the legal framework of waste management;
- 3) Sustainable financing of waste management;
- 4) Human resources: awareness and participation of the population in waste management.

**The indicators for special waste streams:** very ambitious objectives are set in that plan, like:

#### *a) Waste from packaging*

**2025:**

- Recovery: Not less than 10% of the total waste must be recovered.
- Recycling:
  - Not less than 10% of the total weight of paper and cardboard
  - Not less than 10% of the total weight of metals
  - Not less than 6% of the total weight of the plastic
  - Not less than 10% of the total weight of the glass
  - Not less than 5% of the total weight of wood waste

**2030:**

- Recovery: Not less than 30% of the total weight of waste must be recovered
- Recycling:
  - Not less than 30% of the total weight of paper and cardboard
  - Not less than 30% of the total weight of metals
  - Not less than 12% of the total weight of the plastic
  - Not less than 30% of the total weight of the glass
  - Not less than 10% of the total weight of wood waste

#### *b) Biodegradable waste*

**2035:**

- Recovery: Not less than 60% of the total weight of waste must be recovered
- Recycling: Not less than 60% of the total weight of paper and cardboard
  - Not less than 50% of the total weight of the metal
  - Not less than 22.5% of the total weight of the plastic

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- Not less than 60% of the total weight of the glass
- Not less than 15% of the total weight of wood waste.

Referring to the sector strategy (Ministry of Infrastructure and Energy of Albania, 2020), the National Waste Management Plan set to increase the materials recovery from municipal waste through recycling, composting and energy conversion by 25% in 2015, 55% in 2020 and 75% in 2025. Furthermore, the amount of waste sent to landfills would be reduced to 45% in 2020 and 25 % in 2025. But some of those objectives, referred to solid waste reports in subsequent years, have not been met. According to the composition of waste presented in the report “National sectorial plan for solid waste management” (Ministry of Infrastructure and Energy of Albania, 2020), approximately one third of the municipal solid waste generated in Albania is potentially recyclable. The largest percentages of recyclable waste are plastic, paper and cardboard waste.

## **INCINERATION OF MSW - A NEW DISPOSAL METHOD IN ALBANIA**

Incineration of MSW with energy recovery, although a method known and used in many European countries, in Albania is being applied in recent years.

Among the most widely used technologies for MSW combustion with energy recovery are: moving grate furnaces and fluidized bed furnaces. Referring to those two technologies, currently the moving grate furnace is the most widespread and well-tested technology for MSW incineration.

The energy recovered from the MSW combustion treatment can be used as steam for various technological processes, for regional heating and for electricity generation. The best option for our country conditions is the electricity production, for which we will calculate the leveled cost of electricity (LCOE) for two plants with different capacities, to identify the advantage of incinerator plants with higher capacity versus those with smaller capacity.

The formula used for calculating the LCOE of renewable energy technologies is:

$$LCOE = \frac{\sum_{t=0}^n \frac{C_{I,t} + C_{fuel,t} + C_{O\&M,t}}{(1+r)^t}}{\sum_{t=0}^n \frac{E_t}{(1+r)^t}}$$

where:

- LCOE -the average lifetime leveled cost of electricity generation;
- $C_{I,t}$  - investment expenditures in the year t
- $C_{O\&M}$  - operation and maintenance expenditures in the year t
- $C_{fuel,t}$  - fuel expenditures in the year t (in our case = 0)
- $E_t$  - electricity generated in the year t;
- r - discount rate = 10%;
- n – economic life of the system = 20 years.

To estimate the different costs, (in USD) I referred to the study: “IRENA, 2012: Renewable Energy Technologies: Cost analysis series”:

- for MSW combustion technologies, the following are recommended:

- 1) The investment cost:  $C_I = 1880 - 4260 \text{ USD /kW}$

From that range of values for  $C_I$ , the lowest values are considered for plants with large treatment capacities (over 10 MW<sub>e</sub>), which benefit from economies of scale, while the highest values are for the ones with smaller treatment capacities (up to 10 MW<sub>e</sub>).

- 2) The operation and mainentance costs: O&M costs (USD/year)

- $C_{O\&M, \text{fixed}} = (2 - 7) \% \text{ of } C_I / \text{year}$
- $C_{O\&M, \text{variable}} = 0.005 (\text{USD / kWh}) \times 7500 \text{ hours / year}) (\text{USD / year})$

For the two study cases I chose:

a) The plant with capacity P = 2 MWe:

$$C_I = (4.260 \text{ million USD / MW}) \times 2 \text{ MW} = 8.52 \text{ million USD.}$$

$$C_{O\&M, \text{fixed}} = 0.07 \cdot C_I = 0.5964 (\text{Million USD})/\text{year}$$

$$C_{O\&M, \text{variable}} = 0.005 (\text{USD/kWh}) \cdot P \cdot 7500 \text{ h/year}) = 0.005 \cdot 2000 \cdot 7500 = 75,000 \text{ USD/year}$$

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LCOE = 0.1013 USD / kWh

b) Plant with capacity 10 MWe:

$$C_I = (2.5 \text{ million USD/MW}) \cdot 10 \text{ MW} = 25 \text{ million USD.}$$

$$C_{O\&M,fikse} = 0.04 \cdot 25 = 1 \text{ milion USD/year}$$

$$C_{O\&M,variable} = 0.005 \cdot 10 \cdot 7500 = 375,000 \text{ USD/year}$$

LCOE = 0.0523 USD / kWh

## CONCLUSIONS

Although the legal basis for MSW management in Albania is complete and in accordance with EU legislation in the field of MSW management, the safe collection and disposed of it is not yet at the level required by the standards of the sector. In the management plans of MSW over the years have been set objectives, like: to cover the whole territory of the country with the correct service of collection and disposal of MSW; to applicate the separate collection of recyclable fractions; to dispose of all the MSW in sanitary landfill, but those objectives have not been fulfilled and some of the problems listed above still persist.

It is positive that in addition to the disposed of MSW in landfills, the incineration of it with energy recovery has also begun to be used. The first incinerator (in Elbasan, only 42 km from Tirana, the capital of Albania) began to operate in 2017 with a capacity of 2 MW<sub>e</sub> (the quantity of the municipal solid waste generated at Elbasan area is 113,690 tons or 10.8 % of total in 2016 (Raport Gjendja e Mjedisit 2016, Agjencia Kombetare e Mjedisit) and 2 more incinerators are being built (one in Fier and one in Tirana, while the distance Tirana-Fier is about 110 km). The quantity of the municipal solid waste generated for Fier region is 130,172 tons or 12.3 % of total in 2016 and the quantity of the MSW for Tirana region is 268,278 tons or 25.4 % of total in 2016 (National Environmental Agency of Albania, 2016), with capacities less than 5 MWe each. It seems from the data that those incinerators serve to a small area and consequently result in small capacity. The LCOE for a plant with a power 2 MWe resulted equal to 0.1013 USD/kWh. But an incinerator with a larger capacity could benefit more related to economies of scale. Thus, for an incinerator with power 10 MWe, the LCOE resulted 0.0523 USD / kWh, with approximately 60% of the first case. The higher capacity plants can also benefit from the advantages of smaller capacity plants because they can be composed of modular units.

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**O 20. BIOGAS PRODUCTION STAGES AT CUMRA DISTRICT AND ITS CONTRIBUTION  
TO THE COUNTRY AND THE ENVIRONMENT**

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**ABSTRACT:** This study examines the contribution that manufacture of biogas and biofertilizer from wastes issued from bovine animal producing facilities in the Central Anatolian region, which has become the center of agricultural and animal production over the last few years, has on the economy the region and the country. In our country as in the world, the use of renewable energy sources is on the rise in line with global warming. It is also significant in terms of the nation's economy that alternative energy resources are utilized for meeting the need for energy. Manufacture of biogas from animal wastes will not only provide the region with significant economic benefits, but also manifest numerous positive environmental and social effects. The manufacture of biogas in the agriculture and animal husbandry industry has been practiced successfully in developed countries for years. In order to contribute to the popularization of this practice in our country, and especially in the Central Anatolia Region, the quantities of biogas and biofertilizer that could be obtained as a function of different quantities of animals have been presented in this study in tabulated form a world long with the economic returns associated with them.

**Keywords:** Biogas, Organic wastes, Cumra District, Environment

**INTRODUCTION**

One of the most essential requirements for a sustainable level of prosperity is energy. Researches are carried out to meet the increasing energy need when the energy is exhausted in the world. For such a long time, it is imperative that energy needs come from renewables. This stage; Studies in the field of biogas in Turkey and in the world have been discussed in general. It is quite possible to increase the biogas production under the conditions of Turkey. These sedans, vegetal and other wastes are found elsewhere here (KumAŞ et al., 2018).

Within this scope, the sample animal manure of the Biogas Facility in Konya Province Çumra District will be biodegraded anaerobic inside. In Turkey, anaerobic culture biogas production is almost non-existent. There are a limited number of anaerobic treatment applications, especially in the food industry. With these systems; Fermented products with high energy and nutritional value are obtained from organic wastes.

**Animal Wastes:** Cattle, horse, sheep, chicken and pig animal manure, slaughterhouse residues, residues that occur during the processing of animal products.

**Vegetable Wastes:** Grain, stalk and straw, corn residues, sugar beet leaves, hazelnut capsules, wild herbs, residues generated during the processing of herbal products.

**Organic Content City and Industrial Wastes:** Sewage and bottom sludges, paper industry and food industry wastes, industrial and domestic wastewater with a high concentration of dissolved organic matter. These wastes are especially wastes used in biogas production centres established by municipalities and large industrial facilities using high technology. Biogas is a colourless, flammable gas that is released as a result of the fermentation of organic substances and is formed depending on the raw material produced by the way of production, and generally contains 60-70% methane, 30-40% CO<sub>2</sub> and a small amount of sulphureous hydrogen, nitrogen, hydrogen and carbon monoxide in its mixture (Alibaş & Soyupak, 1981).

Organic wastes are generally used as raw materials in the production of biogas. Animal fertilizers have an important place among these wastes. While biogas is produced from animal manure, both gas is obtained and the fertilizer matures within the fermentation period and is thrown into the field early. Thus, the waiting period of animal manure, which takes approximately one year before being thrown

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into the field, can be reduced to 15-20 days. This situation also prevents the loss of plant nutrients that occur during holding the fertilizer. Thus, this gas produced with biogas technology allows both energies to be obtained from organic wastes and recycling of wastes to the soil, thus increasing productivity in agricultural areas (URL-1).

Animal and herbal wastes not used in biogas production in our country are mostly either directly burned or given to agricultural lands as fertilizers. However, it is more common to use wastes in heat production by burning. In this way, the desired quality of heat cannot be produced, and it is not possible to use the wastes as fertilizers after heat generation. In many countries, biogas plants are built using different technologies according to the planned purpose. Biogas facilities can be handled as family type (6-12 m<sup>3</sup> capacity) farm type (50-100-150 m<sup>3</sup> capacity), village type (100-200 m<sup>3</sup> capacity), as well as Germany, USA, Denmark, Switzerland. Industrial biogas plants with a capacity of 1,000-10,000 m<sup>3</sup> are also operated in many countries (Okay et al., 1983.)

Although 50-65 Mtoe (million tons of oil equivalent) agricultural waste and 11.05 Mtoe of animal wastes are produced annually in Turkey, only 60% of these wastes are usable for energy production. is known to be equal to 22-27% of annual energy consumption. The energy potential that can be obtained from agricultural residues in our country every year is equivalent to 5.4 million tons of oil. In addition, our country has a potential equivalent to 5.9 million tons of wood, forestry and industrial waste, and 1.5 million tons of oil equivalent as animal waste. With this total energy equivalent to 12.8 million tons of oil, 40% of the country's energy use will be met. This energy is used as a versatile energy source for direct heating and lighting, as well as alternatives to electrical energy and mechanical energy.

In another approach, the amount of fertilizer obtained from animals varies according to the type of animals. According to this; 3.6 tons / year of wet fertilizer from 1 cattle, 0.7 tons / year of wet manure from 1 small cattle, 0.022 tons / year of wet manure is produced from 1 poultry.

Based on these values, 33 m<sup>3</sup> / year biogas from one ton of cattle manure, 58 m<sup>3</sup> / year biogas from a ton of sheep manure. It has been determined that 78m<sup>3</sup> / year of biogas is produced from one ton of poultry manure. The amount of wet fertilizer that occurs in Turkey depending on the animal potential is calculated in tons / year and the biogas amounts that can be produced (m<sup>3</sup>/year) have been determined according to these values and are given in Table 1.

### **Biogas in the World**

Considering the situation that non-renewable energy sources will be depleted in an average of 100 years worldwide, where energy needs are increasing day by day, all developments and concerns about the future have started to direct the search for alternative energy in the world to renewable energy sources. Renewable energy source is defined as “the energy source that can be present the next day in its own cycle.” By definition, conventional energy sources are not considered as renewable energy sources. It is estimated that the average annual increase in world energy demand will be 1.6% in the period of 2008-2030. At the end of this period, the total energy demand increase by 2030 has started to accelerate, expected to reach.

**Table 1. The Amount of biogas that can be produced for the animal waste potential of Turkey**

<b>Animal type</b>	<b>Animal numbers</b>	<b>Wet Animal Manure Amount (Ton / Year)</b>	<b>Biogas Amount (m<sup>3</sup>/year)</b>
<b>Cattle</b>	11.054.000	39.794.400	1.313.215.200
<b>Sheep, Goat</b>	38.030.000	26.621.000	1.544.018.000
<b>Chicken, Turkey</b>	243.511.000	5.357.242	417.864.876
<b>Total</b>	292.595.000	71.772.642	3.275.098.076

In line with the 2030 targets, countries are increasing their existing installed power capacity day by day. There are many examples from the public or private sector that focus on these areas. The development of biogas, one of the renewable energy sources, is gradually increasing in the world. Considering the facility rates of biogas obtained from animal manure, the facilities in the world; 80% are in China, 10% in India, Nepal and Thailand. Considering the number of biogas and facilities that Europe obtains with animal manure. Germany is the country with the highest production with 2,200 plants at this point. This

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country is followed by Italy with 70 facilities. The construction of biogas plants in Germany has increased since 1993, and again from the same year to the 2000s, from 139 to 2,200 plants.

With residential biogas plants, approximately 2 billion m<sup>3</sup> of biogas is produced throughout China, and with this production, 25 million people use it for cooking purposes most of the year. Inexpensive biogas stoves and lamps that can operate even at very low pressures have been developed and encouraged to find them in every home. In India, biogas plants, which started to develop in 1981, started to be used intensively, especially in large farms. However, approximately half of these facilities are idle and not used for various reasons as in Bangladesh. Most of them are used without a license. In accordance with the Kyoto Protocol signed in 1997, countries are required to gradually reduce their greenhouse gas emission values from year to year according to the protocol signed. Due to the ever-increasing energy need and this protocol, European countries have invested more in renewable energy and increased their production.

## **MATERIAL & METHOD**

### **Research Area**

Konya Biogas Electricity Production Company in Çumra Biogas Integrated Plant covers an area of approximately 17,203 m<sup>2</sup>. The facility has a daily capacity of 12 MW and is the largest Biogas Power Plant in Turkey. It occurs with animal waste. When the facility went and toured, the necessary information was obtained from the facility manager and all the reactors of the facility were visited and the necessary information was obtained from both the facility manager and the employees. Data about the waste from the facility, the operation of the facility and the electricity production were obtained from the facility manager.

### **Amount and Characteristics of Waste**

The total amount of poultry waste (70 tons / day) and bovine waste (7 tons / day) coming to the facility is 77 tons / day capacity.

$$\text{Poultry Animal Waste} = 70 \text{ tons / day} \quad \text{Density} 1 = 0.96 \text{ tons / m}^3$$

$$\text{Poultry Animal Waste} = (70 \text{ tons / day}) / (0.96 \text{ tons / m}^3) = 72.9 \text{ m}^3 / \text{day}$$

$$\text{Bovine Animal Waste} = 7 \text{ tons / day} \quad \text{Density} 1 = 0.99 \text{ tons / m}^3$$

$$\text{Bovine Animal Waste} = (7 \text{ tons / day}) / (0.99 \text{ tons / m}^3) = 7.07 \text{ m}^3 / \text{day}$$

$$\text{Total} = 79.97 \text{ m}^3 / \text{day}$$

Domestic Solid Wastes, the number of personnel working in the facility, the amount of domestic solid waste consisting of personnel, the amount of solid waste produced per person per day is 1.16 kg. 17.4 kg of solid waste is generated per person per day. According to the characteristics of the solid waste (organics, glasses, plastics, papers, metals, etc.), it is collected in separate containers. It is protected in a closed way without polluting the environment in terms of its appearance, dust, odor, etc. Packaging Waste, on the other hand, consists of packaging waste originating from the personnel. The packaging wastes generated are collected regularly, given to licensed companies and disposed of. 15 kg of personnel-originated wastes per day are collected in the waste area separated from others and given to licensed companies for recycling. (Biogas Power Plant, Project file, 2020)

### **Average Amounts of Fertilizer and Biogas That Can Be Obtained from Animal Wastes for Konya, Çumra, Biogas Plant**

When designing biogas facilities, it is necessary to determine the capacity first. For this, if only animal manure will be used in the facility; the amount of fertilizer released daily, the feeding patterns of the animals and the solids content of the fertilizers should be known. The amount of fertilizer produced daily can be in different amounts according to the fertilizer efficiency of the animals. In the calculation of the fertilizer amount; 10-20kg / day (wet) fertilizer yield can be accepted for bovine animals and 5-6% of live weight can be based on daily fertilizer amount. Likewise, 2 kg (wet) / day or 4-5% of live

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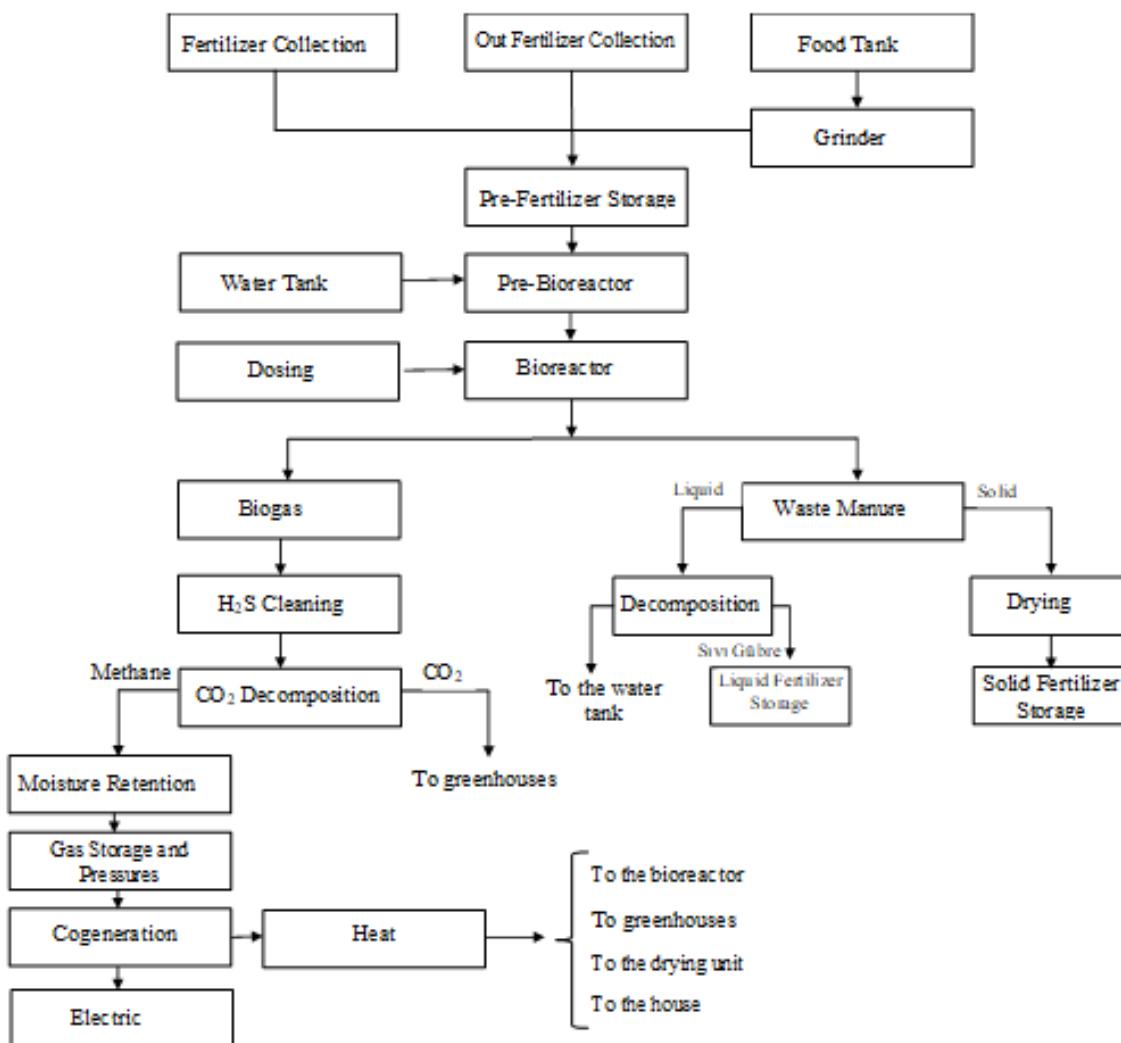
weight can be accepted as daily manure production for sheep and goats. Daily manure production for chicken is 0.08-0.1kg (wet) / day or 3-4% of live weight.

### **Flare (Biogas Burning Chimney)**

In cases where biogas cannot be used, waste feeding is cut to minimize production and the produced biogas flare unit is burned to prevent its release to the atmosphere. In cases of maintenance and failure, when the biogas cannot be burned in the generators, the flare is installed in accordance with the facility capacity. In terms of emissions, it has a height of 8 meters. The flare is automatically ignited and extinguished.

### **Work Flow Chart**

The organic wastes coming to the Biogas Plant are biodegraded in an anaerobic environment. The biogas that will be released during the biological decomposition of organic wastes is used in the cogeneration unit for electricity and heat generation. Solid and liquid fermented product is formed. Balancing the biological system, stabilizing the balance, taking into account the cost and ease of transportation of waste procurement; Bovine and poultry manure are taken to the facility. Work Flow Chart of the facility as shown in Figure 1.



**Figure 3.** Work Flow Chart of the facility

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### **Biogas Production**

Biogas is produced by the decomposition of organic materials in the absence of oxygen, which is also known as oxygen-free fermentation. It is a mixture of organic wastes of animal and plant origin, released as a result of anaerobic fermentation, without colour and odour, lighter than air and flammable. It contains a large amount of methane gas. Energy provided by 1 m<sup>3</sup> of biogas; 0.62 lt. gas oil, 3.47 kg wood, 4,70 kWh electricity, It is equivalent to the energy obtained from 1.46 kg of charcoal. Organic materials such as food residues, fertilizers, crop residues or water residues are fed into the fermenter. It is heated at 38 - 40 degrees Celsius in a fermenter (a cow with the same stomach temperature), mixed for 30 - 60 days, produced by mixing heavy CO<sub>2</sub>, methane and other gases. Afterwards, it can be used for energy production, cooling and heating. Or it can be connected to the network. When the production is finished, the waste that turns into fertilizer is removed from the digestate fermenter and the cycle continues. Biogas, which consists of methane gas, hydrogen sulphide, CO<sub>2</sub> and gas containing the required amount of hydrogen and nitrogen, which is formed anaerobically as a result of fermentation, is shown as a renewable energy source. There is a small amount of oxygen-free treatment processes, especially with the food industry. In these processes, fermented products with high energy and nutritional values are obtained for organic wastes. (Biogas Power Plant, Project file, 2019).

**Table 2.** Investment Cost Analysis

<b>UNIT</b>	<b>Construction Procedures (TL)</b>	<b>Machine equipment and installation operations (TL)</b>	<b>Electrical equipment and installation procedures</b>
<b>Waste Receiving Unit</b>	1.000.000	800.000	250.000
<b>Waste Raw Material Preparation Pools</b>	1.250.000	1.200.000	400.000
<b>Reactor and Reactor Monitoring System Setup</b>	3.200.000	5.000.000	650.000
<b>Gas Cleaning, Gas Conditioning and Gas, Storage System setup</b>	1.000.000	2.800.000	500.000
<b>Cogeneration Facility (Energy Generation System) installation</b>	2.000.000	4.700.000	700.000
<b>Hygiene Unit and dewatering system</b>	1.500.000	2.000.000	750.000
<b>Storage Areas, Liquid and Solid</b>	1.500.000	3.500.000	300.000
<b>Fermented Product Storage Area</b>			
<b>Facility Control and Automation System</b>	500.000	1.000.000	700.000
<b>Other Units (Administrative building, laboratory, vehicle park etc.)</b>	500.000	1.250.000	400.000
<b>Landscaping</b>	500.000	200.000	150.000
<b>Project Works</b>	250.000	150.000	200.000
<b>TOTAL</b>	13.200.000	22.600.000	5.000.000
<b>Integrated Plant Investment Amount</b>	<b>40.800.000 TL</b>		



**Figure 2.** Biogas Reactors View



**Figure 3.** Methane Gas Formation Tanks

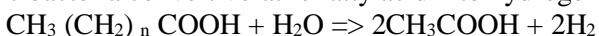
Gas in landfills is a mixed mixture of different gases formed by microorganisms in the landfill. Approximately 40% - 60% of the gas in the landfill is methane gas, the remaining part is usually carbon dioxide gas. The proportions of organic compounds of the other extreme make up the rest. Some values in landfill gas are given below.

- **Gas Content in The Trash**
- CH<sub>4</sub> gas 45 - 70%
- CO<sub>2</sub> gas 30 - 55%
- •Nitrogen gas 2 - 5%
- Ammonia gas 0.1 - 1%
- O<sub>2</sub> gas 0.1 - 1%
- Water Vapors 1 - 3%
- Sulphur gas 0 - 1%
- Landfill gas field Landfill-gas Electricity 5,000 Daily Households
- 1 Mton / Year 500 m<sup>3</sup> / h meets 1 MW / Year Electricity Requirement.  
(URL2)

### Hydrolysis and Fermentation

This stage converts the fermented into CO<sub>2</sub>, acetic acids and volatile soluble organic substances to break down carbohydrates, proteins (6C<sub>2</sub>NH<sub>3</sub>.3H<sub>2</sub>O), oils (C<sub>5</sub>OH<sub>9</sub>O<sub>6</sub>), which are the components of organic matter of bacteria called hydrolytic bacteria. The last group is called the formation of volatile fatty acids [CH<sub>3</sub> (CH<sub>2</sub>) COOH] because the excess of volatile organic substances forms volatile fatty acids.

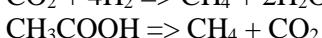
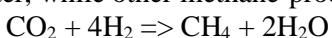
**Acetic Acid Formation:** In this stage, groups of aceto-genic bacteria (forming acids) that have emerged as a result of the first stage, converting volatile fatty acids into acetic acid come into play. Some setogenic bacteria convert volatile fatty acid into hydrogen and acetic acid.



The other group of setogenic bacteria uses the hydrogen and carbon dioxide gas released and converts it into acetic acid. However, the amount of acetic acid formed in this second way is less than the first.



**Methane (CH<sub>4</sub>) Gas Formation:** For the last stage of anoxic fermentation, the bacteria that make up the methane come into play. Some methane-forming bacteria use H<sub>2</sub> and CO<sub>2</sub> and release methane gas and water, while other methane-producing bacteria use acetic acid to form CO<sub>2</sub> and methane.



However, at this stage, the amount of methane formed in the first way is less than the amount of methane formed in the second way. This is done with 30% of all methane produced with the first, and 70% with

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the second. Three different bacteria act in all three stages. There are temperature zones according to the time to wait for oxygen-free fermentation, waste water, waste organic material types, pH 'of the environment and the ions in it, and the structure of the microorganisms formed in a dependent manner.

1-Psychrophilic (Sacrophilic) Bacteria Optimum operating temperature: 5-25 ° C

2-Mesophilic (Mesophilic) Bacteria Optimum operating temperature: 25-38 ° C

3-Thermophilic (Thermophilic) Bacteria Optimum operating temperature: 50-60 ° C

If cattle manure is used in the biogas facility, mesophilic fermentation is applied. (Kahraman, 2013)

### **Factors Affecting Biogas Production:**

It is known that many biogas plants established today are not used. The facility type should be selected according to the regions suitable for all conditions. It depends on some factors., The type and amount of the raw material, the temperature of the environment, the ambient acidity (pH), the large particle size, the duration of the fermentation, the ratio of carbon to nitrogen, the shape of the plant, the amount of dry matter.

### **Environmental Benefits of Biogas Production**

It is known that the biogas system, which is cheap and a source of environmentally beneficial fertilizers, has many benefits for the environment and society. It causes the loss of the effects of most of the diseases that affect human health and underground water caused by animal fertilizers. Following the production of biogas, it turns into organic fertilizer. It is important in terms of recovery. Loss of germination of grass seeds in animal manure. The smell of animal manure is not felt. However, since it is used instead of fossil fuels, it also decreases greenhouse gas emissions. Thus, it is very important in terms of protecting the natural environment and natural resources. Biogas can be used for different reasons such as cooking, lighting, heating and cooling of fuels. 1 m3 of biogas per day = 4 people can cook the meals of a family. 2.43 m3 biogas = For a family of 6 people, the needs for daily cooking and lighting can be met .For a family, needs for daily cooking and lighting can be met. (Demir, 1993)

### **Fermentation Types in Biogas Production**

**Wet Fermentation:** It is the biomass that turns into a slurry. Methane gas is produced by processes in the fermenter, which is called a slurry reactor. The amount of dry matter in the reactor is 5 - 12%.

**Semi Dry System:** It is in liquid form and in the form of mud. The amount of dry matter in the reactor is 10-20%.

**Drying System:** It is undiluted, tunnels are also fermented. Biomass is solid, the amount of dry matter in the reactor is 20-40%. (URL2)

## **RESULTS AND DISCUSSION**

Biogas production calculation is given in Table 3.

**Table 3.** Biogas Production calculation Chart

<b>Raw Material (Waste) Type</b>	<b>Waste Value (t/d)</b>	<b>Dry Value (kg/d)</b>	<b>Dry Mater rate (%)</b>	<b>Dry Mater (kg/d)</b>	<b>Organic Dry Mater Ratio (%)</b>	<b>Organic Dry Mater (kg/d)</b>	<b>Biogas Yield (L/kg)</b>	<b>Biogas Rate (m<sup>3</sup>/d)</b>	<b>Rate (%)</b>	<b>Methane Amount (m<sup>3</sup>/d)</b>
<b>Chicken Stool Waste</b>	70	70,000	77,4	54,2	67,05	36.341,8	620 x 620	22.531,9	60x60	13.519,1
<b>Cattle Animal Waste</b>	7	7,000	62,2	4.354	56,9	2.477,42	310 x 310	768	65x65	499,2
<b>Total</b>	<b>77</b>	<b>77000</b>		<b>58.555</b>		<b>38.819,2</b>		<b>23.299,9</b>		<b>14.018,3</b>

Biogas Production from Chicken Manure (m<sup>3</sup>/d):

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=Amount of Waste (kg/d) x Dry Matter Ratio (%) x Organic Matter Ratio (%) x biogas Efficiency (lt/kg OKM) /1000 kg/ton

$$= 70.000 \times \% 77,43 \times \% 67,05 \times 620/1000 = 22.531,89 \text{ m}^3/\text{d}$$

Biogas Production from Bovine Manure ( $\text{m}^3/\text{d}$ ):

=Amount of Waste (kg/d) x Dry Matter Ratio (%) x Organic Matter Ratio (%) x biogas Efficiency (lt/kg ODM) /1000 kg/ton

$$= 7.000 \times \% 62,2 \times \% 56,9 \times 310/1000 = 768 \text{ m}^3/\text{d}$$

Total Biogas Production:  $22.531,89 \text{ m}^3/\text{d} + 768 \text{ m}^3/\text{d} = 23.299,89 \text{ m}^3/\text{d} = \mathbf{23.299 \text{ m}^3/\text{d}}$

The amount of feces (waste) to be sourced from one poultry is 3% -4% of the live weight of the chicken. The average weight of a chicken is in the range of 1.8-2 kg.

Waste between 0.054 - 0.08 kg / day is generated.

An average of 0.067 kg / day of waste is generated.

The amount of feces (waste) to be caused by one bovine animal is 5-6% of the bovine live weight.

Average weight of a cattle is 500-600 kg.

Waste between 25 - 36 kg / day is generated. (URL-3)

## **Electricity Production Account Spreadsheet**

Methane Value (kWh/ $\text{m}^3$ ) =10

Cogen Engine Efficiency (%) =42

Electrical Capacity from Cattle Feces (kWe) =87

Electrical Capacitance from Chicken Feces (kWe)=2365

Total Electrical Capacity(kWe)=2452

Electricity Generation from Chicken Feces(kWe):

=Biogas Production ( $\text{m}^3/\text{d}$ ) x Methane Ratio (%) x Engine Efficiency x Methane Value x/24 h/d

$$= 22.531,89 \text{ m}^3/\text{d} \times \% 60 \times \% 42 \times 10 \text{ kWe}/\text{m}^3/24 \text{ h/d} = 2365 \text{ kWe}$$

Bovine Feces Sourced Electricity Production (kWe):

=Biogas Production ( $\text{m}^3/\text{d}$ ) x Methane Ratio (%) x Engine Efficiency x Methane Value x/24 h/d

$$= 768 \text{ m}^3/\text{d} \times \% 65 \times \% 42 \times 10 \text{ kWe}/\text{m}^3/24 \text{ saat/d} = 87 \text{ kWe}$$

Total Electrical Capacity (kWe) = 2452 kWe =2,4 MWe

Electricity Generation Amount=2452 kWe x 8760 h/year = 21.479.520 kWh/year

are produced. The electricity produced is sold to the state.

## **RESULTS AND CONCLUSION**

Today, biogas technology, which enables environmentally problematic wastes to be processed, rendered harmless and used for energy generation, is an important factor in renewable energy production. Although biogas, known as an energy production method in the society, has an organic waste potential that can be utilized in our country, it cannot be properly utilized. Our country has a potential of 12.5 million tons of organic waste. If these are evaluated, it is possible to provide a great economic input. Although the environmental and economic impacts of biogas are very important, organic wastes are considered as a standard issue applied in every country, but they are in the last place in our country.

It is clear that agricultural, animal and domestic wastes should be evaluated with anaerobic processes in meeting Turkey's energy needs and solving the energy problem. For this purpose, it is necessary to evaluate the production potential of wastes, to determine the anaerobic degradation conditions and the appropriate generator type, and to develop anaerobic treatment technologies by supporting studies on the subject. Using fossil fuels as long as possible in meeting the general energy demand of Turkey, turning to renewable energy sources as much as possible, obtaining biogas from biomass, which has a viable and useful quality and has an important potential, and its consumption especially in small settlements. It constitutes a good alternative, as demonstrated by the study. The use of this alternative is recommended because it is both economical and reduces environmental problems.

Turkey is foreign dependent in terms of non-renewable energy resources. This causes a significant portion of the resources that need to be allocated for development to be transferred to energy imports. Our country has an inestimable organic fertilizer, plant and urban waste potential. It cannot be said that this potential can be utilized sufficiently, most of the animal manure produced for many years is burned

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as dung. As a result, organic matter, which is indispensable for our soils, also disappears, and the production and use of biogas should be encouraged in order to save energy and contribute to energy production. With the expansion of biogas facilities, organic materials can be utilized and energy can be produced, as well as the biofertilizer obtained can be used in soils and can also contribute positively to environmental health in rural areas.

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**O 21. INVESTIGATION OF BURSA CITY AIR POLLUTION**

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**ABSTRACT:** The part of the atmosphere in which people and other living things live, which is close to the earth; As clean air, nitrogen, oxygen and a small amount of it are made up of other gases. The distribution of these gases is a mixture of 21% oxygen, 78% nitrogen and 1% other gas by volume. Other gases other than oxygen and nitrogen are gases such as argon, carbon dioxide, water vapor, helium, neon, hydrogen, nitrogen monoxide, nitrogen dioxide, ozone and ammonia. Chemical substances that can be in gas, liquid or solid form that change this natural composition of air are called air pollutants. The increase in the number of pollutants in the atmosphere adversely affects the air quality and creates air pollution. Air pollution is defined as the presence of solid, liquid and gaseous foreign materials in the atmosphere that may harm human health and the life of living things or prevent the use of material objects necessary for their survival. Air pollution adversely affects the health of humans, animals and plants and destroys the metal, stone and wood parts of the buildings. Its effects span not only present but future generations as well. The aim of the research is to evaluate the reasons causing the rapidly increasing air pollution problem in cities and the physical geography factors affecting air pollution; Bursa City is to examine the change of air quality over time. First of all, by scanning the literature in the field of study, studies examining the air quality of the city were examined, and the air quality data of the City of Bursa were obtained through the "National Air Quality Monitoring Network of the Ministry of Environment and Urbanization" system between 2019 and 2021. The data obtained were converted into tables and graphics using Microsoft Excel and distribution of pollution level were presented.

**Keywords:** *Air pollution, Bursa city, particle matter, SO<sub>2</sub>*

**INTRODUCTION**

In order to protect the health of all living things in the world, threshold values have been determined for the air quality of the countries. These threshold values are determined by taking into account the varying negative effects of pollutants in the atmosphere in order to prevent short and long-term negative situations in the environment. In the 6th article of the Air Quality Protection Regulation published in the Official Gazette No. 19269 on 2.11.1986 in Turkey, the limit values of air pollutants are specified. According to this, the limit values of air quality are defined as "the levels expressed in concentration units determined by taking into account the changing harmful effects of air pollutants in the atmosphere when they coexist, in order to protect human health and prevent short and long-term negative effects on the environment".

Generally, long-term threshold values are used for air quality threshold values, upper threshold values for chronic effects that appear with long-term inhalation of low amounts of pollutants. The short-term threshold value definition is used to indicate the acute effects that occur when high amounts of pollutants enter the body through inhalation in the short term.

Air pollution from energy facilities, motor vehicles, fossil-based materials used for heating and industrial facilities that use fossil-based substances as fuel has more than one negative effect on the health of living things. Although air pollutants are in small amounts, they contain compounds with carcinogenic effects. Negative effects of air pollutants; diseases that negatively affect health such as lung cancer, bronchitis, rheumatism, osteoporosis and various heart diseases can be given as examples. Apart from these visible effects, effects such as burning in the eyes, blurred vision, difficulty in breathing, and blood poisoning can also be seen on people. As a result of the increase in the dangerous emission pollutants in the air we breathe in the human body, loss of appetite is observed and as a result of this loss of appetite, the immunity of the body weakens and increases the effect of diseases. Various

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negativities are observed with the difficulty of breathing as a result of various dusts combining with body moisture and clogging the pores on the skin tissue. A high degree of fatigue is observed on people after difficult breathing. In addition, as a result of the toxic substances contained in the emissions entering the body through the upper respiratory tract, they mix with the blood and cause an event called blood poisoning. Sulphur-dioxide and nitrogen-oxides in the atmosphere provide the formation of acid particles. These nitric and sulfuric acids adhere to the other emission material and cause the acids to reach the lungs with the inhalation of these emission substances. These acidic dusts and gases that go down to the lungs affect the alveoli in the lungs and mix with the blood.

As a result of the developing technology, the means of transportation have changed greatly. Motor vehicles, which have changed in the process from the steam machines that emerged with the industrial revolution to the present, have started to use fossil-based materials as fuel. Increasing population and increasing urbanization in direct proportion to this brought together public transportation. Gases emitted from the exhausts of individual and collective transportation vehicles, fossil fuels burned for heating purposes in residences, and pollutants such as sulphur dioxide, nitrogen oxide, particulate matter and hydrocarbon released into the atmosphere from industrial establishments have a negative effect on the air. These pollutants are substances that can remain suspended in the atmosphere for more than one day. During its suspension, it enters into various chemical reactions in the atmosphere and can be transported to as far as possible. These pollutant emissions complete the chain reactions by entering into a chemical reaction with the humidity and other components in the atmosphere and form sulfuric acid ( $H_2SO_3$ ), sulfuric acid ( $H_2SO_4$ ) and nitric acid ( $HNO_3$ ). The chemical formations that occur are precipitated by rain and cause acid rain to occur. Harmful formations in places where people and other living things live can reach levels that can directly affect human health, and they affect the health of living things negatively by mixing with the soil as a result of acid rain.

Acid rain negatively affects the structure of the soil. It carries elements such as calcium and magnesium already in the soil to deep points, as a result of which it deteriorates its structure and decreases the yield in agriculture. It prevents the activity by destroying the beneficial microorganisms that make the soil rich in organic matter by breaking up the living residues. Since it affects all living things living in the ecosystem, it also causes the deterioration of the ecological balance between species. The first source of substances that cause the soil to become acidic is sulphur compounds and acid moisture, which pass into the soil as a result of accumulation in the atmosphere. When nitrogen compounds are more than the amount needed by the plants, they mix with the soil and negatively affect its structure and cause acidification.

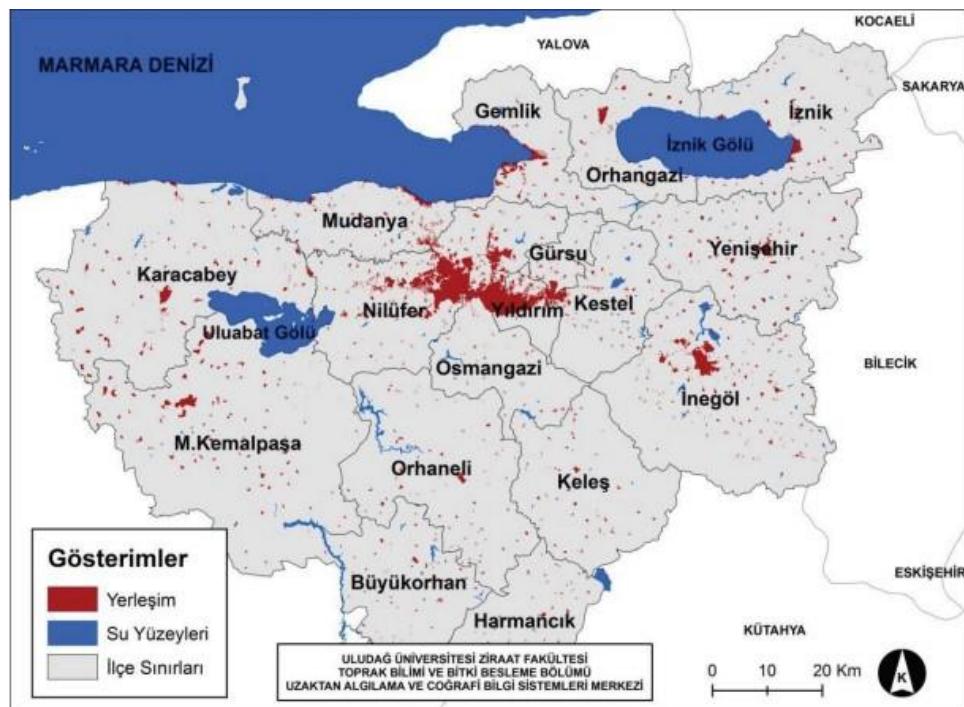
Bursa province is one of the provinces with air pollution potential as it is in the center of a city in Turkey. With the industrial development of the province, the use of fuel for heating and the exhaust emissions of vehicles in traffic, depending on the population, are the most important sources of air pollutants. The aim of this study is to investigate the air quality in the city center as Spatial and temporal variations by using the data of the air quality measurement station in the city center.

## **MARTIALS AND METHODS**

### **Research Area**

Bursa air pollution values T.C. Accessed via the Bursa Governorship website, T.C. It was obtained through the National air quality monitoring network established by the Ministry of Environment and Urbanization. The measurement stations in the city of Bursa (Bursa, Beyazıt, İnegöl-OSB, İnegöl-MTHM, Kestel-MTHM, Kültür Park-MTHM, Uludağ University) in the system provide daily pollution values to the above-mentioned system. These values were tabulated on the Excel program, compared with the limit values and interpreted, taking into account the increase and decrease of pollution values over the years.

The study area layout is shown in Figure 1. Bursa province, located in the South-Marmara region of Turkey, has the distinction of being the fourth largest city in Turkey in terms of population. The city is geographically located between 40° West Longitude and 29° North latitude circles. It has a total area of 10,819 km<sup>2</sup> with its 17 districts. It is among the most developed cities in Turkey in terms of economy and industry. It preserves its importance in terms of history, industry and tourism features, as it was in the past.



**Figure 4.** Bursa Province Settlement Map by Districts

## Measuring Stations

Our country has taken important initiatives in 2008 in order to reduce or prevent the negative effects of air pollutants on animal health and the environment. This initiative is the Marmara Clean Air Center Directorate within the scope of the "Institutional Structuring Project in the Field of Air Quality in the Marmara Region" financed together with the European Union. It was established in the city of Istanbul with the decision of the Council of Ministers dated 10.05.2008 and numbered 26872. With this Clean Air Center directorate, information about air quality and the information obtained are provided to the public through warning thresholds. The Directorate continues its activities within the scope of the Decree Law No. 644 on the Organization and Duties of the Ministry of Environment and Urbanization published in the Official Gazette dated 04.07.2011 and numbered 27984 (Marmara Clean Air Center Directorate, 2018). Marmara Regional Clean Air Center Directorate operates a total of 54 pollution measurement stations in 11 provinces in the Marmara Region (İstanbul, Edirne, Kırklareli, Tekirdağ, Kocaeli, Sakarya, Bilecik, Yalova, Bursa, Balıkesir and Çanakkale) (Marmara Clean Air Center Directorate, 2018). Marmara Regional Clean Air Center Directorate air quality measurement stations; It was established in four different categories as urban, traffic, industrial and rural. There are differences in the parameters measured according to the categories.

Three stations (Kültürpark, Uludağ University and Bursa-Osmangazi) have been established in Bursa to monitor air pollution caused by fossil fuels used for heating purposes. Two stations (Kestel and İnegöl) were established to monitor industrial air pollution. A station (Beyazıt Caddesi) was established to monitor the pollution caused by traffic, which is one of the important problems that developed as a result of the increasing population of Bursa. In total, six stations were established, previously established. It is operated by the Marmara Regional Clean Air Center Directorate (Figure 1). The raw data obtained from the stations are presented to the public on the [www.havaizleme.gov.tr](http://www.havaizleme.gov.tr) website.

## RESULTS

### Air Pollutants Measured at Stations

The city of Bursa is a city established in the lower parts of Uludağ mountain and is surrounded by mountain ranges that can reach 1000 m in height. For this reason, polluted air accumulates in the city.

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In addition, cold air masses moving down from the high mountain ranges surrounding the city reach the plains and tend to precipitate there. The polluted air continues to exist in the city due to the resulting temperature inversion. A total of six pollutants are measured at six air quality measurement stations in Bursa. Air pollutants that can be measured at a total of six air quality measurement stations in Bursa are presented in Table 1.

**Table 1.** Pollutants measured at air quality measurement stations in Bursa

SAMPLING STATION	PM <sub>10</sub>	PM <sub>25</sub>	NO <sub>2</sub>	SO <sub>2</sub>	O <sub>3</sub>	CO
Bursa-Osmangazi	X			X	X	
Beyazıt			X	X		X
Kültürpark			X	X	X	
Kestel	X		X	X		
İnegöl OSB			X	X		
Uludağ University	X	X	X	X		

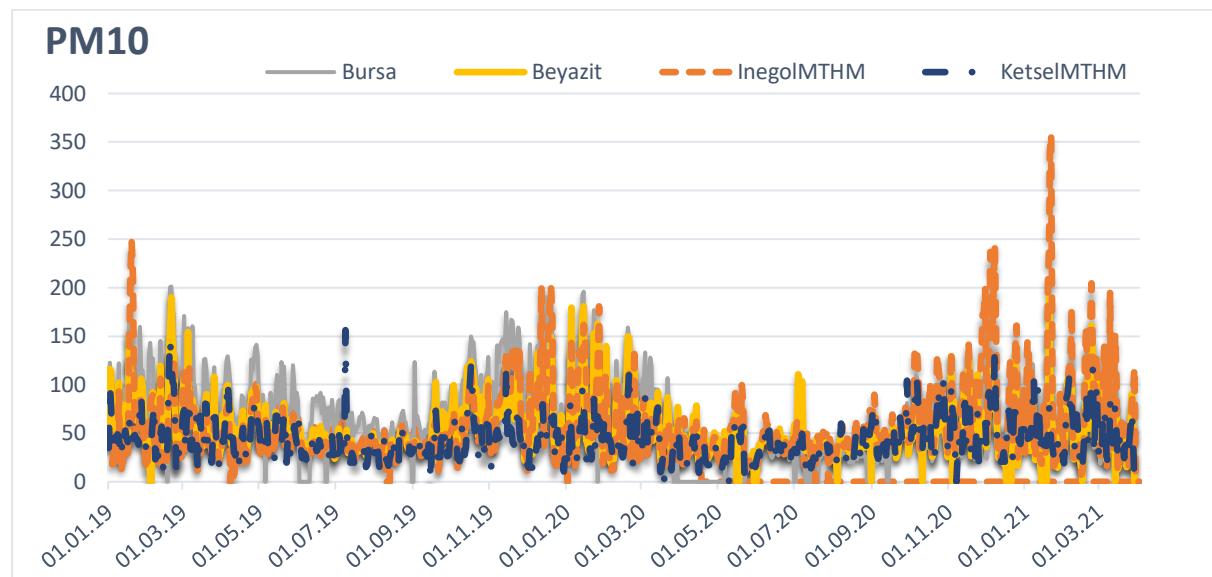
## **Air Pollution in Bursa**

As a result of the researches conducted in Turkey in 2014, Bursa is among the top five cities with the highest annual PM<sub>10</sub> averages. Measured classical air pollutants; SO<sub>2</sub>, PM<sub>10</sub>, NO<sub>x</sub>, PM<sub>2.5</sub> and O<sub>3</sub> are pollutants whose measurements are frequent and whose effects can be observed in the atmosphere to a great extent. As can be seen as a result of the evaluation of the measurement results specified by the Marmara Clean Air Directorate, three pollutant source groups have been identified in the city of Bursa.

### **Particle Matter 10μm (PM<sub>10</sub>)**

These are the main sectors that cause air pollution in the city and are considered classics such as heating, industry and transportation. Considering the reasons for the emergence of this situation; The fact that the income distribution varies greatly according to the regions, the traffic congestion caused by the lack of alternative roads on the main roads and the fact that it has a large industrial network explain the reasons for the formation of pollutants. In the air where PM<sub>10</sub> pollutant was observed, it was observed that the biggest sources of particles were burning coal for heating purposes at a rate of 67%. Considering the reasons for its formation, it was observed that the emissions of motor vehicles were 19% and coal used in industry was 9%.

Throughout Turkey, PM<sub>10</sub>, together with SO<sub>2</sub>, has been measured in all provincial centers since the 1980s. However, since it is more important in recent years, 2.5 micron-sized particles have also been measured. PM<sub>2.5</sub> is also measured along with PM<sub>10</sub> at some stations in every province. Although most of the PM<sub>10</sub> pollutant is estimated to be natural and inert substances, it is thought to originate from the consumption of fossil fuels for heating purposes, industrial activities and vehicle exhausts. Since some of it reaches the lungs, it should be measured and its values should be reduced, and the limit values should be lowered for the following periods. As seen in Figure 2, PM<sub>10</sub> values, which go above the limit values in winter months, decrease to or below the limit values in summer months.

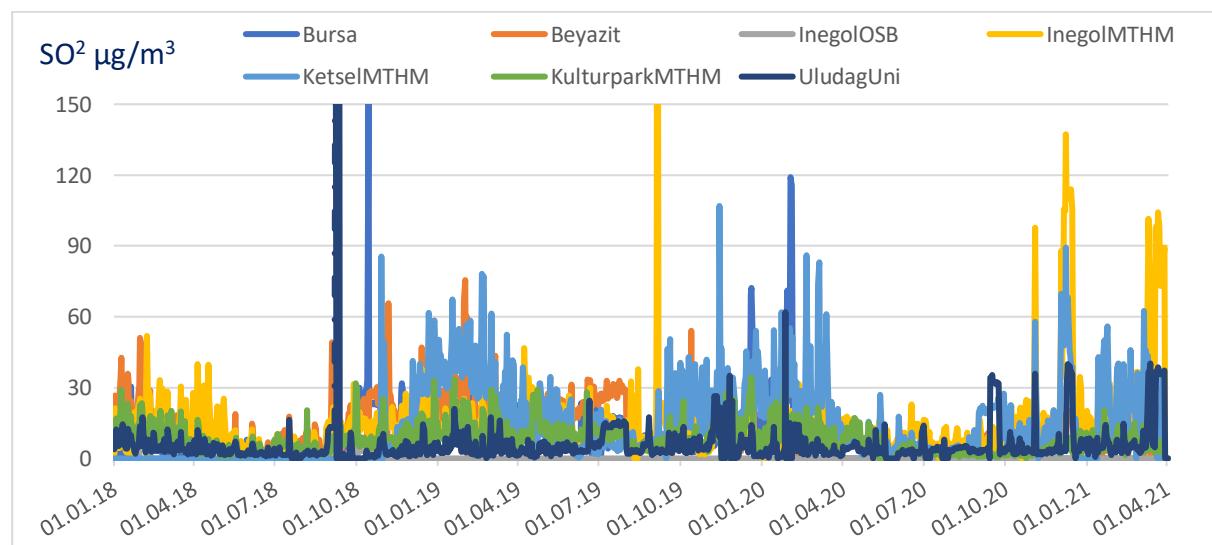


**Figure 2.** Particle Matter (PM10) levels 4 air quality station of Bursa Province last 2 years (2019-2020)

### Sulphur Dioxide ( $\text{SO}_2$ )

Sulphur Dioxide is a non-flammable and colourless gas. About 60% of the measured sulphur oxides are formed as a result of the combustion of fossil fuels used for heating purposes. Thermal power plants are among the biggest sources of  $\text{SO}_2$  emissions due to the coal they use. There are sulphur oxides mixed into the atmosphere as a result of natural events, forest fires and volcanic activities can be given as examples. It has negative effects on living things as a result of its presence in the atmosphere in large quantities. To give an example of its negative effects, it can cause blockages in the respiratory tract. It creates sulphate particles in the atmosphere. These particles can be transported to very distant places by the winds. In the presence of suitable environment such as sunlight and chemicals, sulfuric acids are formed.

The temporal variation of sulphur dioxide values taken from 7 air quality stations in Bursa city is shown in Figure 3. It is observed that the concentrations below the long-term limit values in summer seasons exceed the national and international limit values determined for winter season. It is thought that the very high values that appear on some days are due to the special conditions of meteorological factors. Since these values can sometimes affect human health, special measures are needed on similar days.

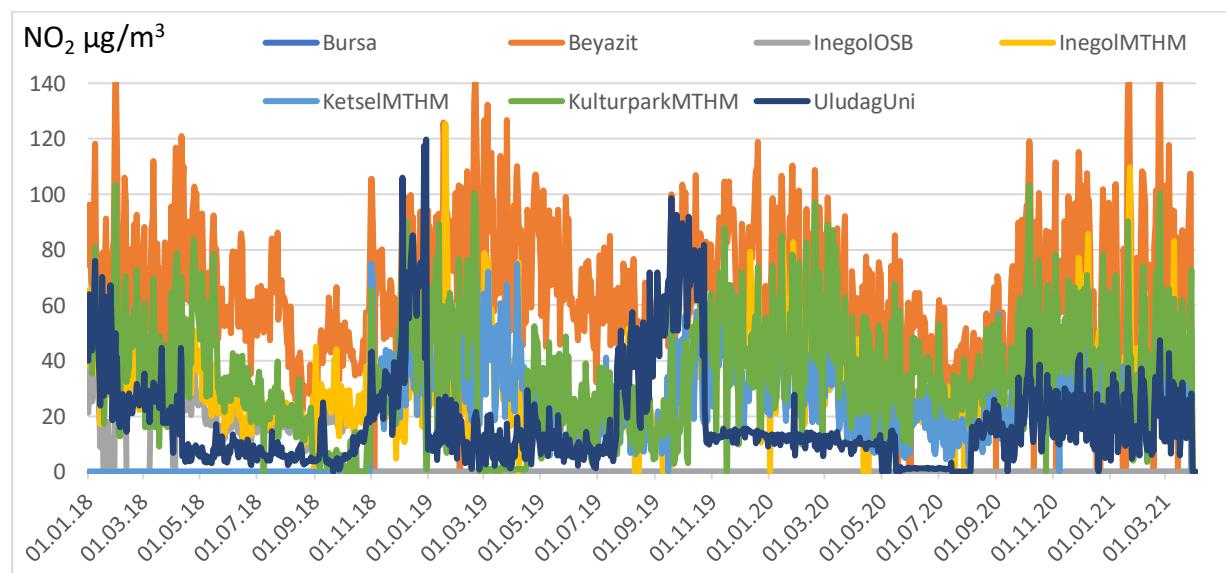


**Figure 3.** Sulphur Dioxide levels 7 air quality station of Bursa Province last 2 years (2019-2020)

### Nitrogen Dioxide ( $\text{NO}_2$ )

Gases defined as nitrous oxide ( $\text{NO}_x$ ) are reactive gases that occur at high temperatures such as 1200 °C. Many types of  $\text{NO}_x$  are odourless and colourless. Nitrogen oxides are insoluble in water. Therefore, they reach the deepest points of the respiratory tract without being filtered in the upper respiratory tract and show harmful effects at these points. Upon combustion at high temperatures, nitrogen monoxide ( $\text{NO}$ ) forms nitrogen dioxide ( $\text{NO}_2$ ), albeit in a small amount.  $\text{NO}$  mixed into the atmosphere transforms into  $\text{NO}_2$  as a result of oxidation.  $\text{NO}_2$ , which is present in the atmosphere in large proportions, is a strong oxidant substance. When they are together with the particles, they can be seen as a red-brown layer in cities. It has two major sources. These sources are the combustion of fuels used in transportation vehicles and fossil fuels used in thermal power plants. The remaining industrial facilities and the use of fuel for domestic heating are among the other sources of nitrogen oxides. The use of motor vehicles, which has increased especially with urbanization, has an important share in the increase of nitrogen oxides. When we look at the developing countries, nitrogen oxide emissions show an increase even though sulphur dioxide and particulate matter are seen in small amounts in the general framework.

When Figure 4 is examined, it will be seen that; Nitrogen dioxide values of 7 air quality stations in Bursa province are quite high between December and May. Although the values of the university station are low in others, it is also seen that the values of this station are high on some days. It is thought that nitrogen oxides mostly originate from industrial facilities and vehicle exhausts, and the topographic structure of the region and meteorological factors are also effective in the increase in concentration. It is seen that the values are low at all stations on the days when the measures started and continued due to the pandemic. The decrease in human activities has also led to an increase in air quality.



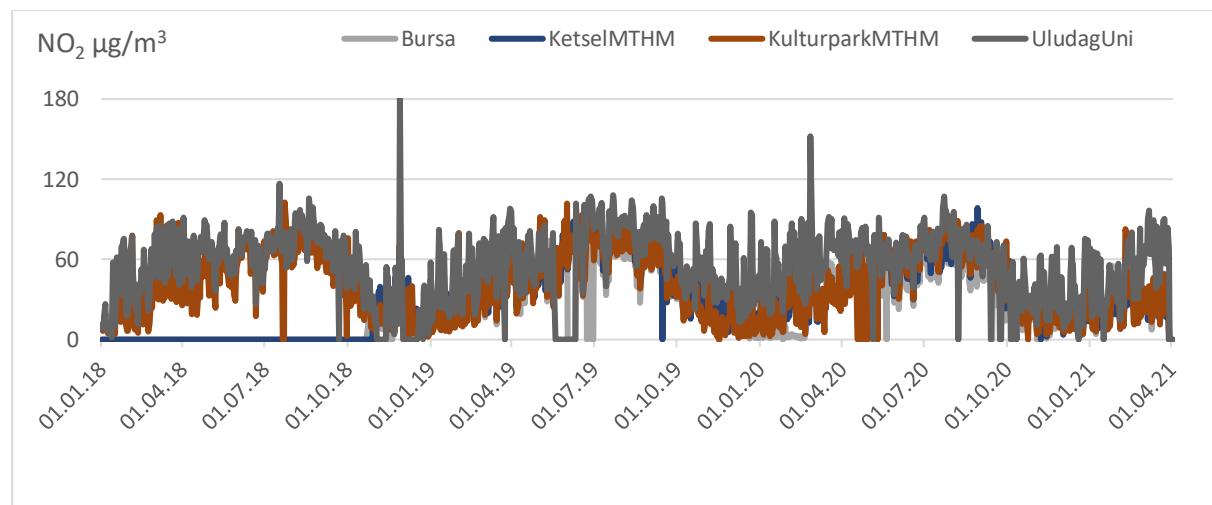
**Figure 4.** Nitrogen Dioxide levels 7 air quality station of Bursa Province last 2 years (2019-2020)

### Ozone ( $\text{O}_3$ )

Although ozone is not one of the basic building blocks of the air we breathe, it is a product of oxygen. It has the property of reaching its maximum concentrations in the stratosphere layer and being reactive. Since ozone is not a water-soluble gas, the amount in the air can reach the lungs and have harmful effects. It occurs as a result of photochemical reactions that occur in the atmosphere of cities and rural areas, in the presence of nitrogen dioxide and sunlight, that is, in suitable conditions. It was first detected photochemically in the Los Angeles atmosphere in the 1950s and is a special air pollutant. The occurrence of ozone in clean and sunny weather can be considered as not a pollutant gas. Ozone concentration, which exceeds certain values, affects the health of living things as well as on goods, including vehicle tires. Ozone can interact with other air pollutants in the atmospheric environment and cause secondary pollutants to occur.

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Since there is no local ozone data at all stations in Bursa, the daily average ozone concentrations of only 4 stations are shown in Figure 5. As can be seen from the figure, the change in temporal ozone values shows the opposite of other air quality parameters. It is observed that the values that are relatively low in the winter months are around 100  $\mu\text{g}/\text{m}^3$  values in the hot and sunny summer months. The fact that high values are encountered, albeit rarely, in winter is due to the effect of clear and sunny weather on some days.

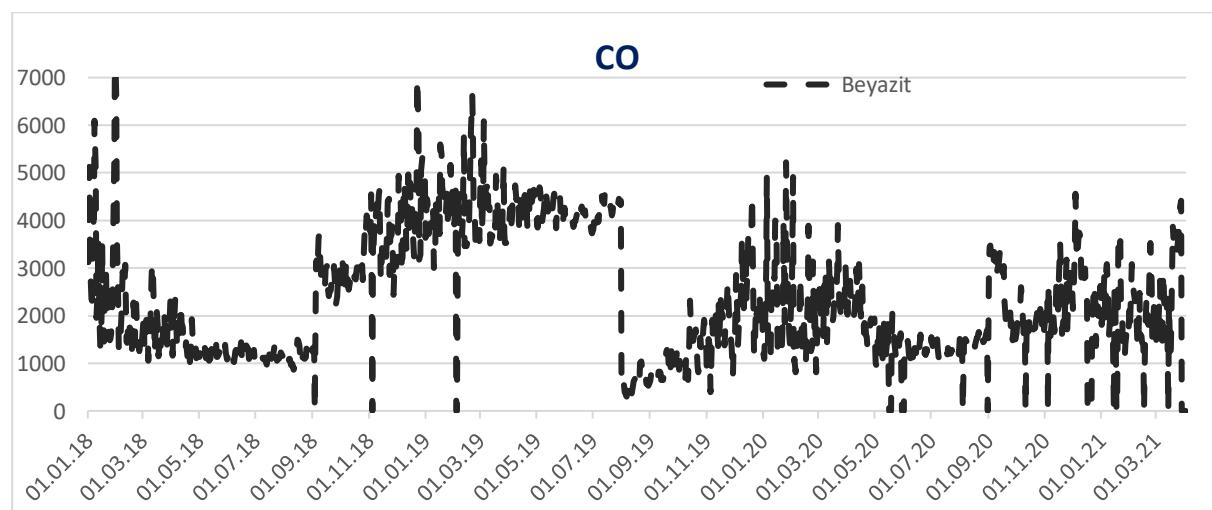


**Figure 5.** Ozone levels 4 air quality station of Bursa Province last 2 years (2019-2020)

### **Carbon monoxide (CO)**

Carbon monoxide is a colourless and odourless gas. It occurs when the carbon in the structure of the fuels is not completely burned. To give an example of the causes of carbon monoxide emissions, Industry, burning of fossil fuels and forest fires can be said. Carbon monoxide diffuses and binds to haemoglobin, leading to the formation of COHb in the blood. Carbon monoxide binds to haemoglobin 200 times more strongly than oxygen. For this reason, it prevents the transport of oxygen to the tissues and eventually leads to suffocation.

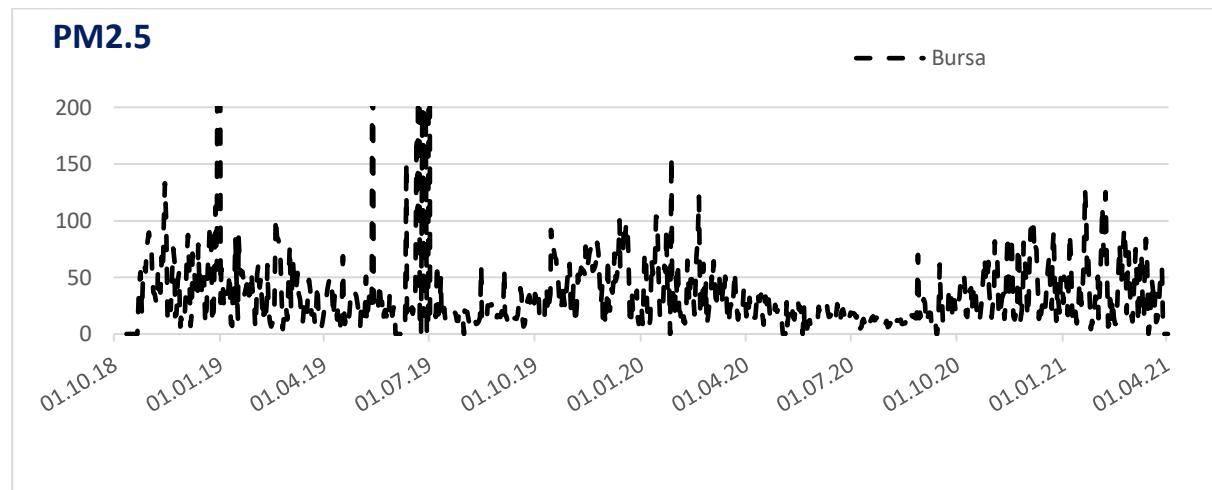
Sufficient CO data could be obtained from only one station (Beyazit) in Bursa city center. Like ozone, CO has recently begun to be measured at stations. Although CO values are measured between 1000-5000  $\mu\text{g}/\text{m}^3$  values, it goes up to 10000  $\mu\text{g}/\text{m}^3$  values (Figure 6). However, the CO values are below the limit values. In summer, the values are low and the use of fossil fuels is considered as a resource.



**Figure 6.** Carbon monoxide levels 1 air quality station of Bursa Province last 2 years (2019-2020)

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PM2.5, which has been started to be measured in Turkey in recent years, has started to be measured at a station in Bursa city center and it is planned to be measured at other stations. Although its sources are mostly exhaust gases, it is thought to be formed by the condensation of other combustion products and gaseous/liquid air pollutants. In terms of origin, it is more toxic than larger particles. Considering Figure 7, although the values are high enough to be important, the legal limit values related to this are limited. Although high values are observed in the winter season, very high values are observed in the summer months, and it is seen that the pollutants originating from traffic and industry are important for the region.



**Figure 7.** Particle Matter (PM<sub>2.5</sub>) levels 1 air quality station of Bursa Province last 2 years (2019-2020)

## **RESULT AND DISCUSSION**

It has been observed that 32% of the fuels in Turkey are used for heating purposes. It has been observed that most of the extracted fuels have low flammability, substances such as sulphur, nitrogen, ash and moisture content is quite high. The expensiveness of quality fuels has led the people who have no economic power to use cheap and more polluting fuels for a long time. This trend, together with the lack of thermal insulation in the buildings and the continuation of the so-called slums, increased the fuel use and the concentrations of pollutants needed for energy production. It has been observed that the air pollution, which increases in the winter months in Bursa, is generally caused by industrialization and urbanization. It has been seen that Bursa is a city that receives rapid immigration, together with unplanned urbanization without taking into account its topographic and geographical structure, the rapid disappearance of green areas that greatly reduce air pollution, creating unhealthy environmental conditions. Apart from these unfavorable conditions, it was seen that the rapidly increasing transportation vehicles had a significant share in air pollution in Bursa. Apart from public transportation vehicles, the increase in traffic observed as a result of the citizens getting on their personal vehicles also brings air pollution. The average of the data recorded on Excel was taken in the change part and the tables were prepared. The tables created by averaging from the first data to the last data were compared with the air pollution limit values determined by the Ministry of Environment and Urbanization. As a result, it was observed that SO<sub>2</sub> values were below the limit values. When comparing NO<sub>2</sub>, it was seen that the average of the measurements made in Beyazıt exceeded the annual limit value (annual) 40 µg/m<sup>3</sup> for NO<sub>2</sub>. The reason for this situation was observed as the traffic jam on the front step boulevard in November and the use of coal rather than natural gas for heating by the locals. It was observed that the annual averages of PM10 data exceeded the (annual) air pollution limit of 40 µg/m<sup>3</sup> for PM10. The limit value (annual) determined for PM2.5 is 25 µg/m<sup>3</sup>, and it is the Bursa station that is observed to exceed this limit.

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**O 22. ANKARA AIR QUALITY STUDY**

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**ABSTRACT:** In particular, annual amounts of pollutants released from artificial sources reach from a few hundred tons to millions of tons. These produce effects in varying degrees, depending on the area and quantities in which they are formed. The adverse health effects that occur as a result of the inhalation of pollutants (direct exposure) by humans (direct exposure), the mixing of the pollutants accumulated from the air, soil, plants, animals and other environmental environments into the drinking water and food chain (indirect exposure), and the accumulation and absorption of chemicals entering the body. is the important result. Especially in cities, with the increase in air pollution caused by heating, traffic and industry in recent years, there has been an increase in health problems. Air pollution is the release of chemicals, particulate matter or biological materials that harm or disturb humans or other living organisms or harm the natural and artificial environment. The change in the physical, chemical and biological properties of the air affects natural and artificial non-living beings as well as living things. Air pollution occurs when the natural composition of the air changes to a certain extent. Air pollution is the release of chemicals, particulate matter or biological materials that harm or disturb humans or other living organisms or harm the natural and artificial environment. The change in the physical, chemical and biological properties of the air affects natural and artificial non-living beings as well as living things. Air pollution occurs when the natural composition of the air changes to a certain extent. In the calculation of emissions from traffic, data on the length of the roads in the project area, the number of vehicles in the project area and the amount of fuel consumed in the project area have been compiled. From the number of vehicles in our city, the ratio of the number of collecting vehicles was obtained, and from here, the amount of fuel and how much it was used was calculated by proportioning to the fuel types. According to the amount of fuel consumed; Emissions from traffic are calculated using the emission factors of fuels.

**Keywords:** Air pollution, Ankara city, particle matter, SO<sub>2</sub>

**INTRODUCTION**

Our world has changed in the last 50 years for many reasons, both industrial and technological advances. These differences have led to an increase in the world population, and with the migration in developed cities, the population has increased and the use of energy has also increased. With this situation, in the industrialized world; As a result of energy and heat generation, sulphur dioxide and particulate matter pollution have increased. (Fenger 2009). Due to the increase, the classical way has been followed for environmental protection. In this classic way; first of all, an increase in pollution levels with increased financial comfort, and then to take measures towards reducing pollutants in order to protect public health. Along with the studies, there are important breaks. Environmental pollution problems today are greater than they were in the 1950s. It is especially seen in developing countries with main cities and their environs (Shafik 1994, Fenger 2009). Environmental pollution problems still persist in the industrialized world and are mainly caused by nitrogen oxides, volatile organic compounds and photochemical oxidants associated with increased traffic. Especially, new hazardous compounds from industry have been identified by advanced analytical techniques. As a result; Recently, air pollution has been affecting ecology considerably (Shafik 1994, Fenger 2009). Air quality management in Turkey is carried out by the Ministry of Environment and Urbanization of the Republic of Turkey. EIA, Environmental Permit and License, Industrial Air Pollution Control, Air Quality Assessment Management, Air Pollution Control Due to Heating etc. regulations and measures for air pollution and implementation of mitigation studies are ensured.

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Air pollution is “the presence of one or more types of pollutants in the open air outside the building in an amount that harms human, plant and animal life, commercial or personal belongings, and an environmental quality that can be enjoyed over a certain period of time” (Muezzinoğlu, 2000). Air pollutants can be examined in two groups. The first group consists of CO<sub>2</sub>, CO, SO<sub>X</sub>, NO<sub>X</sub>, hydrocarbons (HC), hydrogen fluoride (HF), hydrogen sulfur (H<sub>2</sub>S), methane (CH<sub>4</sub>), chlorofluorocarbon (CFC) and powdered particulate matter. O<sub>3</sub>, SO<sub>3</sub> (sulfur trioxide), H<sub>2</sub>SO<sub>4</sub> (sulfuric acid), acids and photochemical oxidants formed later in the air are added to the second group. (Saracoglu, 2010; 6-7).

The Project for Improving the Air Quality Assessment System in Cities (KENTAIR Project) is a project that started its activities in the field of environmental cooperation between our Ministry of Environment and Urbanization and the Dutch Government National Institute of Environment and Public Health (RIVM). The aim of this project is to determine the air pollution in certain provinces in Turkey (Gaziantep, Adana, Mersin, Samsun, Ankara and Erzurum) and to monitor the air quality in the cities, to prepare the data and action plans by increasing the capabilities of the responsible institutions and organizations at the local scale, and to inform the public about the health effects of air pollution. reinforcement is given.

## **MATERIAL AND METHOD**

### **Air Quality Measurement Methods**

Analysis activities in determining air quality are carried out in two ways. These can be done manually and automatically. The manual is usually done for particulate matter and SO<sub>2</sub> determination. A data can be obtained after 24 hours from the manual measurement. The reliability of the measurement information obtained with these systems is low. These systems were used in our country until 2005, but now automatic mechanisms are used. Since 2005, the Ministry of Environment and Forestry has carried out activities to establish an Air Quality Monitoring Network throughout our country, and the National Air Quality Monitoring Network was established by building air quality measurement stations in 36 provinces in 2005, taking into account the cities with high air pollution. At present, air quality measurements are carried out at 116 points by the Ministry of Environment and Urbanization. At the same time, 3 mobile air pollution measurement tools within the structure of the Ministry are dispatched to provinces and districts to measure at a certain time according to the demands. The purpose of establishing measurement stations is to detect air pollution arising from heating.

### **Limit Values of Pollutants**

In our country, to know and determine the air quality objectives in order to stop or reduce the threat of air pollution to ecology and living health, to observe the air quality based on these methods and data, to keep this well-being under control in the regions where the air quality is good and otherwise improve it, to do enough about the pollution. Air Quality Assessment and Management Regulation was published and entered into force in order to obtain data and raise awareness of the society with warning limits. Limit values for pollutants have been introduced within the scope of Annex-1 of the Regulation. (Air Quality Assessment and Management Regulation (HKDYY) 2008.)

**Table 1.** Limit Values of Air Pollutants in Turkey (Turkish Air Quality Assessment and Management Regulation (HKDYY, 2008.))

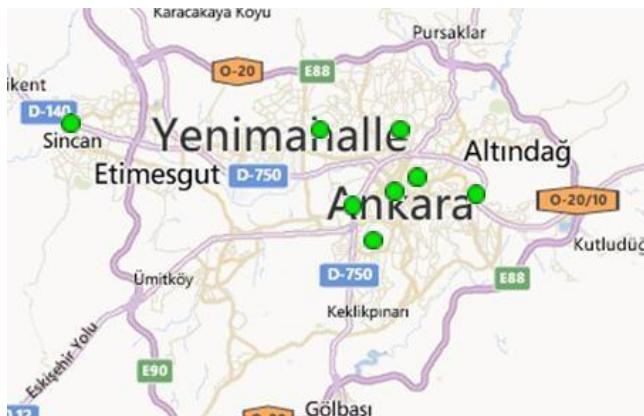
Pollutants	Average Duration	Limit Value
SO <sub>2</sub>	24 for the hour	125 µg/m <sup>3</sup>
NO <sub>x</sub> )	for the hour	200 µg/m <sup>3</sup>
PM	24 for the hour	50 µg/m <sup>3</sup>
CO	Daily maximum	10 µg/m <sup>3</sup>
O <sub>3</sub>	8 hourly average	120 µg/m <sup>3</sup>
Benzene	Annual average	5 µg/m <sup>3</sup>

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## Research Area

There is a lot of air pollution problem during winter period in Ankara. The reason for this is the topography of the city, the use of poor-quality fuel in the heating area, and the misuse of these fuels, the use of poor-quality fuels without improvement, the very low wind speed of the city, exhaust gases, etc. effects accumulate in the city and cause pollution.

There are 8 air quality measurement stations in Cebeci, Demetevler, Dikmen, Bahçelievler, Sıhhiye, Keçiören, Kayaş and Sincan districts affiliated to the National Air Quality Monitoring Network of our Ministry of Environment and Urbanization in order to determine the general situation of air quality in Ankara and to determine measures accordingly. PM2.5, PM10, SO<sub>2</sub>, NO<sub>x</sub>, Ozone, CO etc. in stations. Meteorological measurements with pollutants are made for 24 hours.



**Figure 1.** Representative Locations of Air Quality Stations (THEP, 2019)



**Figure 2.** Bahçelievler Air Quality Measurement Station  
(<https://ankara.csb.gov.tr/>)

**Table 2.** Coordinates of Air Quality Measurement Stations and Measured Parameters

## RESULTS

### **Sulphur dioxide ( $\text{SO}_2$ )**

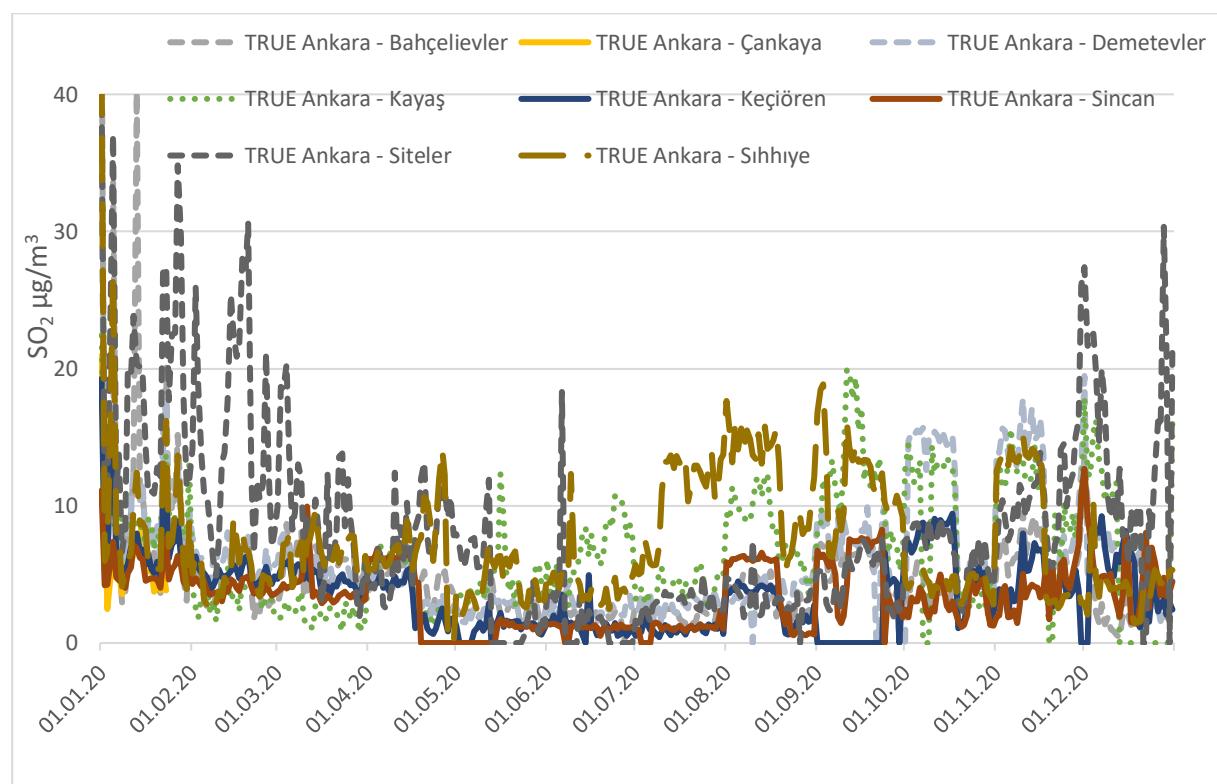
Sulphur oxides are among the most well-known air pollutants. Sulphur oxide, which is a non-flammable, colourless, suffocating, acidic gas, persists in the atmosphere for 40 days (Incecik, 1994). Sulphur compounds in the structure of coal and fuel-oil combine and burn to form SO<sub>2</sub>. Sulphur dioxide producing activities are industrial works, domestic fuels used for heating purposes, thermal power plants and the use of diesel fuelled vehicles. SO<sub>2</sub> concentrations are generally high in central areas of cities and industrial areas where coal is used for domestic heating (Akyürek, 2012). While the sulphur dioxide values do not exceed the 24-hour limit values specified in the regulation, they are above the long-term limit values and international limit values. While the values reach very high values in winter months,

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they are relatively low in summer months. However, high values can be observed in industrial areas such as Ankara sites. It is attributed to the use of fossil fuels as a source.

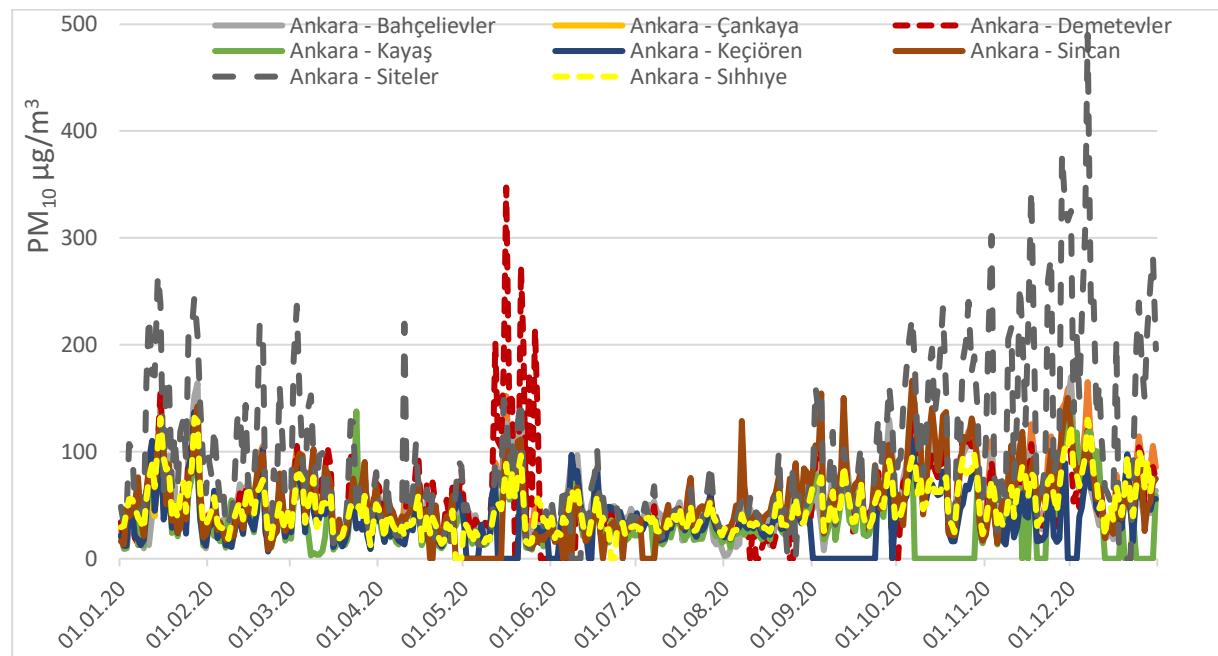
### **Particulate Matter (PM)**

Because particulate matter is so heavy and large, they can precipitate quickly in the atmosphere. They are also very small granular solid or liquid particles dispersed in the atmosphere. In terms of particulate matter, quality and quantity; particle sizes, concentration, chemical composition and health effects vary. (Öztürk, 2007). Particulate matter sources consist of anthropogenic and natural sources. While SO<sub>2</sub> and PM<sub>10</sub> (particles smaller than ten micrometers) are measured in all air quality stations in Turkey, as in many other countries in the world, the measurement of the PM2.5 parameter, due to its chemical properties, has begun to become widespread. Since the particles smaller than ten microns have a high rate of reaching the lower respiratory tract and are important due to their physical/chemical effects, limit values have been set and values have been reduced over time. PM10 values measured at Siteler station after October are thought to be due to industrial activities and the use of fuel for heating purposes in this period. High values in the middle of summer at Demetevler station can only be explained by a special situation for the region. In general, it is seen that PM10 values are above the limit values.



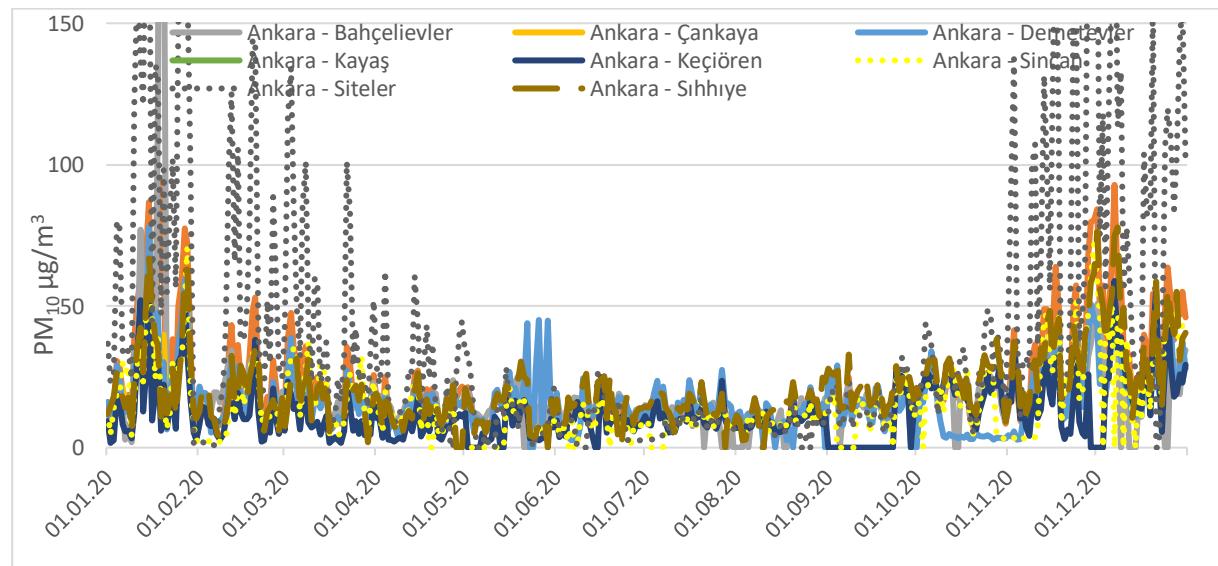
**Figure 3.** Sulphur dioxide (SO<sub>2</sub>) levels 8 air quality station of Ankara Province in 2020

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**Figure 4.** Particle Matter (PM<sub>10</sub>) levels 8 air quality station of Ankara Province in 2020

Particulate matter Contaminants smaller than 2.5 microns are usually caused by combustion products. Combustion events will be fuel consumption for heating purposes, as well as exhaust gases of transportation vehicles. Meteorological events in the winter months can be a factor in the rise of pollutants. At all stations in Ankara, PM<sub>2.5</sub> values are observed to be above the limit values in winter months, while the values decrease in summer months. The increase in air temperatures may be a factor in the formation of the pollutant as well as in its distribution (Figure 4).



**Figure 5.** Particle Matter (PM<sub>2.5</sub>) levels 8 air quality station of Ankara Province in 2020

### Nitrogen Oxides (NOx)

Nitrogen oxides (NOx) are highly disintegrating gases and most of them are colorless and odorless. In addition, they are insoluble in water and are formed at high temperatures (1200 °C). NOx are formed when solid or liquid fuels are burned at high temperatures. Two important sources are motor vehicles and thermal power plants. Fuel consumption for other industrial plants, commercial and domestic heating are among other sources of NOx. Especially in urban areas, NOx concentrations increase due to the increase in the number of vehicles. Therefore, it causes health problems in the upper respiratory tract

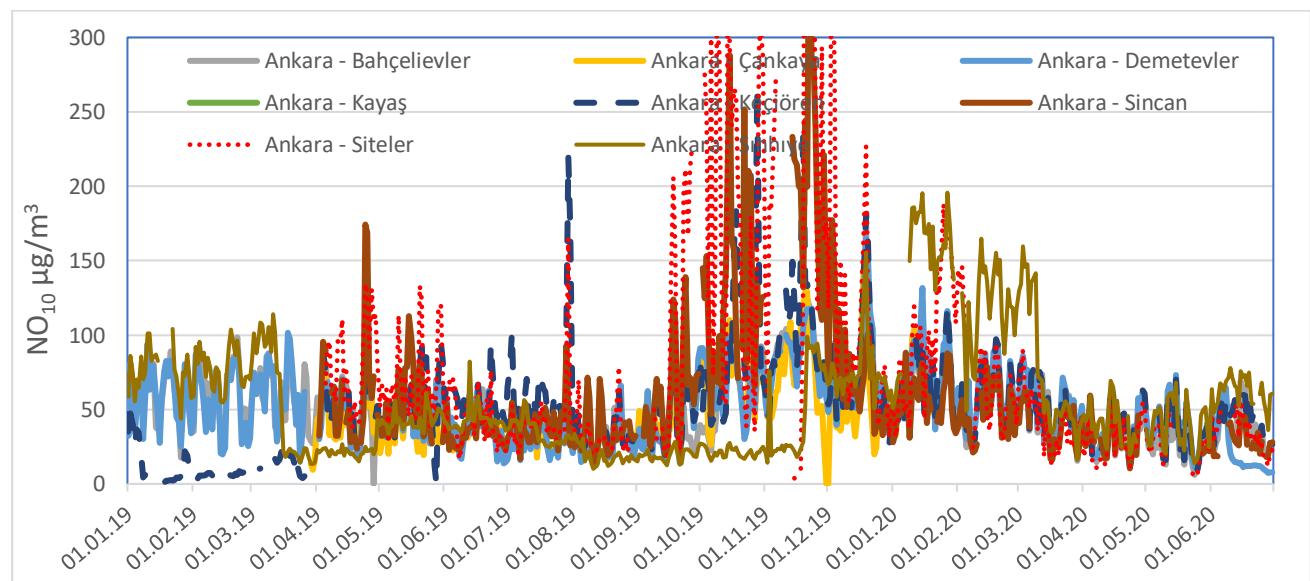
## **Proceeding Book of ISESER 2021**

(Incecik, 1994). Even though SO<sub>2</sub> and particulate matter generally decrease in developing countries, NO<sub>x</sub> emissions increase due to the increasing number of vehicles and industrialization.

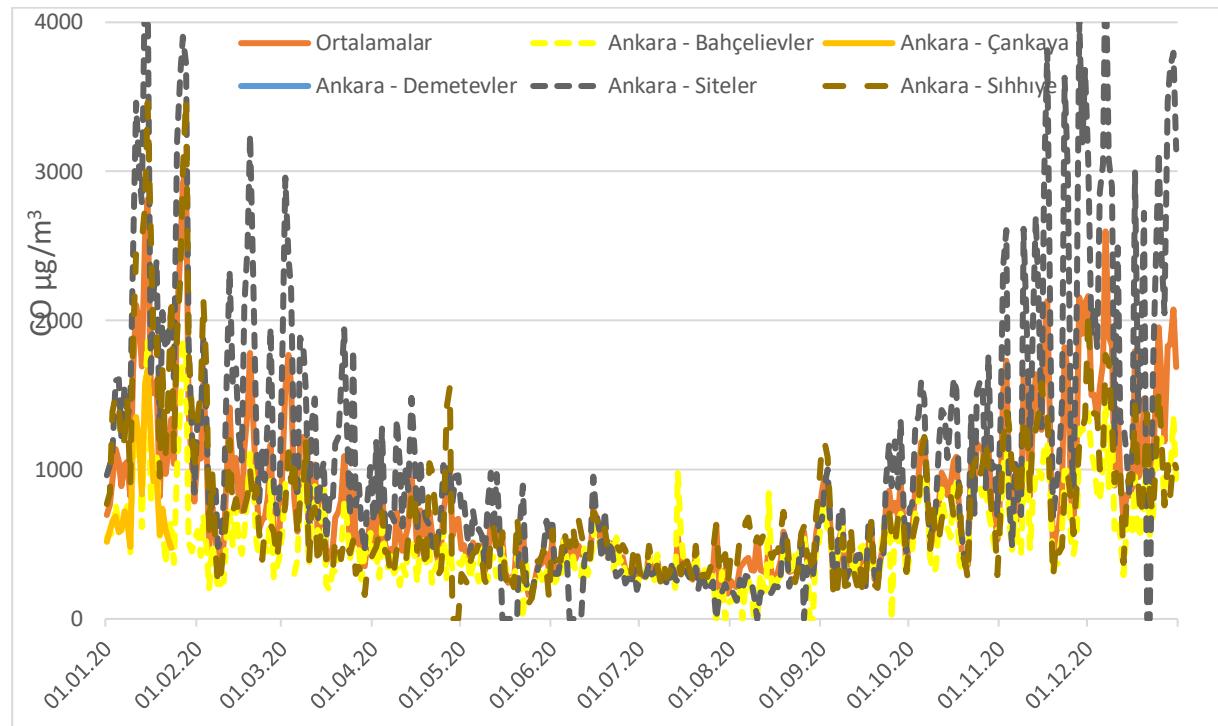
Figure 5 shows the NO<sub>2</sub> daily grazing values of 8 air quality stations in Ankara for the years 2019-2020. While the general average values are below 100  $\mu\text{g m}^{-3}$ , it is seen that the normal values are 3-4 times higher in the last three months of 2019. The explanation of this increase value seems quite complex. If it is not due to measurement errors, this situation needs to be investigated carefully.

### **Carbon Monoxide (CO)**

Carbon is generally formed in fuels when it is not fully combusted. The carbon monoxide (CO) formed is an odorless and colorless gas. CO<sub>2</sub> in the urban atmosphere is generated from both vehicles and industry, wood burning and forest fires. CO, together with diffusion in the alveolar-capillary membrane, binds to hemoglobin in the blood and causes carboxy-hemoglobin (COHb). CO is an important indoor air pollutant. And because its affinity for hemoglobin is much higher than that of oxygen, it stops oxygen from binding to hemoglobin. In this way, it prevents the flow of oxygen to the tissues, causing health problems such as headaches and suffocation. Figure 6 shows the average daily CO values measured at 6 stations in Ankara. Although the values are below the annual average values, it is seen that the values reach 5000  $\mu\text{g/m}^3$  in winter and below 1000  $\mu\text{g/m}^3$  in June-August. It is thought that this pollutant does not pose a risk for the measured time period and areas.



**Figure 6.** Nitrogen Oxides (NO<sub>x</sub>) levels 8 air quality station of Ankara Province in 2019-2020

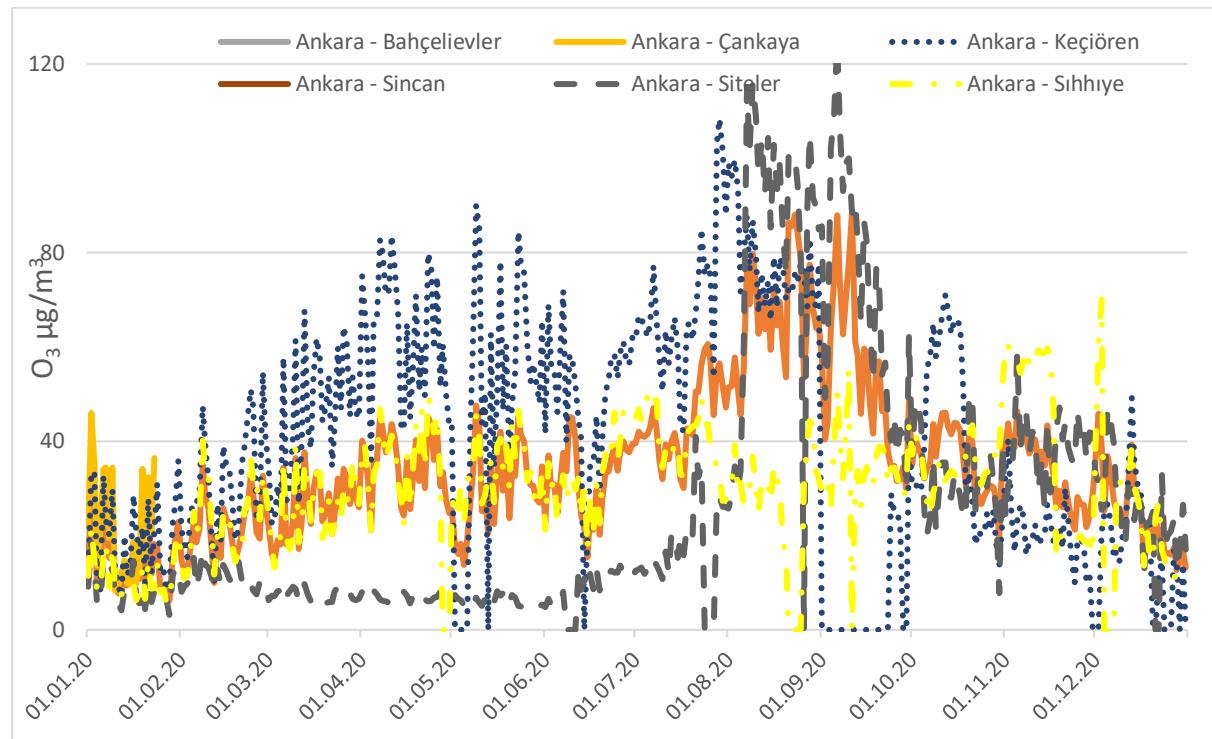


**Figure 7.** Carbon Monoxide (CO) levels 6 air quality station of Ankara Province in 2020

### Ozon ( $O_3$ )

Ozone reaches high concentrations in the stratosphere and is a naturally occurring reactive gas in the atmosphere. In the troposphere, it can be formed as a result of photochemical events from pollutants in anthropogenic sources such as power plants, refineries, chemical factories. (Güler & Akin, 2015). It consists of photochemical processes that take place in the urban and rural atmosphere in the presence of  $NO_2$  and sunlight. It began to be noticed in the atmosphere of Los Angeles in the 1950s. Although transport from the stratosphere also contributes to the increase of  $O_3$  in the atmosphere we live in, it can occur from atropogenic sources to a large extent.

Figure 6 shows the values with the  $O_3$  daily environment for the year 2020, measured at 6 stations in the province of Ankara. While it is observed that the values are below  $40 \mu\text{g}/\text{m}^3$  in the winter season, it is observed that the values increase from the summer months and exceed  $80 \mu\text{g}/\text{m}^3$  especially in three stations. The number of days when the values exceed the long-term limit values is rare. It is estimated that air pollution is relatively high in regions where ozone value is low in summer months.



**Figure 8.** Ozon ( $O_3$ ) levels 6 air quality station of Ankara Province in 2020

## SUGGESTIONS

Diseases arising from air pollution should be declared for public health. Individuals who experience discomfort due to pollution should go to the hospital. Diseases caused by the disease should be investigated in the hospital. At the same time, necessary measures should be taken to reduce the diseases and deaths caused by air pollution. And that's how city plans should go. The absence of unnecessary freedom in thermal power plants will be an important decision in terms of keeping air quality in good condition and reducing it. In order to reduce emissions arising from traffic, which has become the problem of big cities; green wave and smart signalling systems should be used more widely. For patients, children, pregnant women and the elderly, the days and times of temperature reversal should be reported in advance and they should be warned about what to do. Means such as social media and some informing method should be chosen for information. Special precautions should be taken together with the warnings of the measuring stations.

## EVALUATION AND CONCLUSION

It was seen that there is a lot of air pollution in Ankara during the winter months. In general, it has been observed that this pollution is caused by traffic, industrialization and rapid population growth. At the same time, the ignorance of the public about air quality accompanies this pollution. Graphs were prepared as a result of the data entered on Excel. By comparing the threshold values determined by the Ministry of Environment and Urbanization, the state of the pollution was determined. In general, it was observed that the pollution increased at Siteler, Demetevler and Bahçelievler stations. This increase will have a great impact on the public health of the society.

**Acknowledgements:** The authors gratefully thank for providing air quality data to Ministry of Environment and Urbanization

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**O 23. RECYCLING TECHNOLOGIES OF ALUMINIUM ALLOYS IN ALBANIAN INDUSTRY**

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**ABSTRACT:** The increasing rate of aluminum use and its alloys in recent decades has highlighted the problems of its relationship with the environment. Aspects of reuse or recycling, and ecology in general, have become increasingly important, conditioning the design of each product from the outset. Utilization of technological waste, on the one hand, and scrap of obsolete products, on the other hand, often requires modification of traditional production processes (of primary aluminum), and even the design of new technologies, mainly scrap recycling. Ensuring the necessary purity of the product obtained from the rewriting, at a reasonable cost and without harming the environment, remains one of the strongest challenges for these technologies. Their effectiveness, consequently, is conditioned to a large extent by the processes: preparation, collection, disassembly, cleaning, sorting, chopping and briquetting of scrap. Although seemingly simple, these processes require careful design and rigorous implementation of technical discipline. It is in these last two aspects that we think that more attention should be paid to the manufacturers and processors of aluminum alloys in our country.

**Keywords:** Ecology, aluminium alloys, recycling technologies, technological waste, environmental protection

**INTRODUCTION**

Recycling is a major consideration in continued aluminium use, representing one of the key attributes of this ubiquitous metal, with far-reaching economic, ecological and social implications. [ISWM; Kevorkjian, V.,] The increasing use of aluminium and its alloys has made it increasingly sharp the problem of the respective environmental impact, related to all the stages of processing raw materials, production of alloys and semi-finished products, product realization final and their use until obsolescence. This issue, often referred to as the "Life Cycle", in the broadest sense of the term includes (giving even primary place) issues of reuse / recycling of raw materials, semi-finished products and obsolete products, as well as those for the treatment of aluminium waste, generated in each of the above stages. The objectives of sustainable development are precisely in the industry of those countries that are in development, meets the needs of people in need. "Sustainable development" is less result of consumption and underdevelopment required. [ISWM;]

The goals of aluminium recycling are to further improve the properties of the aluminium material in optimizing production and further development of production. Specific properties together (such as low density, high strength, high electricity and thermal conductivity, excellent resistance to corrosion) provide useful products that bear the mark of aluminium. In industry it is done mixing aluminium with additives, investments of trading partners and contributions given to foreign countries for the development of economically underdeveloped regions, especially in those countries that are in industrialization. [alu.org; ISWM; Kucharíková, L.,]



**Figure 1.** Map of Albania with technological waste of industrial zones

## **RECYCLING TECHNOLOGIES OF ALUMINIUM**

The aluminium recycling industry, including both refiners and remelters, treats and transforms aluminium scrap into standardised aluminium. Refiners and remelters play integral roles in aluminium recycling but they, in turn, depend on other crucial links in the chain. Indeed, without the collectors, dismantlers, metal merchants and scrap processors who deal with the collection and treatment of scrap, they would not be able to fulfil their roles. [ISWM; Kuchariková, L.,]



**Figure 2.** Structure of the Aluminium Recycling Industry [world-aluminium.org (alu.org)]

The essential purpose of all waste regulations is the protection of human health and the environment from the harmful effects caused by collection, transportation, processing, storage and waste treatment. Directive 2008/98 / EC (Directive Waste Framework) provides a new approach on waste management based on prevention of negative impacts of waste generation and administration on human health and the environment, as well as aiming to limit waste production, as well as promoting the use of waste as a source by recycling and recovery. [alu.org; ISWM; Kuchariková, L.,] Another technical point important of aluminum scrap and aluminum alloys related to human health and environment is that they do not corrode but simply oxidize on the surface and creating a thin protective layer, not emitting into the environment.



**Figure 3.** Waste management separation [ISWM]

## **RECYCLİNG OF ALUMİNÜM AND ALUMİNİÜM ALLOYS İN ALBANİA**

Currently in Republic of Albania there are several companies that produce Aluminum and Aluminium alloys, such as Everst sh.p.k, Alumil sh.p.k. and some other minor companies. Regarding the process of aluminium and aluminium alloys recycling in this paper we focused on the Everest sh.p.k company, which has a state of art technology regarding the recycling process and has implemented the process in full compliance to the national and international standards.

The production of recycled Aluminum billets in Everest Company in Albania for achieving the requested chemical composition of wrought alloys made from recycled aluminium is realized by melting the aluminum scrap and enriching it with pure Aluminum which generally comes from ingots. Aluminium alloys that are producing with recycling technological waste are: A6005, A6060, A6061, and A6063. Production of recycling Aluminium alloys or mixing ratios (scrap with pure material) in this case would depend on the alloy of aluminum that would be produced. Depends on the chemical compositions of aluminium alloys which will produce it will depend and the amount and type of additives (pure additive elements) that would be added to a mixture for producing for achieving their standard concentration. For the production of certain alloys or even those of use in general the company refers to the relevant standards (*SSH EN 573-5:2019*) or customer requirements.



**Figure 4:** Aluminium Scrap (a) Ingot of pure Aluminium (b) (Everest sh.p.k Company in Albania)

For Aluminum Recycling in Everest Company in Albania the following steps are as described below:

1. the materials are loaded/added in the melting furnace
2. after the material is melted and the chemical composition is adjusted, the furnace is unloaded in the form of tickets.
3. the next process is to cut the billets in standard length and place them in baskets for the next process.
4. inserting the billets in the homogenization oven.
5. remove from Homogeneity and place in the Cooling Oven.
6. then it is stored or sent directly for production.

From an environmental point of view, aluminium recycling is ecologically advantageous if the environmental impact of the collection, separation and melting of scrap is lower than that of primary aluminium production. [alu.org; ISWM; Institute of Statistics,]



**Figure 5:** Aluminium Recycling equipments technology in Everest industry in Albania

## CONCLUSION

In this study we have presented the recycling of aluminium alloys in Albanian Industry, in Everest company and their technology of recycling and production of the recycling billets of Aluminium Series 6060,6061,6063,6005,6082. The increasing rate of aluminum use and its alloys in recent decades has highlighted the problems of its relationship with the environment. Aspects of re-use or recycling, and ecology in general, have become increasingly important, conditioning the design of any product from the outset. [ISWM; Kucharíková, L.,]

Aluminium can be recycled over and over again without loss of properties. [alu.org; ISWM] The high value of aluminium scrap is a key incentive and major economic impetus for recycling.

Already this design relies heavily on life cycle analysis and sustainable development concepts.

These concepts are based on the search for new solutions, focused mainly on:

- extending the life of raw material resources,
- reducing energy costs and keeping climate change under control,
- facilitating the mass of products / details to save energy,
- optimization of technological processes, aiming at the most rational use of material and energy,
- increasing the recirculation rate,
- minimization of losses,
- minimization of harmful emissions.

**Acknowledgments:** The authors would like to acknowledge the Everest Company in Albania Engineer Ermil SITA, for the information regarding the recycling aluminium scrap.

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**Author Contributions:** The authors substantially conceived, designed and wrote the review, and they contributed to data collection, analysis and comments.

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**O 24. ENGINEERING ANALYSIS AS A GUIDE FOR PREVENTION OF EPIDEMIOLOGY  
OF ROAD ACCIDENTS IN ALBANIA**

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**ABSTRACT:** Road accidents are a serious problem of the modern world. They are one of the main causes of injuries and are the third most frequent cause of death. Every year, more than one million people, adults and children, die on the roads and several millions get injured. Mortality rate due to injuries from road accidents amounts to 2.2% of all deaths in the world. The research presents epidemiology of road accidents with particular emphasis on the key issues of road safety in Albania, related to the dangerous behavior of road users (disregard toward traffic rules). Despite the various measures which are taken to improve safety on Albanian roads, the number of dead and wounded in the vehicle mishap is still large, and losses borne by society are high. To improve safety on Albanian roads, it is necessary to continue multi- action plan to systematically progress in the level of road safety.

**Keywords:** *Road accidents, traffic, road safety*

**INTRODUCTION**

The main purpose of this study was to analyze the main factors of road accidents in Albania. Furthermore, in this article, the statistics of the number of accidents are analyzed and other influential and contributing aspects are shown. The main causes of traffic accidents can be divided into three risk factors, such as: people, vehicles and road infrastructure [1]:

- *Driver*-dependent risk factors include speeding, driving under the influence of alcohol and other psychoactive substances, driving a helmet without helmets, not wearing a seat belt, children transported without child seats, driver's psychological attitude, distractions during driving (e.g. cell phone use) and driver behaviour. Driver experience and observation skills allow to avoid possible traffic incidents. The authors of the paper [2, 3] distinguished three types of behaviour that increase the risks of causing an accident: errors, lapses and violations.
- The *vehicle* factor is related to the road suitability of the vehicle or fleet, technical condition, age, etc.
- Another risk factor is *road infrastructure*, with its characteristics such as: geometric design conditions, maximum speed allowed, number of turns and their radius, climatic conditions, type of road surface, area, category, signage, lighting, etc.

The death rate as a result of road accidents per 1 million inhabitants is an indicator of (un) safety used by the European Union. In Albania, this indicator in 2020 reached 64 deaths per 1 million inhabitants (Tab. 1, Fig.2), while for the entire European Union it was 51 [4,5].

During the last 10 years, 20,529 road accidents occurred in Albania, as a result of which 3146 people were killed and 23587 were injured. On average, 286 people die each year on the country roads as a result of accidents. In 2019, the number of accidents increased by 18.9% and injuries decreased by 10% compared to 2018. Unfortunately, the number of victims as a result of a road accident increased by 6%. From 2009 to 2019, there was an increase in the number of vehicle accidents by 39% and a decrease in the number of victims by 40%. Even in 2020 there was a decrease in cases but still the exposure was reduced when considering the pandemic period.

When analyzing the number of vehicle accidents, attention should be paid to the average number of fatalities per 10,000 vehicles which has decreased by close to 56% when comparing 2009 with 2019 or 68% compared to 2020. (TABLE 1).

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**Table 1.** Road accidents and indicators by years of occurrence

ACCIDENTS	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	1564	1876	1870	2075	1914	1992	2033	1978	1718	2044	1234
Fatalities	352	322	334	295	264	270	269	222	213	227	181
Injuries	1716	2150	2235	2503	2353	2422	2510	2389	2030	1817	1417
Fatalities / 10,000 vehicle	8.38	7.84	8.46	6.61	5.38	5	4.78	4.1	3.68	3.62	2.67
Fatalities / 10,000 inhabitants	12.1	11.09	11.52	10.18	9.15	9.38	9.35	7.73	7.44	7.97	6.35

\*(Source: Research thesis, Shala K. "Engineering analysis of accidents in Albania, as preventive approach to road safety")

Based on the type of collision (TABLE 2), it should be noted that the number of side accidents is the most common form of accidents between vehicles. Moreover, from 2009 to 2019, their number remains on average close to 500 per year. Also, the number of frontal collisions in 2019 is 329 while rear-end collisions close to 300 per year. It should be noted that deaths in accidents between vehicles resulted in a quarter of fatalities or a third of annual accidents (TABLE 2):

**Table 2.** Types of collision

Accidents	Type of collision					
	Type of accidents	No injury	Slight injury	Serious injury	Fatalities	Total
Self-inflicted accidents	29	77	15	20	<b>141</b>	
Flooded vehicle	6	16	6	1	<b>29</b>	
Rollover vehicle	24	76	12	20	<b>132</b>	
Head on collisions	106	154	22	13	<b>295</b>	
Curve collisions	13	11		3	<b>27</b>	
Vehicle overtaking	34	28	6	2	<b>70</b>	
Side collision	171	170	11	12	<b>364</b>	
Rear-end collisions	94	102	5	12	<b>213</b>	
Two-wheeled vehicle collisions	136	113	19	20	<b>288</b>	
Collisions with animals	1			1	<b>2</b>	
Pedestrian collision	367	301	61	52	<b>781</b>	
Collisions vehicle/other	169	142	18	17	<b>346</b>	
Bicycle/pedestrian collision			1		<b>1</b>	
Other un-identified	27	44	7	8	<b>86</b>	
<b>Total</b>	<b>1177</b>	<b>1234</b>	<b>183</b>	<b>181</b>	<b>2775</b>	

## **INTERPRETATION AND ANALYSIS OF THE CAUSES OF ACCIDENTS**

**Self-inflicted accidents and flooded vehicle accidents** - include 170 cases of self-inflicted accidents which are most often caused by human error, distraction, driving under the influence of illicit substances, excessive speed, fatigue and drowsiness, technical defects of the vehicle, infrastructural defects including and improper maintenance, climatic conditions;

**Rollover vehicle** - includes 132 accidents that are caused by: high speed inappropriate to road conditions, driving under the influence of narcotics or alcohol, vehicle or pneumatic defects, infrastructure defects.

**Head-on collisions** - include 295 accidents that almost all occur on two-lane roads without traffic dividers, outside urban areas and off highways. Again the causes result drowsiness, the influence of alcohol, distraction by phone.

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**Side collision** - includes 364 accidents with close to 3% fatality rate and has the highest prevalence in the type of collisions between vehicles. It turns out that such with fatal consequences mainly occur at non-urban intersections, where the vehicle moving in the direction is hit by the other coming from the side road or vice versa. At urban intersections such accidents cause injury and damage. The reasons are: distraction, non-evaluation of traffic circumstances, negligence of information, non-processing of information, speeding above the allowed limits, non-compliance with the priority, side slip, inability to brake or accelerate.

**Rear-end collisions** - include 213 cases with 5% fatality rate. So, 95% of these collisions occur on urban roads, respectively with minor injuries and material damage. Rear shocks are fatal when they occur as a result of chain collisions of vehicles or the wave of vehicles reaching the accident. The dominant causes are: distraction, not keeping distance, alcohol, speeding, inability to avoid an accident. Cases in urban areas are characterized by injuries or material damage and come as a result of distraction from long driving in congested traffic

**Curve collisions** - there are 27 cases with a fatality rate of 11%. The main causes are human violations such as inadequate speed in relation to road conditions, climatic conditions and technical condition of the vehicle.

**Car crashes with two-wheeled vehicles** - includes 288 accidents with 7% fatal frequency. These mainly occur on urban roads towards cyclists where during the turns to the right no attention is paid to the traffic on the cyclists' path. Cyclists in urban areas are often distracted or even lack sensitivity to the environment from the use of headphones in both ears. There are also cases of collisions on non-urban roads, mainly at night, where contributing reasons for not noticing these participants in addition to speed are the lack of two-wheeled light signalling, the colour of the cyclist's clothes and the lack of street lighting.

**Vehicle collisions with pedestrians** - are 781 cases with a fatality rate of 7%. The main causes that influence pedestrian accidents are because of distraction, driver incompetence, impatience, carelessness, dark coloured clothes on unlit roads, workshops on the street, left turns at intersections. Pedestrians are also contributing factors, especially those with headphones on both ears crossing the road in places not marked for crossing, unexpected exits on the road, the simultaneous free movement of left turns and pedestrians at traffic light intersections.

## **ANALYSIS OF THE CIRCUMSTANCES OF THE OCCURRENCE OF FATAL ACCIDENTS**

In addition to the causes of accidents, the circumstances of fatal accidents have been analyzed and after analyzing the data processing, the following table 2 results.

**Table 3.** Analysis of the circumstances of the occurrence of fatal accidents

Analysis of the circumstances of the occurrence of fatal accidents	Fatalities	%
By day	104	62 %
In dry weather	165	91%
Road in good condition / promising road	169	93.3%
Straight road	144	79.5%
Asphalted road	179	98.8%
Vehicle age over 12 years	134	55.8%
Driving experience 3 to 6 years	46	23%
Driving experience over 9 years	79	39%
For violation of rules by pedestrians (crossing the road carelessly)	22	38%

## **CONCLUSIONS**

The types of accidents reviewed based on official records from the Accident Information System show that:

**Distraction** (mistakes, carelessness and omissions) - is a widespread phenomenon among albanian drivers. Distraction is any activity that distracts the driver from the driving task. Driving the vehicle deserves full attention. The most common distraction comes from using the phone while driving,

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especially from texting, then from the mental and spiritual state associated with the personality traits of the individual. It should be noted that even the interior of the vehicle is able to distract the driver. Also billboards, large screens, illuminated signs, all those elements that attract the driver's attention can cause the driver's inattention, and thus cause a road accident [1,8].

**Drunk driving** - are the cause of decreased brain performance, respectively slows down the reaction and reduces the skills required for safe driving. Driving under the influence of alcohol is considered a legal violation.

**Speed above the allowed limits** (violation) - accompanies the vast majority of accidents. Speed is more than a violation of the law, and is a supplementary factor that in harmony with some other circumstances increases the consequences and chances of an accident. Increases the potential for loss of control over the vehicle, reduces the effectiveness of the user's protective equipment, increases the stopping distance after the danger is perceived, increases the severity of the accident, leading to more serious injuries, economic consequences, increased consumption of fuel / cost and emissions.

**Technical deficiencies** - respectively age-related defects of road vehicles constitute the cause of 55.8% of fatal accidents. Unmainted and technically uninspected vehicles are a source of accidents

**Driving experience** - is a factor that causes Albanian drivers carelessness, negligence, self-confidence and disregard for traffic signs and traffic rules. From the analysis it seems that drivers with over 9 years of experience are the most common cause.

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**O 25. AIR QUALITY OF O<sub>3</sub> AND NO<sub>2</sub> TIMELINE CHANGES IN KONYA CITY CENTER**

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**ABSTRACT:** In cases that air quality will change the living health or environmental quality, the composition of the air should not change or the substances that are dangerous to be in the air that not be present in the atmosphere. Air pollution, which is a result of urbanization and fuel use brought about by different life styles, can create a dangerous impact area on a global scale as well as in Turkey. Air pollution has a significant impact on human health, so the issue of air quality is of great importance all over the world. The management of the parameters related to the outdoor air quality is carried out in accordance with the Air Quality Assessment and Management Regulation. A country's or region's success in improving and protecting the air quality, local and national air pollution problems, and the support of citizens who are well informed and informed about the developments in pollution reduction are needed. For the investigation of air pollution in Konya, NO<sub>2</sub> and O<sub>3</sub> parameters have been evaluated. The stations are statistically analysed according to the measurement results made in the required periods. As a result of this, it is aimed to study on the continuously measured parameters and their effects, what the necessary measures should be in order to reduce the effect and what the applications could be by evaluating and graphing the data. In this study, the effect of temporal NO<sub>2</sub> and O<sub>3</sub> changes on air quality was evaluated.

**Keywords:** *Environment, Temporal change, Air quality, NO<sub>2</sub>, O<sub>3</sub>*

**INTRODUCTION**

Air pollution is the presence of pollutants, which can be found in solid, liquid and gaseous form, in the atmosphere in an amount or for a period of time that will harm human health, living life and ecological balance or prevent the use of material objects from life. The problem of air pollution emerged after the industrial revolution and especially in industrialized areas. Development is the whole of industrialization (Manosalidis et al., 2020; Dursun et al., 2021). Increasing environmental problems and the deterioration of the ecological balance caused by these problems, the health problems faced by living things and the decrease in living diversity, have presented the environment-friendly development model as a sustainable development model, and that the continuation of the world owes to the peace and balance between development and economy, ensuring the safety of all living things. has brought. Air pollution is only one of the environmental problems and it has become the most binding type of pollution that makes countries responsible to each other in the globalizing world (Vadrevu et al., 2017; Fenger 2009; Kılıç et al., 2020). All combustion processes, emission of combustion processes required for industry, emissions of fossil fuels required for heating, emissions from agricultural combustion, forest fires, emissions from motorized or mobile traffic, mining, process leaks, are the most important sources of nitrogen oxides (Molina 2021; Toros et al., 2013).

Air pollution, which is a result of urbanization brought about by modern life, has a global impact as well as local and regional. Due to the significant effects of air pollution on human health, the issue of air quality is given great importance all over the world. In order to solve air pollution problems and determine strategies, the scientific community and the relevant authority have focused on monitoring and analysing pollutant concentrations in the atmosphere. In addition to the responsibilities of the authorities regarding the protection and improvement of air quality, it is also among their responsibilities to provide the public with up-to-date information on air pollution through communication tools, since it is an issue that directly affects public health.

Ozone (O<sub>3</sub>), which is a toxic pollutant near the earth's surface, consists of the combination of three oxygen atoms and is of vital importance in the stratosphere layer. Ozone, which is found at a very low

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rate compared to the basic gases that make up the atmosphere, both affects the climate and plays an important role in the protection of living things on the earth's surface. Ozone, in particular, eliminates most of the ultraviolet rays coming from the sun together with oxygen within the stratosphere layer and prevents these rays from reaching the earth's surface, thus eliminating the corrosive effect. Nearly 90% of the ozone in the atmosphere is located in the stratosphere layer, which is between 10-50 levels from the earth's surface. The remaining 10% of ozone is in the troposphere layer, which extends from the ground to about 10-15 km (Wright, 2003). The ozone partial pressure is usually highest between the 15th and 25th kilometres in the lower stratosphere, and the maximum ozone density (10 ppmv) is reached between these distances. However, ozone molecules of different concentrations are located at a distance of about 50 km from the ground, and the total amount of ozone in this range is often called the ozone layer (Deniz et al. 2013; Mutlu et al., 2019).

Stratospheric ozone occurs naturally in the atmosphere and is naturally degraded in the stratosphere. In this region, ultraviolet (ultraviolet) radiation from the Sun separates the normal oxygen ( $O_2$ ) molecule into two oxygen atoms, and then the  $O_2$  molecule combines with the O atom to form ozone ( $O_3$ ). When atmospheric  $O_2$  combines with O, some molecules, such as nitrogen, react, removing excess energy. If excess energy is not removed during the reaction, ozone ( $O_3$ ) is converted back to oxygen ( $O_2+O$ ).

In 1987, the Montreal Protocol on Depleting Substances of the Ozone Layer was signed. The main purpose is to eliminate all chemical substances that cause ozone depletion. The Protocol was subsequently amended four times (1990 London, 1992 Copenhagen, 1997 Montreal, 1999 Beijing). Turkey attended the Vienna (1985) and Montreal (1987) meetings and signed the Protocol with the London (1990) and Copenhagen (1994) amendments (Grubb et al., 1999; UN ECE, 2002; UN EP, 2002). In this framework, all countries of the world are tasked with the protection of stratospheric ozone and adequate measures should be taken in cooperation.

However, the ozone concentration at the ground level should not threaten the health of humans and other living things, and it should also be maintained at a level that will not harm the goods. The effects of ozone and photochemical oxidants on human health have been reported (Ertürk, 1993). For this, legal limits have been determined in the regulations related to air quality. Since the most important factor in ozone formation is caused by natural solar radiation, it will not be in the hands of people to limit it. However, it is important to take protective measures in case the measured values are possible to affect human health.

It is known that air pollution reduces the quality of life by directly or indirectly affecting human health. Today, local, regional and global problems due to air pollution concern all societies. Due to reasons such as rapid and intense urbanization, wrong planning and location of cities, increase in the number of motor vehicles in the city, irregular industrialization, poor quality fuel use, topographic and meteorological conditions, air pollution can be experienced in our big cities, especially in winter. Sulphur dioxide, which is the oldest and most effective in air pollution, can interact with other pollutants as it oxidizes and turns into sulphate and sulfuric acid after reaching the atmosphere. Together with other pollutants it can form drops or solid particles that can be transported over great distances. Sulphur dioxide and oxidation products are removed from the atmosphere through dry and moist deposits (acidic rain). Particulate Matter, the term denoting solid particles in the air, are pollutants as old and effective as  $SO_2$ . So we have more information with these two parameters. Particulate Matter does not have a uniform chemical composition and can vary depending on its source.

After these two pollutants, Nitrogen Oxides ( $NO_x$ ) is prominent in atmospheric air. Nitrogen monoxide ( $NO$ ) and nitrogen dioxide ( $NO_2$ ) are the main ones, but other nitrogen oxides form. Nitrogen oxides are usually (at 90%) depleted as  $NO$ . It is formed as a result of the reaction of  $NO$  and  $NO_2$  with ozone or radicals (such as  $OH$  or  $HO_2$ ).  $NO_2$  is one of the most important air pollutants in urban areas, as it is the nitrogen oxide type that most affects human health. Nitrogen oxide ( $NO_x$ ) emissions occur from sources created by humans. The main sources are vehicles in land, air and sea traffic and incinerators in industrial plants. Inversion is when warm air sits above cold air, preventing vertical mixing of air. Thus, the pollution is collected in the cold air layer near the ground level (Kara et al., 2019; Kara et al. 2020).

Nitrogen oxides and ozone concentrations are directly related in the atmospheric environment. Ozone ( $O_3$ ), consisting of three oxygen atoms, is formed in special summer, sunny weather and hot seasons ( $NO_2 + \text{sun rays} = NO + O \Rightarrow O + O_2 = O_3$ ). Ozone production is continuous and variable and is also affected by some pollutants in the atmosphere ((EPA-97/12; Toros 2000). It accelerates the formation of VOC and carbon monoxide. In some comparisons, ozone and other pollutants do not mix directly

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with the ambient air. Near the surface ozone is composed of complex structures. Ozone is a very strong oxidizer and interacts with other air components in different ways. The effect of ozone in terms of public health is directly dependent on the ozone concentration and contact time (Abdul-Wahaba et al. 2005; Brown et al. 2006).

In this study, it is aimed to evaluate the ozone and nitrogen dioxide values, which are two important pollutants in the atmospheric environment, in Konya city center. In this evaluation, the variation and interaction of the values at different stations in different periods of the year will be investigated. By comparing the obtained data with national and international standards, information about air quality will be obtained.

## **MATERIALS AND METHODS**

### **Research Area**

Konya province has the largest surface area in Turkey in terms of surface area and is located in the central region of Turkey. The large area of the plains in the province, which consists of many plateaus, is important in the development of agriculture. The city, which is an agricultural city, is developed in industry. There are 4 big Organized Industrial Zones (OIZ) in the city center. 2/3 of the population of the province, which is in the top 5 in terms of population density in Turkey, lives in the city center. The development of the industry affects air pollution depending on the quality and quantity of fossil fuels used as an energy source depending meteorological and topographical structure. In addition, due to the fact that the industrial zones are in the direction of the prevailing wind, it causes an increase in air pollution in the winter months. Fossil fuel consumption, which is used for heating purposes, can also be shown as one of the sources of air pollution, since the winter months are very cold. The fact that the city center settlement area is on a flat plain and the high mountain ranges extending in the south-southwest direction affect the atmospheric distribution of pollutants formed in the city center by the prevailing winds in the north-northeast direction. For this reason, since the distribution of exhaust gas emissions in traffic is also affected, this can be counted among the causes of air pollution. Thus, besides the sources of air pollutants, the topographic structure and meteorological conditions in the region determine the formation of air pollution.

### **Measuring Stations**

Air pollution in Konya city center has been determined by 2 air quality measurement stations for a long time, depending on its population. Their locations were determined in the city center by considering the living spaces of people and sources of air pollution. 2 of these stations belong to Environment-Urbanism Banak and 2 of them belong to Konya Metropolitan Municipality. Locations of air pollution measuring two devices belonging to the Ministry of Environment and Urbanization in the city centre of Konya (responsible Southern Central Anatolia Clean Air Centre Directorate, 2020), two air pollution measurement device belonging to Konya Metropolitan Municipality and three new stations were included during last year in Konya city centre is given in

Three air quality monitoring stations belonging to Konya Metropolitan Municipality, which is affiliated to the National Air Quality Monitoring Network in Konya Province, and there is continuous sulphur dioxide ( $\text{SO}_2$ ) particulate matter ( $\text{PM}_{10}$  and  $\text{PM}_{2.5}$ ), nitrogen oxides ( $\text{NO}_x$ ,  $\text{NO}$ ,  $\text{NO}_2$ ), ozone at the stations. ( $\text{O}_3$ ), carbon monoxide (CO) and meteorological parameters are measured by automatic devices and are taken as hourly average values.

A total of 9 stations belonging to the Ministry of Environment and Urbanization operate in Konya, and 2 Konya Meram and Konya Selçuklu (Karkent) stations can be viewed online at [www.havaizleme.gov.tr](http://www.havaizleme.gov.tr). Efforts are underway to connect all stations to the National Air Quality Monitoring Network (Table 1).

### **Measurements**

Evaluation of measurements s network of four monitoring stations is in operation in the Konya region; Two monitoring stations are operated by the Metropolitan Municipality, while both are operated by the

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Provincial Directorate. Particulate matter ( $PM_{10}$ ) and sulphur dioxide ( $SO_2$ ) are continuously measured to generate hourly average values at all stations. Both monitors are frequently calibrated and maintained to function properly. It is assumed that the results from each monitoring station represent a relatively large area.

During the data evaluation, if there are indicators indicating the existence of a short-term or longer-term special situation, the data are examined to clarify this situation. Special nitrogen dioxide ( $NO_2$ ) and ozone ( $O_3$ ) measurement campaigns have been carried out for a limited time (4 weeks in summer and 4 weeks in winter) to complete the air quality assessment with the data of pollutants that have not yet been measured. These pollutants are included in the regulation and are relevant substances in terms of health. This pollutant was added to the parameters of the specific measurement campaign to verify the low  $SO_2$  levels observed in continuous monitoring in the network. These parameters were taken from the Konya Airport meteorology station, as meteorological parameters greatly affect the pollution levels. The evaluation results for each parameter are presented in the following sections and are compared with the limit values given in HKDYY where appropriate.

## **RESULTS**

Although ozone is considered a harmful gas for the environment in the atmosphere we breathe, that is, in the layers of the atmosphere close to the earth's surface, it has a very important function as it protects the living life from solar radiation with the layer it forms in the stratosphere in the upper layers of the atmosphere. ground level ozone; Nitrogen oxides and hydrocarbon primary pollutants are secondary air pollutant parameters formed by photochemical reactions accompanied by solar energy. Today, ozone concentrations are constantly increasing in residential areas, especially in developed countries. Similarly, the same increase is seen in rural areas and large forest areas. If there were no photochemical reaction, the ozone concentration in the atmosphere would be expected to increase continuously. Ozone is produced and decomposed by some photocatalytic reactions, so that a certain ozone concentration in the atmosphere remains relatively stable (Shayia et al, 2019).

The average daily ozone concentrations of the three air quality measurement stations in the province of Konya for the last 3 years (2018-2020) are shown in Figure 2. In Konya province, ozone measurements are not available at all stations, and activities related to the establishment of systems that can perform measurements over time and regular measurement of measurements are carried out. While the measurement process was started at only 2 stations in 2018, sufficient measurements could not be made in all periods. Towards the end of 2019, ozone measurement studies were started at the 3rd station. While 3 ozone measurements were made in 2020, the number of missing data decreased. In 2021, studies on ozone measurement were started at other stations. When the measurements of 2020 are examined, it is seen that the values in the summer months are higher than the winter months. It is seen that the data of Erenköy station among 3 stations are higher than the other two stations (Meram and Karatay) and the summer values are around 3 times the winter values. Since the main source of ozone formation is solar radiation, it is estimated that ozone formation is higher in summer months with the reduction of air pollution as well as effective daylight. Considering the values in Figure 2, although the air quality for 2020 is almost similar in all 3 regions, it is thought that there is a clear improvement in the Erenköy region during the summer months.

Nitrogen oxides have an important place and effect among air polluting gases. It is a very important resource for the plant world in the ecosystem after it returns to other forms, which is in the highest ratio in the composition of the atmosphere and does not have any negative effects on living life as it is. The most important source of nitrogen in the soil is provided by the reduction or oxidation of atmospheric nitrogen. For this, it is transported to the soil through nitrogen-fixing microorganisms and atmospheric reactions. Atmospheric nitrogen ( $N_2$ ) produces nitrogen oxides ( $NO_x$ ), especially nitrogen monoxide ( $NO$ ) at high temperature (above 1,100 °C) in combustion chambers. In city centres, it mostly occurs as a result of combustion in automobile engines. The main source of this gas comes out as a result of the breakdown of nitrogen fertilizers in the soil and reaches the atmosphere. According to the results of the research, the effect of  $NO_2$  combined with other gases is greater than the negative effect it has alone. The gas rising up to the stratosphere layer damages the ozone ( $O_3$ ) layer.

Daily mean concentration of nitrogen dioxide for 3 air quality stations (Erenköy, Karatay and Selcuklu) of Konya Province during curfews imposed due to the pandemic Corana-19 and early period in 2020.

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Figure shows daily average NO<sub>2</sub> values of three stations and while the data of 3 stations were 40 µg/m<sup>3</sup> before the pandemic measures in 2 different periods, they do not show the period average below 20 µg/m<sup>3</sup> during the pandemic measures period. While the values of the Seljuk sage before the pandemic-measures were considerably higher than the other 2 stations and were 70 µg/m<sup>3</sup>, it decreased to around 30 µg/m<sup>3</sup> during the period when the pandemic measures were implemented. The NO<sub>2</sub> values of the Karatay region have also decreased a little with the pandemic measures; but there was no significant change in Karatay station data. The decrease in the Seljuk region caused a change in the averages of the 3 stations.

In Second Period (16 March-31 May 2020), it is clearly seen lockdown effects on air pollution. It is observed that concentration of NO<sub>2</sub>, has decreased by 55% accordingly thanks to measures such as the prohibition of transportation to big cities, curfews, and stopping of flights and O<sub>3</sub> values, have increased by 54%. The closure of businesses such as cafes, restaurants, coffee shops, shopping centers, and the suspension of the operations of cement and wood factories in Konya has a great role in increasing air quality especially.

## **CONCLUSION**

Air pollution is a consequence of the modern age. With developing technologies, we can easily extract fossil fuels that have accumulated underground for millions of years. There is a frenzy of overproduction and consumption. In some parts of the world, people cannot reach the most basic resources of land, water, energy and food, while in some places they live in extreme luxury and waste is not counted. Unfortunately, the deprived people suffer more from the environmental destruction caused by excessive production, purchases and consumption. In the cities that we have built in a cramped order and confined ourselves to living in, the gas residues of mass production to meet the energy required for transportation, heating/illumination and our ever-increasing and diversifying consumption needs have filled the air with dense gas and dust residues. The most important factor polluting the air is combustion. Ground-level ozone, as an air pollutant parameter, primarily causes adverse effects on human health. On the other hand, it causes negative effects on forests and agricultural production. Ozone is produced locally in air pollutant sources and causes an increase in concentration on a local scale by being carried by air movements that cross the borders. In this respect, it is also defined as a regional-scale air pollutant parameter. Ozone is a very strong oxidizing agent. Ozone can seriously destroy the respiratory system. Since most of the ozone reaching the lungs cannot be excreted through the respiratory tract, ozone can cause deterioration in lung functions, changes in the structure of red blood cells, and irritation of the eyes, nose and respiratory system.

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### O 26. SPIRAL CASING DESIGN PARAMETERS ON CENTRIFUGAL FAN PERFORMANCE WITH THE AIM OF INCREASING ENERGY EFFICIENCY AND REDUCTION OF CO<sub>2</sub> EMISSIONS

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**ABSTRACT:** Industrial fans are subject to European Union energy labelling and Ecodesign requirements. The cost-efficient improvement potential through design is about 34 TWh per year, which corresponds to 16 Mt of CO<sub>2</sub> emissions. Ecodesign requirements for industrial fans are mandatory for all manufacturers and suppliers wishing to sell their products in the EU. In this paper, the effect of the diffusor angle and width-scale parameter of the spiral casing on the performance of the centrifugal fan was investigated using the CFD software OpenFOAM. Considering a large number of parameter variations, the simulation results are performed by an automated loop in MATLAB which enables the processing of a considerable amount of data in a short time. The performance characteristics studied were efficiency, static pressure recovery coefficient, total pressure loss coefficient, as well as graphical examples that show the pressure fields and fluid speed in different parts of the volute.

**Keywords:** Centrifugal fan, volute, CFD, OpenFOAM, efficiency, CO<sub>2</sub> emissions

## INTRODUCTION

A centrifugal fan is widely used machinery in the industry which consists of an impeller in a spiral casing as a typical piece of turbo-machinery that converts external mechanical energy into pressure and kinetic energy of the working fluid. Many articles related to centrifugal fans have studied and optimized only the fan impeller and some of them treat the fan as a whole unit, while the study of the spiral casing is less well-known. Currently, the minimization of energy loss is dependent on the characteristics of the spiral casing. Research on the spiral casing has drawn relatively little attention, but in order to improve the performance of centrifugal fans to an acceptable level, a study of the characteristics of the spiral casing is needed. For this reason, this study of the effect of the diffuser angle and width-scale has been conducted, which should lead to better advanced recommendations for the shape of the spiral casing.

## VOLUTE SHAPE DESIGN METHOD

Constant circulation method [2] is a method applied by drawing a spiral case based on the fact that velocity circulation is a constant  $rc_u = \text{constant}$ . In practice, this rule is valid with the restriction that one spiral must be so far displaced from the impeller that deflections conditioned by the consideration of a finite number of blades can be ignored. This rule constitutes the basis for the dimensioning of a volute in the cases where friction has been ignored. The velocity c at an arbitrary place can be calculated from its components  $c_m$  and  $c_u$ ,  $rc_u = r_2 c_{u2}$ . From the condition that the same volume-flow must flow (the continuity equation) through all the streamline in volute it gives the correlation:

$$Q = 2\pi r_2 b_2 c_{m2} = 2\pi r B c_m$$

From which follows  $r_2 b_2 c_{m2} = r B c_m$ , by arranging terms in the equation, we obtain the following inclination  $\alpha$  of the streamlines:

$$\tan(\alpha) = \frac{c_m}{c_u} = \frac{c_{m2}}{c_{u2}} \frac{b_2}{B}$$

Because we obtain the boundary of the volute from the streamline, again it yields,  $\tan(\alpha) = \frac{dr}{rd\varphi}$ ;

$$\frac{dr}{r} = d\varphi \tan(\alpha) = d\varphi \tan(\alpha_2) \frac{b_2}{B}$$

Finally, the solution states,

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$$\ln \frac{r}{r_2} = \varphi \operatorname{tg}(\alpha_2) \frac{b_2}{B} = \varphi \frac{c_{m2}}{c_{u2}} \frac{b_2}{B}$$

Accordingly, the trajectory of fluid particles in the spiral casing is as follows (Caroulus 2013) [3],

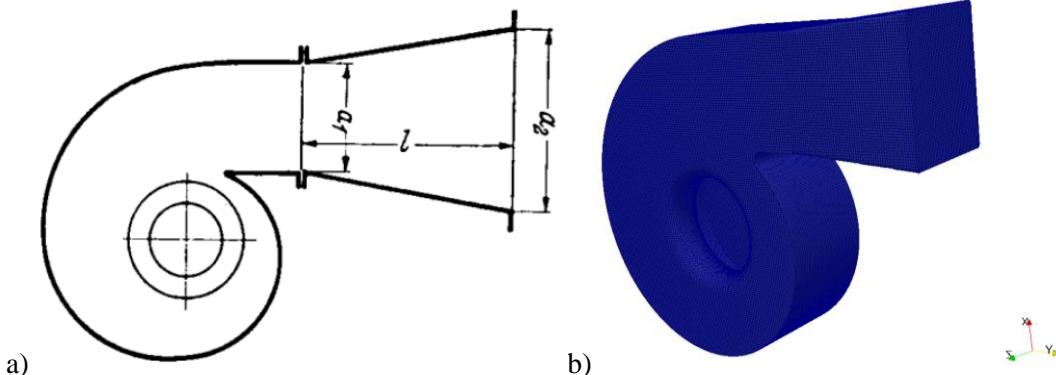
$$r_{(\varphi)} = r_2 e^{\varphi \operatorname{tg}(\alpha)} = r_2 e^{\varphi \operatorname{tg}(\alpha_2) \frac{b_2}{B}}$$

$r_{(\varphi)}$ , is the radius of the volute at an angle  $\varphi$ ,

$r_2$ , is the outer radius of the impeller that is equal to 150mm in our case

$\alpha$  is the angle that the absolute velocity vector makes with the peripheral direction  $\operatorname{tg}(\alpha) = c_m/c_u$ .  
 $b_2$ , the width of outlet impeller;  $B$ , the width of volute

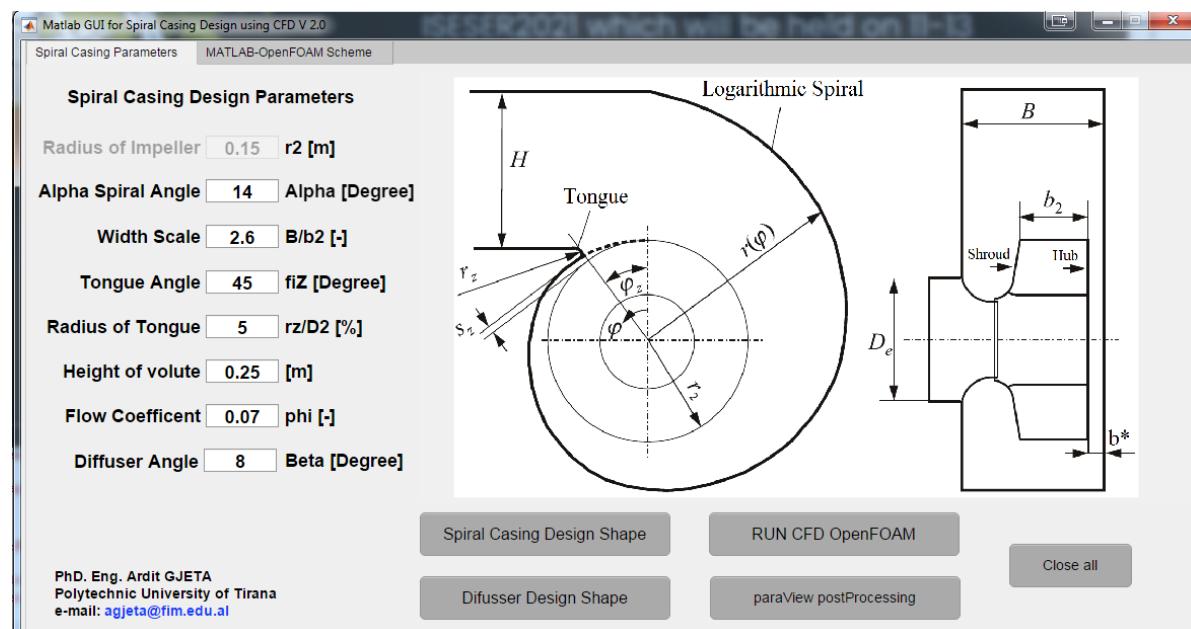
The spiral casing should be designed according to the rules discussed above, in order to avoid adverse effects on the rotor or undesirable effects on the spiral casing [4], [5], [6], [7]. However, to increase the performance of the volute, an additional diffuser can be installed as shown in Figure 1.



**Figure 1.** a) Improving the spiral casing by adding diffuser to the end (Eck 1973) [2]  
b) The geometry of spiral casing with diffuser after the meshing process.

This would continuously reduce the velocity of the air at the outlet as the cross-sectional area gradually increases. Similar but very large diffusers are widely used in mine ventilation system. Research on diffusers has focused on Reynolds small numbers. This indicates that, in certain circumstances, it is advisable to increase the area immediately after a short period of conical growth.

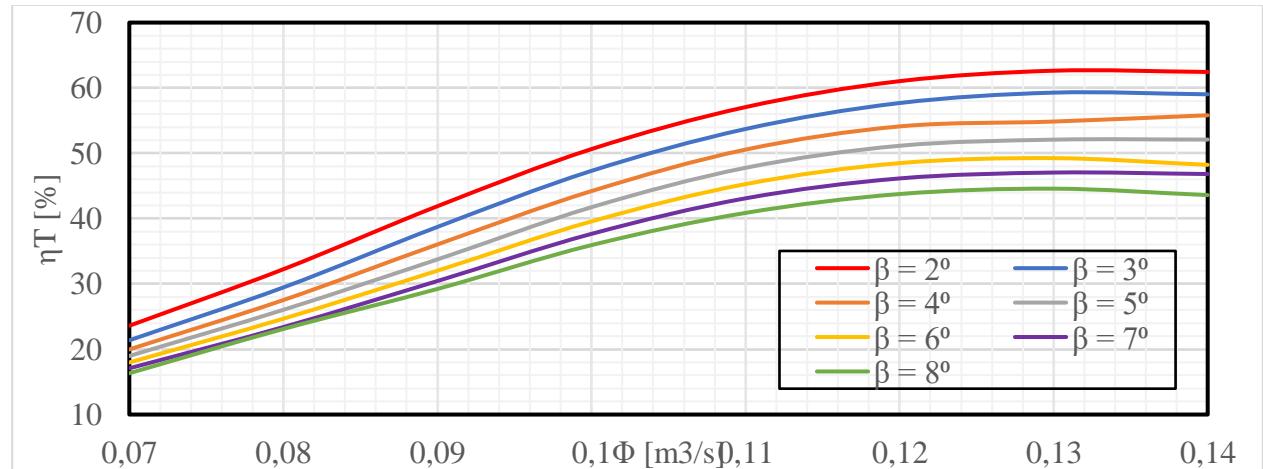
## MATLAB GUI FOR SPIRAL CASING DESIGN INCLUDING DIFFUSER



**Figure 1.** MATLAB graphical user interface for spiral casing design including diffuser [8]

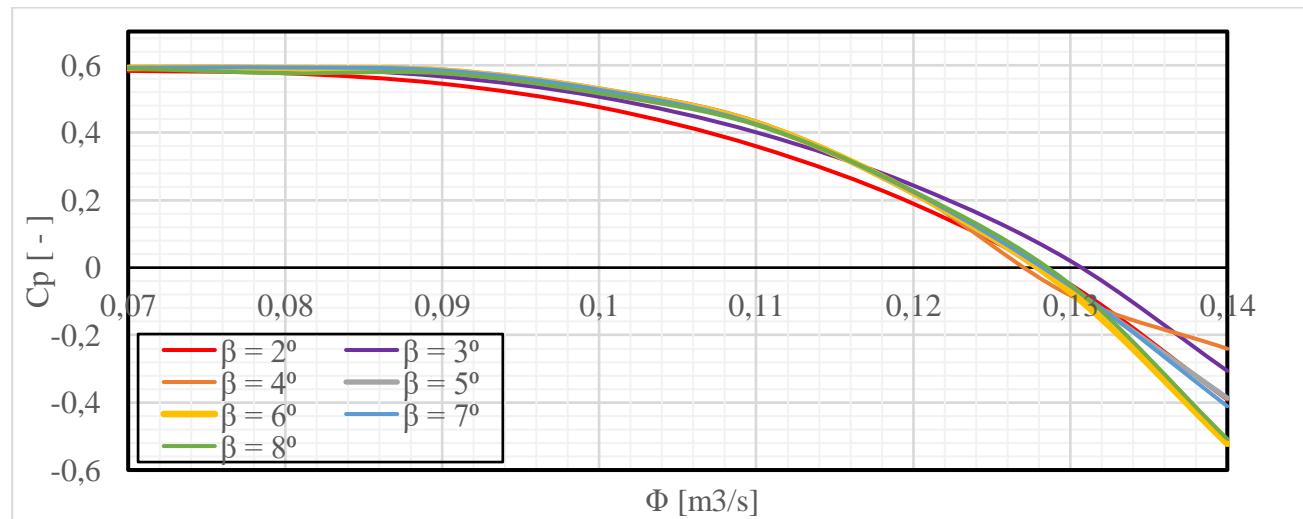
### Effect of diffuser angle

In this case study the parameters to modified is angle of diffuser. The geometrical parameters such as the angle of volute tongue  $\varphi = 45^\circ$  and radius tongue  $\frac{r_z}{D_z} = 5\%$  remains unchanged. The study takes into consideration the values of the diffusor angle from  $2^\circ$  up to  $8^\circ$ .



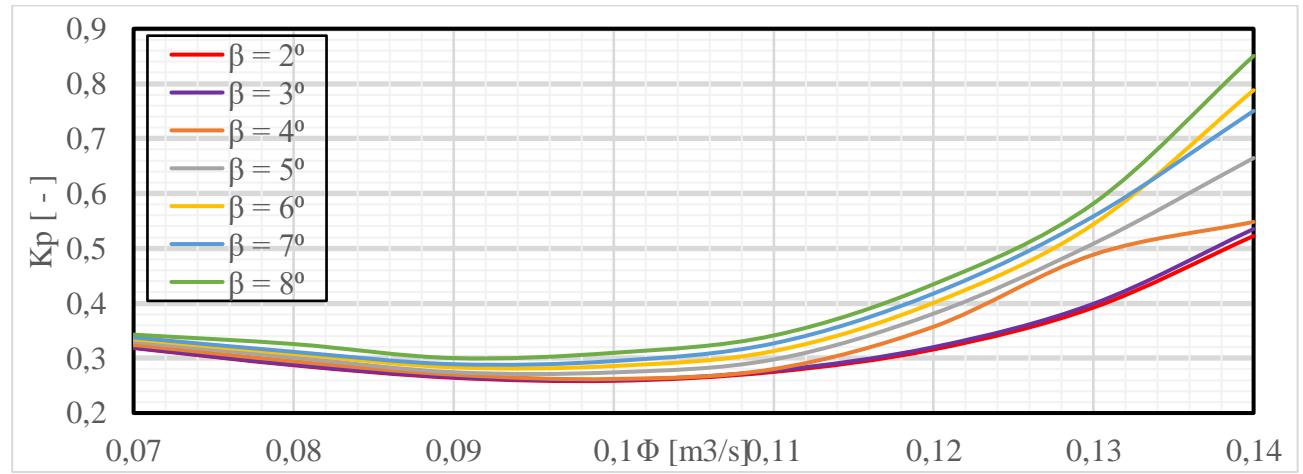
**Figure 2.** Total efficiency of the spiral casing as a function of flow coefficient

The simulation results shows that the maximum efficiency is obtained for a small number of diffuser angle and a high value of flow coefficient. Specifically, for a diffuser angel  $\beta = 2^\circ$  the total efficiency reaches maximum value. Since the diffuser opening angle is small, this would result in a higher  $c_3$  velocity. Also, for a small diffuser angle the average pressure value would result in an increased value. By increasing the diffuser angle, it is noticed that the total efficiency decreases significantly. Specifically, for  $\beta = 8^\circ$  the results shows that the total efficiency has the lowest value.



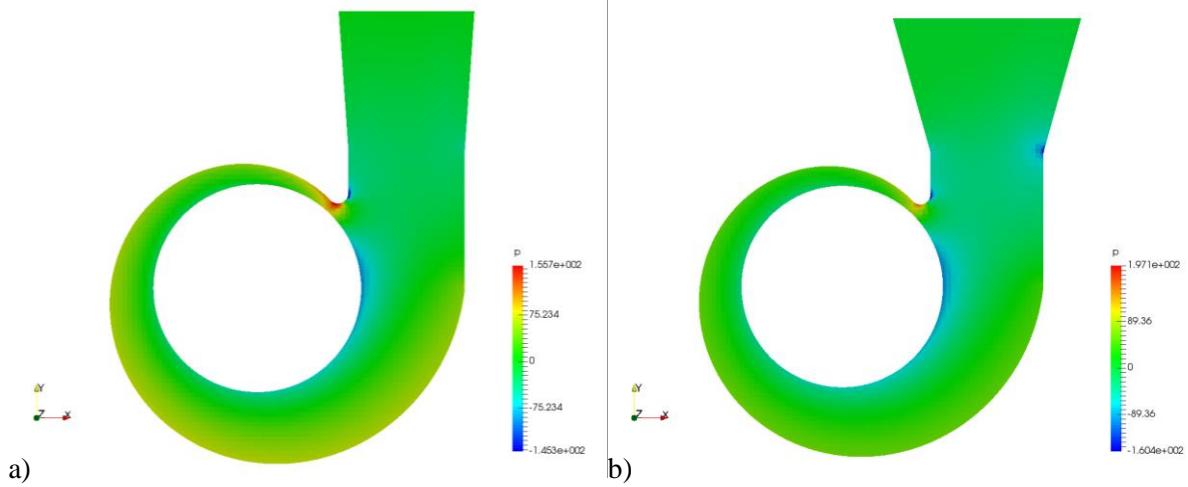
**Figure 3.** Static pressure recovery coefficient as a function of flow coefficient

The graph results show that for the all diffuser angles the static pressure recovery coefficient values have slight changes. For  $\beta = 2^\circ$  it is noticed with increase of flow coefficient value the static pressure recovery coefficient significantly decreases. It should be noted that for negative values of the static pressure recovery coefficient results in incorrect volute design. As result we say that different diffuser angles do not have a significant impact on the static pressure recovery coefficient. As we notice in the graph between the values  $\beta = 2^\circ$  and  $\beta = 8^\circ$  with increasing the flow coefficient, the static pressure recovery values have a small difference.

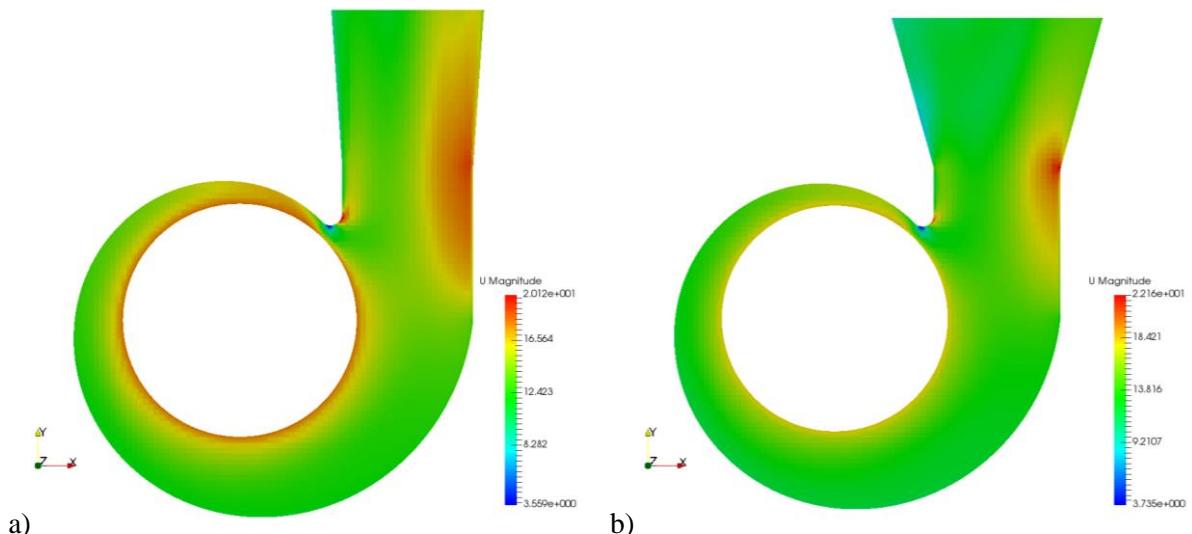


**Figure 4.** Total pressure loss coefficient as a function of flow coefficient

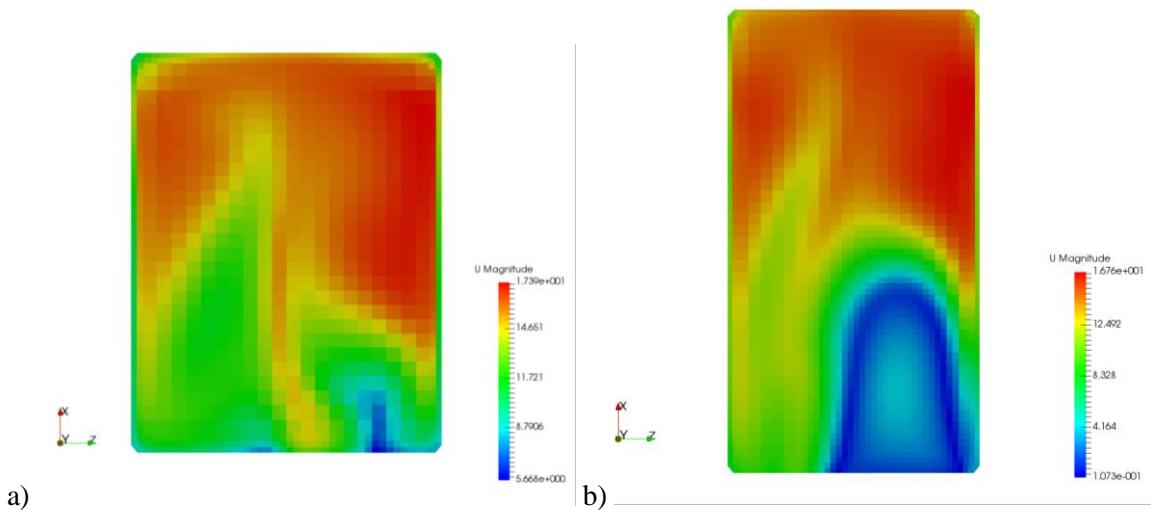
It is noticed that with the increase of the flow coefficient, the total pressure loss coefficient is increased. For a higher flow rate the total pressure loss coefficient will have a higher value. The graph shows that for  $\beta = 2^\circ$  the total pressure coefficient has the smallest values compare to the other angles. The recommended working points for flow coefficients is from 0.09 to 0.11.



**Figure 5.** Pressure magnitude field for diffuser angle a)  $\beta = 2^\circ$  and b)  $\beta = 8^\circ$

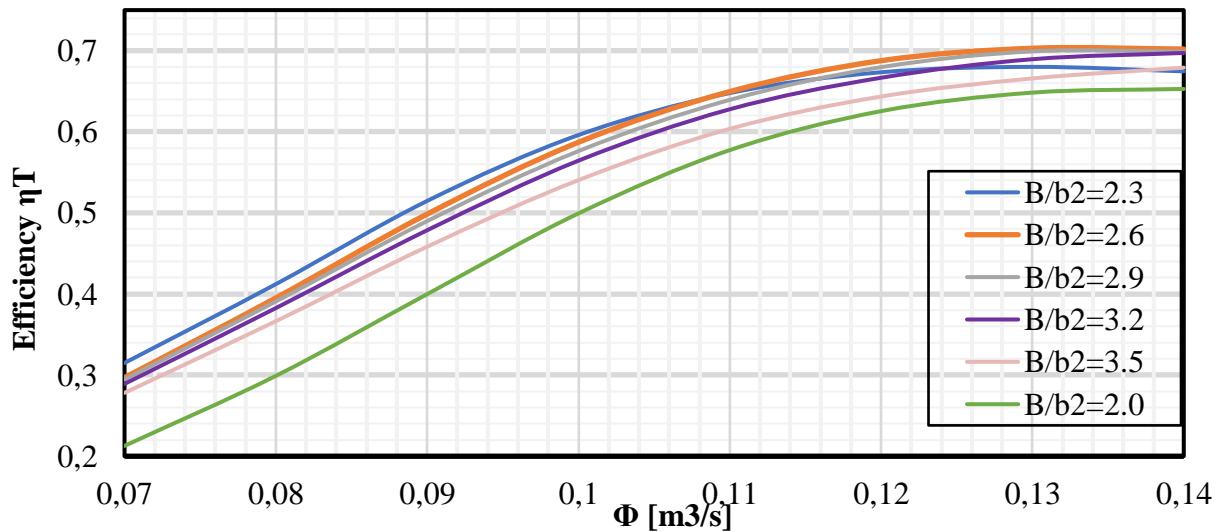


**Figure 6.** Velocity magnitude field for diffuser angle a)  $\beta = 2^\circ$  and b)  $\beta = 8^\circ$



**Figure 7.** Outlet velocity magnitude for diffuser angle a)  $\beta = 2^\circ$  and b)  $\beta = 8^\circ$

#### Effect of width-scale parameter $B/b_2$



**Figure 8.** Total efficiency of the spiral casing as a function of  $B/b_2$ .

From this graph we can see that for the small values of  $B/b_2$  the efficiency of the spiral casing is lowest compared to the other values. The line with the highest efficiency is for  $B/b_2=2.6$  showing a maximal efficiency of barely past 70.2%.  $B/b_2=2.0$  exhibits the lowest efficiency of all other values. Higher values of  $B/b_2$  would cause an increase in size of the volute compared to the rotor thus lowering the pressure in the volute outlet.

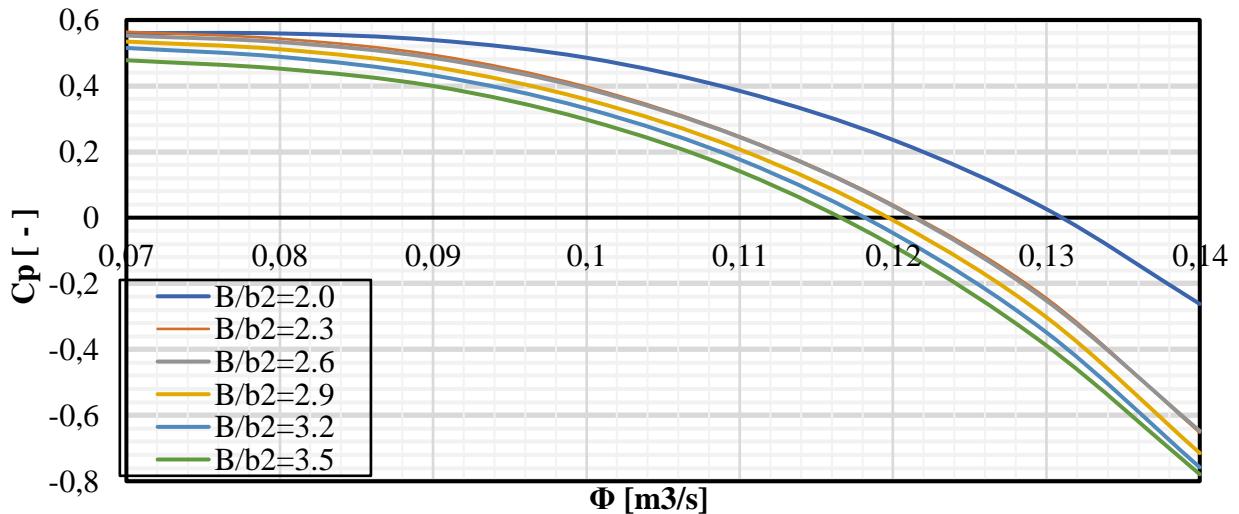


Figure 9. Static pressure recovery coefficient [ $C_p$ ] as a function of  $B/b_2$

The second parameter that values the performance of the volute is the static pressure recovery coefficient  $C_p$ . As we can see from the graph, the higher the  $B/b_2$  the lower this coefficient gets, whilst for lower values of  $B/b_2$  this coefficient takes its maximal values. Judging the graph, we could say that for values of  $B/b_2$  above 2.0, the rate of static pressure drop gets small as  $B/b_2$  values get higher thus having smaller and smaller effect in the decrease of the static pressure recovery coefficient. We can also notice that for values of  $B/b_2 \geq 2.3$ , the values of the static pressure recovery coefficient change very little.

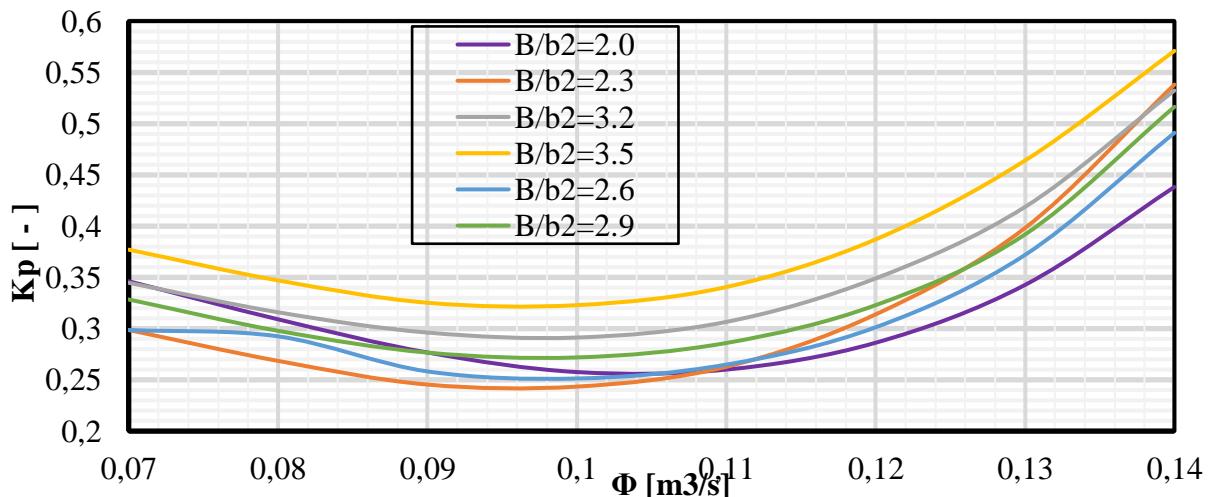
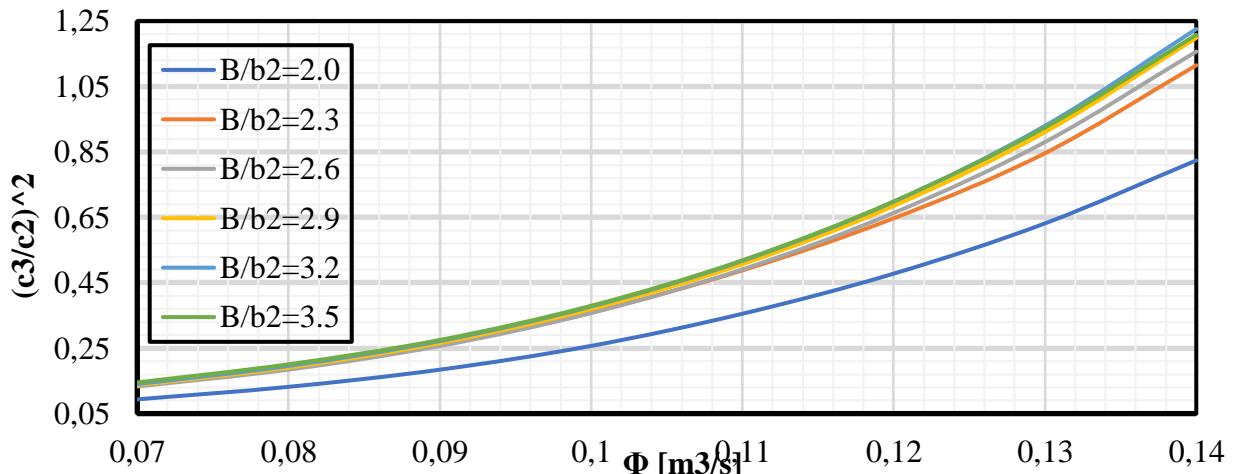


Figure 10. Total pressure loss coefficient [ $K_p$ ] as a function of  $B/b_2$

From the graph we notice that the total pressure loss coefficient [ $K_p$ ], decreases in the average values of flow coefficient and then from the value of 0.1, the values of the total pressure loss coefficient increase. The total pressure loss coefficient is function of a certain geometric parameters  $K_{p_{opt}} = K_{p_{min}} = f(\alpha, \frac{B}{b_2}, \phi_z, \varphi_z, etc.)$  and its values should be as low as possible. For low to average values of  $\Phi$ , the values of this coefficient are lowest for  $B/b_2=2.3$ . Past the average values of  $\Phi$ , the lowest values of the total pressure loss coefficient are for  $B/b_2=2.0$ .

From the graph we can see an increase of the volute outlet speed which increase almost linearly with the increase of  $\Phi$ . Only for values of  $B/b_2=2.0$  the speed is distinctly lower while for the other values of  $B/b_2$ , the values of speed are very close to each other.



**Figure 11.** Kinetic energy ratio in the outlet of the volute and outlet of rotor  $[c_3/c_2]^2$  as a function of  $B/b_2$

From this graph we notice that for higher values of  $B/b_2$  we have an increase in the values of this coefficient which gets stronger in the higher values of  $\Phi$ . Values of this coefficient should be less than 1.

## CONCLUSIONS

From the results of the numerical simulation, we can obtain the following conclusions:

- a) The internal flow distribution could be improved by decreasing the diffuser angle.
- b) Smaller diffuser has higher efficiency and for this type of centrifugal fan, the maximum efficiency is reached for flow coefficient  $0.13 \div 0.14$ , while for diffuser angles  $\beta = 5^\circ, 6^\circ, 7^\circ, 8^\circ$  total pressure losses increase significantly.
- c) For diffuser angle  $\beta = 2^\circ$  it turns out that the centrifugal fan has higher performance. For the flow rate of  $Q = 0.4 m^3/s$  the efficiency results at  $\eta_T = 61.031\%$ .
- d) Referring to static pressure recovery coefficient, no significant changes are observed.
- e) Static pressure recovery coefficient is negative for flow coefficient  $0.13 \div 0.14$ .
- f) Optimal value of the total pressure loss coefficient is observed for flow coefficient  $0.09 \div 0.11$ .
- g) Maximum efficiency is achieved for values of  $B/b_2 = 2.3$  and  $2.6$  at around  $70.02\%$ .
- h) The static pressure recovery coefficient is highest for smaller values of  $B/b_2$  and decreases (also takes negative values) with the increase of  $B/b_2$ .
- i) Best performance for low to average values of flow coefficient is shown by width-scale  $B/b_2 = 2.3$ , for average to high values of flow coefficient, lowest values of  $[K_p]$  are shown by  $B/b_2 = 2.0$ .
- j) Each data and graph taken from the numerical simulations should be verified experimentally in a laboratory in order to validate its results.
- k) With Matlab-OpenFOAM coupling it is possible to perform a wide variety of repetitive tasks and cycles by changing certain parameters. Matlab then updated automatically the other values making it easier to get the expected results and in a shorter amount of time.

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**O 27. TECHNO-ECONOMIC EVALUATION OF ENERGY EFFICIENCY MEASURES IN  
BUILDING SECTOR, CASE STUDY FIER REGIONAL HOSPITAL**

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**ABSTRACT:** Energy efficiency is considered today as a source of energy. This paper aims to analyse some of most important energy efficiency measures to be taken in building sector. For this reason, a regional hospital is considered for study. Hospitals represent an important and very complex energy consumer for building sector in Albania. To achieve the objective an energy audit is performed and analysed. Some techno-economic indicators are represented and used to estimate energy efficiency measures. Then these measures are prioritised based on indicators described. These procedures will help decision-makers to select the most suitable measures according to many factors influencing in it.

**Keywords:** Energy efficiency, hospitals, economic evaluation, energy audit

**INTRODUCTION**

In the world of today when the cost of energy is increasing day by day, saving energy is becoming one of the main issue. So, energy efficiency it can be considered as source of energy. Efficiency mean producing same product or service with less energy (Dorri 2017). In Albania building sector represent one of the main energy consumers. In this sector hospital building represent an important public building typology. Hospitals are known for their complexity regarding energy consuming, for space heating/cooling, sanitary hot water, lighting, electric equipment, etc. The building conditions and the trends in the households/public buildings consumption of the energy and water play an important role in estimating the chances of accomplishing these ambitious objectives.

In this context efficient energy management possesses a key challenge for all building management and especially for hospitals. Adding the benefits of energy survey and audit as instrument to improve energy management has the potential to improve overall energy situation. In order to have a clear idea about energy consuming an energy audit is necessary. It give to us the balance the total energy inputs vs. its use and identify all the energy fluxes in a facility. The Energy Audit will give a positive orientation to the energy cost reduction, preventive maintenance and quality control programmes which are vital for production and utility activities (Thumann and Younger, 2008). In general, Energy Audit is the translation of conservation ideas into realities, by lending technically feasible solutions with economic and other organizational considerations within a specified time frame. The primary objective of Energy Audit is to determine ways to reduce energy consumption. An audit programme will help to keep focus on variations which occur in the energy costs, availability and reliability of supply of energy, decide on appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc.

Financial analysis and cost investment represent another important issue in an energy auditing process. It will give a clear picture for decisionmaker to select the right and most effective scenario of investment proposed by the energy audit process. To this aim actual work is realised for a regional hospital located in Fier county.

**MATERIALS AND METHODS**

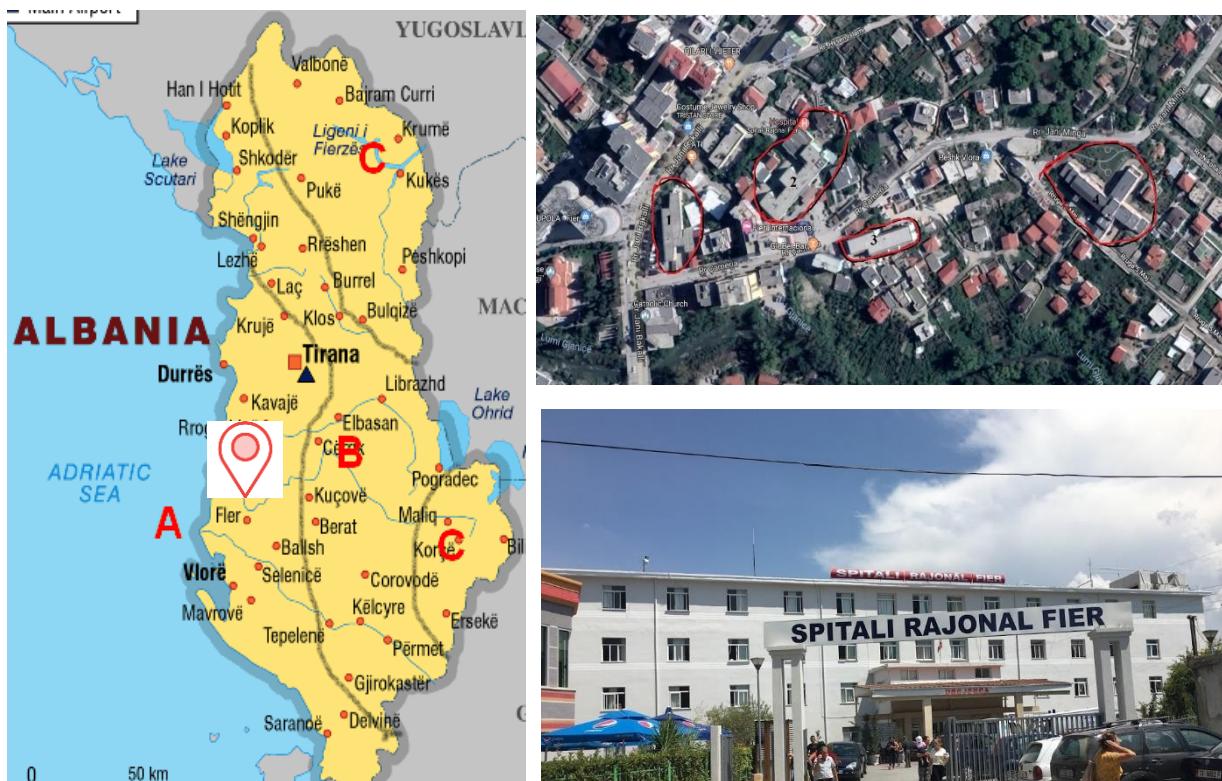
Regional hospital of Fier is the biggest hospital in southern Albania, thus the number of patients that this hospital treats is quite big. It consists of 4 buildings which are located in a distance not very far from each other:

- 1) Polyclinic, which provides medical consultations for patients but no bedding for patients that require further treatment. The number of patients that are consulted in polyclinic is quite big, on average 152 746 patients during the whole year

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- 2) Hospital (emergency)
- 3) Maternity
- 4) Pediatria

The regional hospital of Fier is constructed in 1958 and as the largest in southern Albania it serves about 171 662 patients (not including patients that are treated in paediatrics department). The district of Fier has a population of 302.506 inhabitants, about 40% more than number of patients in the hospital. Below we shown figures of the regional hospital complex of Fier.



**Figure 5.** Position and view of Fieri Regional Hospital

The initial site assessment consisted of spending a day in the building during August 2020, interviewing staff, inspecting equipment, performing an audit, and performing an analysis of the site-gathered data. The investigative process consists of first obtaining as much building documentation to become familiar with the building and its systems. Equipment lists, system schematic drawings and 3 years months of utility billing data are collected. The information contained in this paper is based on a range of sources that have been compiled during inspections; these sources include building monthly/annual energy consumption data, electrical meter readings, site observations, and discussions with site personnel and municipality officials in charge of hospital maintenance.

**Table 3.** General information for Fieri Regional Hospital

The hospital is	<input type="checkbox"/> Private Hospital	<input checked="" type="checkbox"/> Public Hospital
The building of the hospital is	<input checked="" type="checkbox"/> Own	<input type="checkbox"/> Rented
Construction Year		1936
Number of floors		3
Daily operating schedule (hours)		00.00 – 23.59
Days in a week on emergency		7
Which is the total number of the administrative officers and patient/doctors/client including the security people?	Administrative and working staff = 79 medical staff + nurses = 552	

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No of beds	780
Percentage of average annual bed occupancy?	58%
Annual number of incoming/outgoing patients	171 662
Heated spaces surface (m <sup>2</sup> )	8 619
Air conditioned spaces surface (m <sup>2</sup> )	1 724
Average height (m)	3
Heated space volume (m <sup>3</sup> )	25 857
Air conditioned spaces volume (m <sup>3</sup> )	5 172

Additional information and findings could be presented based on the site visit carried out on this regional hospital:

- The level of medical equipment is medium to high, e.g. new dialysis center, new emergency with advanced equipment (CT, MRT scanners, reanimation, etc).
- The general condition of the building is good. The level of damages of the building envelope and openings is low and maintenance level is medium
- The last general building retrofit took place in 2008. In 2018 the emergency complex (some 2/3 of main complex) has been renewed (emergency rooms, registration, entrance, policlinic partly).
- The building management (interviewed stakeholders director and facility managers) has a good understanding of retrofit and energy and efficiency aspects.
- Currently Municipality of Fier develops an development plan for the city of Fier with special focus of improvement of heat supply of public and residential customers in the city center. Supply scenarios which may have an influence for the heat supply of the hospital over medium time horizon (of 4-5 years) are: (A) connection with natural gas network, (B) construction of a combined heat and power plant (CHP) with district heating network, supplying the priority public buildings. A feasibility study for the CHP need to be done and will be part of the detail energy audit study.

The operation expenses of the hospital are covered by funding from the Ministry of Health and secondary funds.

## **RESULTS AND DISCUSSION**

Preliminary evaluation of conditions is done according to visual inspection, verification measurement (on demand), interview with facility manager and expert estimations. The main determinants for the identification of prioritized sectors are a) hospitals energy spending, b) potential energy savings related to the relative energy intensity and c) the level of control by the energy consumption over sectoral budgets, regulation and enforcement power for energy efficiency and RES measures.

The main figures related to energy consumption related to baseline figures and is given in the table below.

**Table 2.** Energy consumption and needs for Fieri regional hospital

Item	Unit	BASELINE- REAL consumption	BASELINE - NORM supply demand
Energy consumption for heating, kWh	kWh/yr	1,174,451	961,539
Energy consumption for SHW, kWh	kWh/yr	160,000	333,678
Energy consumption for Lighting kWh	kWh/yr	19,996	40,682
Energy consumption for equipment kWh	kWh/yr	128,310	167,910
<b>Total Energy consumption kWh</b>	<b>kWh/yr</b>	<b>1,482,757</b>	<b>1,503,808</b>
Specific consumption total	kW/m <sup>2</sup> x yr	172	174

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The ratio of norm supply versus real consumption baseline is 105%, which means the level of energy supply is 48% of its demand. The building is considerably under-heated by 95%.

The objective of the building's energy efficient retrofit is:

- ✓ to achieve sanitary indoor norms of illumination, space heat and hot water supply,
- ✓ to meet the indoor comfort temperature requirements of 20°C ,
- ✓ reduction of consumption of firewood for heating in the nature park area,
- ✓ to reduce energy expenditures for the public funding agency (Ministry of Health) and
- ✓ to enable a high-quality level of public service such as health care, education, social protection, administration.

The achievable energy savings - compared to the baseline - will lead to energy costs savings and additional benefits to increase the building's functionality and comfort for users.

- Option A: Heat delivery by district heat system, produced in pellet boilers
- Option B: Heat delivery by district heat system, produced in CHP
- Option C: Use of natural gas for own heat production in efficient gas boilers, or production heat and power for own needs of the hospital in a own (small to medium size 500-900 kW) gas fired CHP.

The operating costs, energy savings, estimated on a yearly basis, are included into the part of the fixed costs, independent of the load of the plant. This includes the costs for the staff, costs for primary and auxiliary materials, the maintenance expenses and the cost for various services, loans and payments made to third parties. The cash flow is the difference between profits accruing each year from the selling of electricity, and the operating cost and the gross profit tax. Various methods have been and are being employed to produce a financial decision, including that on net present value (NPV), the internal rate of return (IRR), the wealth maximizing rate (WMR), and the payback period (PBP). The financial formulas most wide used include NPV and IRR, and their respective calculations are given in formula 1 and 2.

$$NPV = \sum_{t=0}^{30} \frac{B_t}{(1+r_t)^t} - \sum_{t=0}^{30} \frac{C_t}{(1+r_t)^t} \quad (1)$$

$$NPV = \sum_{t=0}^{30} \frac{B_t}{(1+IRR)^t} - \sum_{t=0}^{30} \frac{C_t}{(1+IRR)^t} = 0 \quad (2)$$

Where:

$t$  → the period of the cash flow: varying from 0 (year of installation) to n (the last year equal to lifetime  
 $r_t$  → the nominal discount rate (for the purpose of such financial analysis; 6-9% (it must also be noted that a sensitivity analysis has also been made) based on the reference values recommended by the Bank. In the sensitivity analysis, where variation of NPV is compared to rt, reference is made to the interval (6-9%);

$B_t$  → profits accrued under the Project, which are obtained by multiplying the energy savings by the price of energy source for each year;

$C_t$  → initial investment (only CO) and the operating cost of the Project, which is obtained by multiplying the energy savings by the price of energy source for each year.

Another approach towards making the financial decisions accommodates the concept around the payback period for the investments. The payback period has been determined as the least indispensable time required by all EE/RES measures, to ensure that, during such period, profits exceed costs. Let us mark by 'Xt' a cash flow in the year ' $t$ '; Xt is negative if it represents the cost and is positive if it represents a profit. Let us mark the payback period for the investments by 'PBP.' Hence, the simplest formula for calculating PBP is obtained from the following:

$$\sum_{t=0}^{PBP} X_t \geq 0 \quad \text{where } X_t = B_t - C_t \quad (3)$$

Without discounting the cash flows, PBP has a significant gap since it ignores the time value

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of money and therefore it should not be used any longer. As the discounting is included, then the equation for calculating the payback period will be:

$$\sum_{t=0}^{PBP} \frac{X_t}{(1+r_t)^t} \geq 0 \quad (4)$$

In this case, the discounted cash flows accumulate until their sum becomes positive. For making a comprehensive financial ratio analysis of all EE/RES measures, all the financial formulas described earlier on, including NPV, IRR, LDC, and PBP, will be employed.

After financial calculations for purposed EE measures results are given in the table below”

**Table 3.** Investment for EE measures

Recommended catalogue of EE measures (according to the actual needs of the building)	Total investment costs (EUR), incl. installation works, 10% contingencies	Specific investment costs (EUR /m <sup>2</sup> heated area) <sup>1</sup>
Insulation of walls	268,853	31
Replacement of windows	180,986	21
Replacement of doors	30,408	4
Insulation of roof ceiling (attic)	150,833	18
Insulation of floor ceiling (in basement ceiling)	37,708	4
Ventilation system, decental heat exchanger	491,400	57
Wood boiler replacement	0	0
Electric boiler replacement (decentral)	0	0
Diesel boiler replacement including heating network	0	0
Biomass boiler including network	0	0
Renewal of heating network + radiators	72,400	8
Heat pump for heating incl. Network	0	0
Combined Solar/ HP for heating	0	0
Combined Solar/ Biomass (wood) for heating	0	0
LED lighting indoor+ outdoor+ wiring	119,459	14
Renewal of AC system (split/ central)	0	0
Heat pump for SHW	0	0
Solar collector for SHW (2.2-2.5 m <sup>2</sup> collector)	12,600	1
Automatic entrance door with air curtain	6,300	1
Renewal of electric wiring	0	0
DH pump replacement, VSD	3,150	0
Replacement of laundry equipment	0	0
Energy management/ lighting control	18,100	2
<b>TOTAL CAPEX</b>	<b>1,392,196</b>	<b>162</b>

Recommendations are divided in three categories: with low, medium ang high costs. The conclusion of the analysis shows that the application of all EE & RES measures is beneficial for this building. While the net present value is positive, IRR = 13.6% and the investment maturity is 7.4 years.

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### **CONCLUSIONS**

The objective of technic-economic analysis is to achieve and maintain optimum energy procurement and utilization, throughout the organization and:

- ✓ To minimize energy costs / waste without affecting production & quality
- ✓ To minimize environmental effects.
- ✓ Produce benchmarks and design guidelines for ZenH
- ✓ Improve the technical capacity of professional staff operating energy systems in Fier Regional Hospital;
- ✓ Prepare detailed analysis and test the benchmark models for upgrading Fier hospital buildings into NZEB that will be ready to seek financial tools for their implementation.

This analysis presents the key findings and recommendations from the application of EE/RES measures for Fier Regional Hospital. Financial analysis will help us to be well oriented toward the most feasible EE measures that should implement. In our case the financial and economic profitability of the EE intervention with the recommended EE technology package is at a level of IRR 11% with 9.5 years payback time, which can be evaluated as good level for public building retrofit.

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**O 28. CLOUD COMPUTING MANAGEMENT AND NETWORK SECURITY. CASE STUDY,  
E-ALBANIA PORTAL**

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**ABSTRACT:** This paper studies the security of applications in Cloud Computing, and belongs to the discipline of information systems, governance of information systems. As a case study in Albania, it was analysed the cloud computer used in the e-Albania portal. Cloud Computing is today a trend in the information and communication technology (ICT) industry, for which there is a growing interest both in technology and economics. Cloud computing has found wide use in various fields, from individuals to governments or large enterprises. The facilities that this use brings are numerous, ranging from easy access of data by customers to monitoring of every transaction by those responsible. The paper presents and analyses the basic concepts of Cloud computing, construction and use of the Albanian e-Government Cloud, its development model and service. The paper addresses the threats in the cloud, especially network security. It elaborates on the security problem by taking the source of the problem and also the possible solution. It addresses the privacy, data protection and identity management. The paper talks about the e-Albania portal, where it is based to guarantee security in the networks it uses. It presents the strategies taken by the Albanian government to encrypt and code data on networks. The paper analyses any security risks in order to be able to suggest an efficient and economical solution for network security.

**Keywords:** *Cloud Computing, Network Management, Cloud Security, Government Cloud, Cloud Usage, Cloud Framework, Computer Networking*

**INTRODUCTION**

Cloud Computing is today a trend in the information and communication technology (ICT) industry, and there is a growing interest in technology and economics.

A cloud infrastructure can be built according to several development models: Public Cloud, Private Cloud, Community Cloud, or Hybrid Cloud [1] The differences between these models are based on how resources are provided to the customer of Cloud services. A Public Cloud is a model in which resource utilization and infrastructure are generally enabled by a public network. A private Cloud is owned by an organization, which sells services and serves a diverse number of clients.

Cloud computing is a platform by which are shared the resources and data used among various enterprises, but there is always a security threat. An important aspect of cloud computing is security. Cloud service providers have the responsibility for providing security as one aspects of quality of service. Many challenges related with security in Cloud computing have not been addressed well yet. [2]

Pecchia et al. 2020, stated that “security alerts collected under real workload conditions represent a goldmine of information to protect integrity and confidentiality of a production Cloud”. Their paper investigated the use of different text weighting schemes to filter an average volume of many alerts produced in a day by a security information and event management tool in a production SaaS Cloud. The data shared and accessed through many devices from the cloud are not safe. They are likely to have various attacks like Identity Access Management, by internal or external intruders, hijacking a service. Ethelbert et al. 2020 stated that “a major role to secure the data within the cloud environment is done from the cryptography”. The mandatory element is to protect the data stored in the cloud by using standard encryption and decryption mechanisms. Every cloud provider has its own security mechanisms to protect the key. The client cannot trust the service provider completely in spite of the fact that, at any instant, the provider has full access to both data and key. In their paper, they defined a new system which

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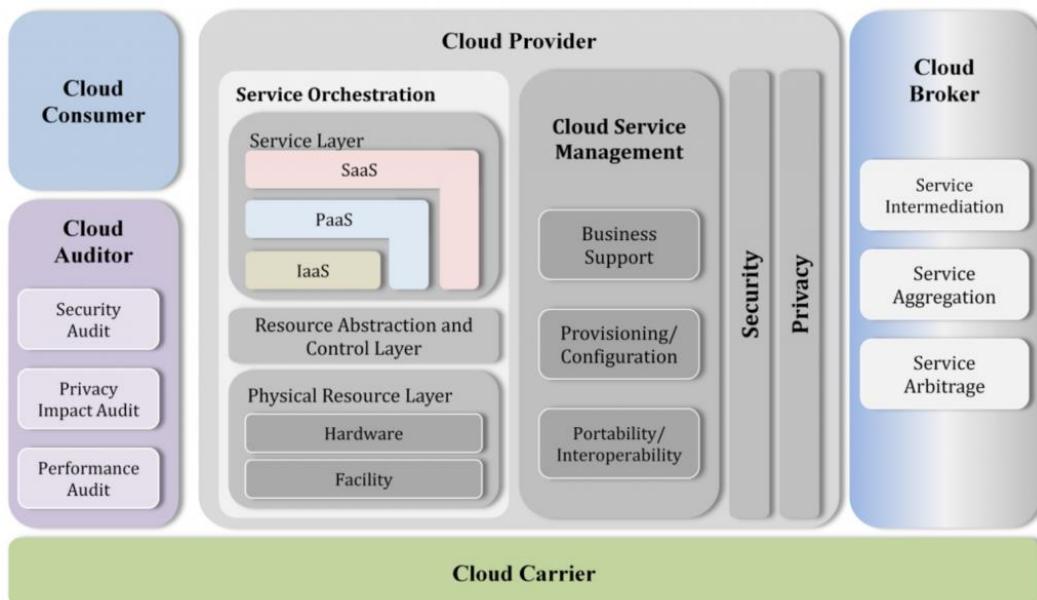
can prevent the exposure of the key as well as a framework for sharing a file that will ensure security using asymmetric key and distributing it within the cloud environment using a trusted third party. Rathore and Chouradage, 2017 have defined that “compromise in terms of security is one of the flaws that proves to be a big threat for the user”. In the paper they explained cloud computing and its threats faced by the users and introduce the existing systems which have been previously deployed to rectify the mentioned problems. They tried to rectify this flaw by proposing a system which provided both encryption and also an access control system for the users.

Liu et al. 2015 have proposed a two-factor data security protection mechanism with factor revocability for cloud storage system. Their system allowed a sender to send an encrypted message to a receiver through a cloud storage server. The sender only needed to know the identity of the receiver but no other information (such as its public key or its certificate). The receiver needed to possess two things in order to decrypt the ciphertext. The first thing is his/her secret key stored in the computer. The second thing is a unique personal security device which connects to the computer. It is impossible to decrypt the ciphertext without either piece. Once the security device is stolen or lost, this device is revoked. It cannot be used to decrypt any ciphertext. The cloud server cannot decrypt any ciphertext at any time. It will immediately execute some algorithms to change the existing ciphertext to be un-decryptable by this device. This process is completely transparent to the sender. Security and efficiency analysis show that their system was secure and also practical. [3]

## **MATERIAL AND METHOD**

In the architecture of Cloud computing, five main actors are identified: the customer of cloud services, the cloud service provider, the carrier of services in the cloud, the cloud services auditor and the cloud services broker. Each actor is an entity in the Cloud and can be a person or an organization that participates in a transaction or process and performs certain tasks.

Cloud Consumer is a person or organization that maintains a business relationship with, and uses service from, Cloud Providers. Cloud Provider is a person, organization, or entity responsible for making a service available to interested parties. Cloud Auditor is party that can conduct independent assessment of cloud services, information system operations, performance and security of the cloud implementation.



**Figure 6.** Cloud computing conceptual model (Source NIST,2020)

Cloud Broker is an entity that manages the use, performance and delivery of cloud services, and negotiates relationships between Cloud Providers and Cloud Consumers. Cloud Carrier is an intermediary that provides connectivity and transport of cloud services from Cloud Providers to Cloud Consumers.

## **Security Threats in the Computer Cloud System**

We highlight in this section the main security risks which can be classified into three categories. Each of these types of attacks is examined in more detail below:

- Security threats originating from the host (hypervisor).
- Security threats originating from VM, Virtual Machines.
- Security threats coming from the client and the data center.

## **Security problems faced by businesses and governments**

Businesses and governments are shifting more and more workloads into the cloud. However, some organizations remain resistant to significant cloud pulls due to prolonged concerns about data security in Cloud Computing.

The main security risks of cloud services are:

- Compliance violations
- Identity theft
- Malware infections and data breaches
- Decreased consumer confidence and potential loss of revenue

A good cloud security provider will provide a scalable solution that detects threats before they reach the data center, helping to alleviate the following security concerns:

- Data loss
- Malware infections
- Legal / compliance issues

## **Security issues in service models**

Security is based on a wide range of policies and technologies, which are used to protect the data, applications and various infrastructures of Cloud Computing. Security risks are shared between Cloud providers and customers in the Cloud, based on Cloud delivery and service model. [4] The most security risks in the Cloud are related to weak policies, integrity, data control, privacy, availability of respective services and data, physical network security, encryption complexity, logistics security, and physical security. Each service model has its own specific problems regarding security. [5]

**Table 4.** Security issues according to the service model

Service Model	Service provider	Customer of the service
IaaS	<ul style="list-style-type: none"> <li>-Virtual instances in IaaS often do not have continuous storage methods (incoming data must be stored in the long-term storage location) and volatile (volatile) data can be lost.</li> <li>-Providers in many cases do not want to provide final disk images because they may infringe on privacy rights.</li> <li>Problems may arise with the unclear situation regarding how the provider manages the termination of clients' contracts. Clients find it impossible to verify whether sensitive data stored on virtual machines has been deleted or not.</li> </ul>	<ul style="list-style-type: none"> <li>-IaaS instances provide more information for analyzing various attacks or incidents occurring in the Computer Cloud.</li> <li>-RFC 3227 contains some practices of good applicable to the IaaS in the event of security incidents.</li> </ul>
PaaS	<ul style="list-style-type: none"> <li>- Some cloud service providers offer the ability to collect and store a variety of incident diagnostic data.</li> </ul>	<ul style="list-style-type: none"> <li>-The main applications are under the control of consumers.</li> <li>-Customers do not have direct control over the execution environment</li> </ul>

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		-Login and encryption mechanisms can be applied.
SaaS	<ul style="list-style-type: none"> <li>-Logging tools must be executed on the service provider infrastructure</li> <li>-Providers may not give access to clients' IP logs that access content or metadata of all devices</li> </ul>	<ul style="list-style-type: none"> <li>- The client does not have an in-depth view of the system and infrastructure that enables the service.</li> <li>- SSO (Single sign-on) checks must be requested</li> <li>-The client should contribute to the process of identifying past incidents by implementing rules to enable data retrieval.</li> </ul>

### **Disadvantages of cloud computing**

Despite the huge benefits that come from using of Cloud Computing, the downsides and disadvantages that come with centralization and distributed resources are growing so much that the benefits gained from these platforms can be overstated. Data in the Cloud are not under the control and management of the institution that owns them, and this fact carries in itself risks and threats which may pose a risk to the security of the system and data of the organization. [6] Risk identification and analysis is important to prioritize the implementation of governance and data control implementation, as well as to deploy an auditor or controller of the virtualized and cloud environment. Based on the identification and analysis of risks, appropriate controls should be built and implemented to ensure that the necessary measures are taken to address the risks and achieve the IT objectives.

Safety represents the measures taken to avoid the impact that the occurrence of an incident has as a result of vulnerabilities associated with Computer Cloud. The latter can cause damage to the system or organization. The cloud is evolving and the risks associated with its use are not fully understood. Effective security management is essential to establish a balance between benefits and risk reduction.

### **RESEARCH AND FINDINGS**

In public administration, it is necessary to use new technologies which can lead to a reduction in costs. Some of the more developed countries view Cloud computing as a partial or complete solution to existing problems, where CC allows it to focus its resources where it is most needed, enables better organization of government structures and allows easier and faster exchange of information between different government organizations.

### **Use of Computer Cloud in Albania**

If before most of the applications in the Albanian government and programs were executed by software loaded on physical machines or servers in the same building, now Computer Cloud allows access to the same applications through the Internet. Many businesses and governments, including the Albanian government, are moving their services to the Cloud. This comes as a result of the positive effects that Cloud has in improving efficiency, helping to reduce costs, good use of resources, etc.

The following are some of the most important reasons that the paper found from the research of the transition of Albanian e-government services to Cloud Computing platforms.

1. Cost savings. One of the main benefits of moving to the Cloud is the reduction of financial costs.
2. Speed of adaptation. Cloud is designed to provide services with unlimited scalability, which is considered as one of its main features.
3. Ease of use. Cloud computing is also easy to use. All employees of an institution or organization can access data in the Cloud very easily, wherever there is an Internet connection.
4. Increasing storage capacity. The cloud offers unlimited storage capacity compared to typical hard drives or server limits.
5. Flexibility and scalability. Cloud based services are very suitable for institutions or organizations and their increasing bandwidth requirements. Through the use of the Cloud, scaling up or down capacity is much easier than before and institutions can always pay depending on the capacity they use. [7]

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6. Facilitate the work of IT staff. The IT departments of the respective institutions will spend less time on maintenance and will be freer to focus on strategic initiatives, which would increase the performance of the respective institution.
7. Recovery from injuries. The backup and recovery solutions provided by the use of the Cloud enable time savings as well as eliminate the need for large investments made by government institutions for error recovery.
8. Security. Since our data is stored in the Cloud, any institution can access it, regardless of any type of accident that may occur. It also offers the ability to delete all data from lost laptops so that they do not fall into the wrong hands.
9. Auditing and Logging. The audit process as well as the security audit should be performed periodically to ensure the security of the system. The cloud can help analyze large volumes of data and detect fraud. This data analysis would help build protection and security enhancement mechanisms, thus making applications more accessible and reliable. [8]
10. Environmentally friendly. The environment also benefits from the movement on the platforms in the Cloud. The use of hardware resources makes it possible to use only the necessary energy, ensuring a smaller impact on the environment.
11. Reporting and intelligence. Data submission makes many reporting services provided by the government more transparent. Applications can get a large amount of reliable real-time data, which helps in making decisions about providing the best services.
12. Policy management. Cloud architecture helps implement policies in data centers. Security-related policies can be designed and implemented in the data center.

## **Cloud Infrastructure in Albania**

The Albanian government is focused and investing in a data digitization program, which includes the process of digital data transfer, indexing, integration into ICT systems, and interoperability. [9]

Some of the concrete and most important steps in building digital infrastructure are 3:

- Back-end systems ('basic registers') in the IT departments of organizations, where the main applications are executed, which provide services and where the data are stored (civil registry data, property register data, addresses, asset information, pension data, etc.);
- The central component is the connecting layer for each civic service application. Further, it serves as a layer of interaction for any data exchange between government institutions.

Its basic components are:

- Government Portal (GG - which is primarily an Enterprise Service Bus application)
- Department Integration Servers (DIS), which is a connecting component located in the back-end institution building. Enables mediation / interpreter between GG and back-end institution.
- Payment Gateway to provide payment services for citizens who use services published through the e-Albania portal.
- e-Albania portal. Currently services for citizens / businesses (Front Office) are exposed through a public portal called e-Albania. The portal enables the exposure of electronic services published through GG to the user interface. This means: citizens are using 'network services' in a self-serving way.

## **Enforcing security in the Albanian e-government cloud and the risks imposed**

Private Cloud in Albania offers dedicated services and a dedicated (single-tenant) operating environment, with all the benefits and functionality of resilience and a support model suitable for many public institutions. This is the most convenient way for applications that require full control and configuration of infrastructure and security. The main reasons why the combination of public and private cloud was chosen in Albania are:

1. The hybrid cloud enables the creation of a cloud covering the entire building, which is used in conjunction with the public cloud (Microsoft solution in this case) to reduce maintenance costs;
2. Hybrid cloud enables greater security of data and processes.

This mix of Cloud models has brought several advantages:

- Infrastructure in the data storage center;

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- Elimination of delays due to internet traffic; each user in the perspective of the public body benefits from access to the data center infrastructure using a VPN;
- Faster processing time as some data is processed locally.

The hybrid model used may provide effective management of distributed resources, but it risks becoming complex due to security issues that may arise. It also carries problems with logging data logging and actions taken to obtain logs / logs in a single location in a common format. On the Government Cloud platform in Albania, Hyper-V servers are exposed to malware and viruses just like any other operating system and therefore adequate protection must be provided. The potential complexity of this model underscores the need to use virtualization tools to develop, maintain, and audit the translation of rules and rights into access controls. [56]

Some concrete examples to be addressed in the full protection of the Government Cloud are listed as follows:

- o Anti-virus, anti-spyware for HTTP;
- o Anti-phishing;
- o Firewall and firewall application should detect VoIP and p2p applications;
- o Incident reporting;
- o An Antivirus service for HTTP, HTTPS 2.3.1 and FTP applications;
- o Antivirus that enables the blocking of Viruses, spyware, Trojans, scams, worms, etc .;
- o Advanced firewall functionality;
- o Services blocking should be possible for protocols such as: http, ftp, smtp, pop3, p2p, etc .;
- o Protocol-based blocking or application should be specifically possible: p2p, instant messaging, chat, etc .;
- o All actions should be listed in logs, according to a well-defined configuration;
- o Domain Keys (DKIM): use of Public / Private pair keys in order to be controlled against those published in the DNS;
- o Tar pitting: a technique consisting of inserting a delay when negotiating an SMTP connection so that the email server or SMTP Gateway is protected from connections initiated by systems that send spam automatically;
- o Antiphising Services;
- o Bandwidth Management must be provided. This functionality should allow administrators to restrict traffic to IP addresses or an institution which is managed and provisioned independently.

## **CONCLUSIONS AND DISCUSSION**

The portal enables the exposure. Security is one of the major issues on New platforms worldwide. The portal enables the exposure. Security problems can be of different types such as: security of resources, unauthorized access, data loss, potential malware, etc. The Albanian e-government cloud with the use of the Hybrid Cloud model, may encounter many problems in terms of security. It is imperative to enable proper security controls in the Government Cloud environment based on a predefined security model or architecture. In order to enable proper security controls in government cloud, the computing environment, security architecture / model, and regulatory framework must be interconnected between all actors and roles in cloud.

Citizens and businesses need to rely heavily on government-enabled cloud services, which must do all they can to ensure that service users data is properly stored.

Risk forecasting is one of the most important points in cloud computing platforms both in its use and in the governance framework. Risks are closely related to the new service model.

The service level agreement is one of the key elements of using Cloud Computing whatever the service model it offers. SLA carefully address the use, monitoring, obligations and responsibilities between the parties in consuming or providing services.

Some of the key recommendations of the paper are related to the drafting of strategic documents by the Albanian state regarding the security of the Cloud. Development of SLA models, which defines the relationship between all New actors. Draft a framework document for the governance of the Government Cloud, which addresses issues of risks and controls.

What is of great interest is the fact that cloud computing platforms are finding such widespread use and are becoming increasingly essential to the future of human society.

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**O 29. THE ECONOMIC EFFECTS OF THE COVID-19 PANDEMIC ON ORNAMENTAL PLANTS SECTOR IN TURKEY**

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**ABSTRACT:** Covid-19, also known as the corona virus, first appeared in November of 2019, in the city of Wuhan located in Hubei province of China. During the earliest moments of Covid-19, people were unable to guess at the radical changes in day-to-day life. However, as Covid-19 swept across the world, it has become clear that there are tremendous changes in many areas. Especially in that of health, education, economy, consumer behaviour, and social life. Another area that has been damaged by Covid-19 is the ornamental plant sector. Ornamental plant production began to gain importance in the early 20th century throughout the world and has persisted until now. Turkey has important advantages in ornamental plant cultivation, due to its favourable climate and geographical conditions, proximity to market countries and cheap labour. In Turkey, the ornamental plant sector improves every year in terms of production amount and production area. However, due to Covid-19, consumption habits have changed and this has affected the ornamental plant sector. In this study, the importance of ornamental plants on the environment and human beings, and the effects of Covid-19 on the ornamental plant sector in Turkey were evaluated.

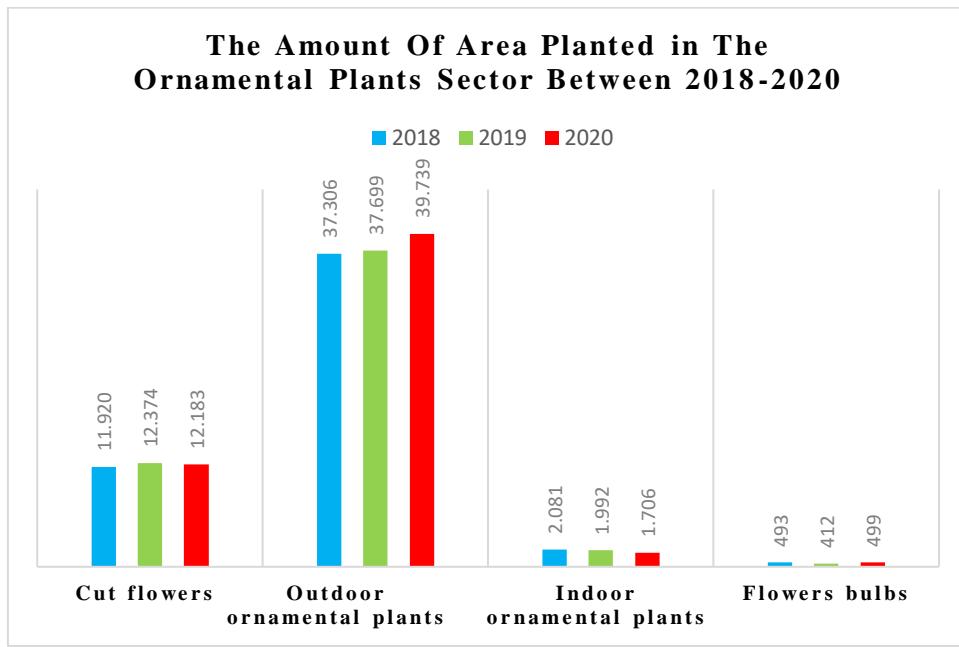
**Keywords:** *Covid-19, Ornamental Plants, Environment and Human*

**INTRODUCTION**

Ornamental plant cultivation is a subsection of agriculture that appeals to a person's aesthetic needs of instead of their dietary needs. It distinguishes itself from other agricultural products in that it imbues one's environs with a natural, bucolic beauty. As such, ornamental plants are indispensable to us as humans and have a consumption potential in each season of the year (Kelkit 2002). The emergence of ornamental plants as a subsector of plant production sector coincides with the beginning of the 20th century. Urbanization has played the biggest role in this process. In addition, today, it is thought that there is a linear relationship between the development of the ornamental plant sector and a country's education level, gross national product value per individual, and other development criteria (Ay, 2009; Gülgün & Yazici, 2016). The historical development of the ornamental plant sector in Turkey began in and around Istanbul during the 1940s as urbanization accelerated, similar to that of other countries. Later, the sector expanded to the Aegean and Mediterranean regions with suitable climatic characteristics. With an export value of nearly 81 million dollars, ornamental plants have become an important plant production sub-sector for Turkey in modern times.

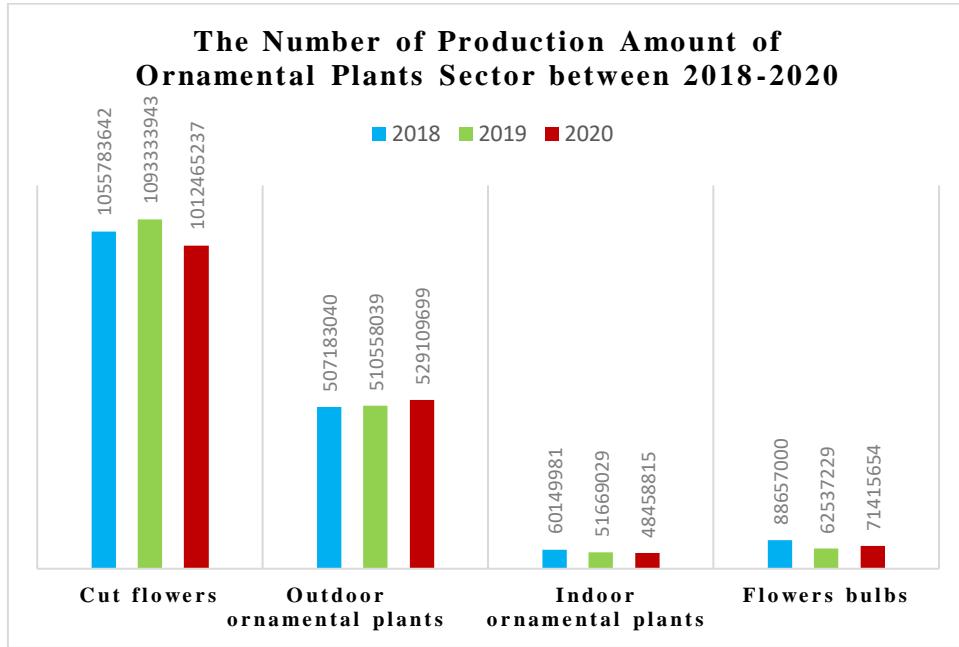
**TURKEY 2018-2020 ORNAMENTAL PLANTS SECTOR**

Süsbir (2019) has reported that the production areas of ornamental plants increased 2.5 times between 2002 and 2017 in Turkey. Despite this increase, the sector needs a greater production area to achieve its goals. The production areas of the sector largely consist of small plots of land, as they do in agriculture in general. Most of the land used in production is rented and this is reportedly the reason why the sector has been prevented from receiving many necessary infrastructure investments. When the production amount and area of 2018-2020 is examined, the effects of the Covid-19 pandemic process can also be evaluated. The area where ornamental plants are cultivated and the level of production in Turkey are given in Figure 1 and Figure 2.



**Figure 1.** The Amount of Area Planted in the Ornamental Plants Sector between 2018-2020 (da) (Tuik,2020)

According to Tuik (2019), ornamental plant production increased by 0.4% in 2019 when compared to the previous year. When we subdivide the sector into cut flowers and ornamental plants, we can see that cut flowers represent 63.6% of the sector and other ornamental plants represent 36.4%. Cut flower production increased by 3.6% compared to the previous year, while outdoor ornamental plant production increased by 0.7%, and indoor ornamental plant production decreased by 14.1%.

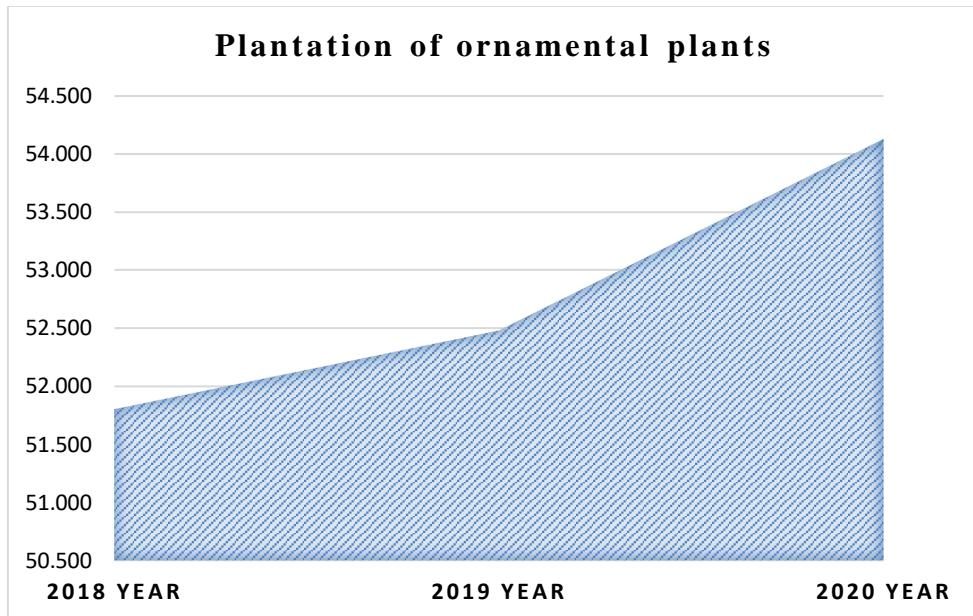


**Figure 2.** The Number of Production Amount of Ornamental Plants Sector between 2018-2020 (Tuik,2020)

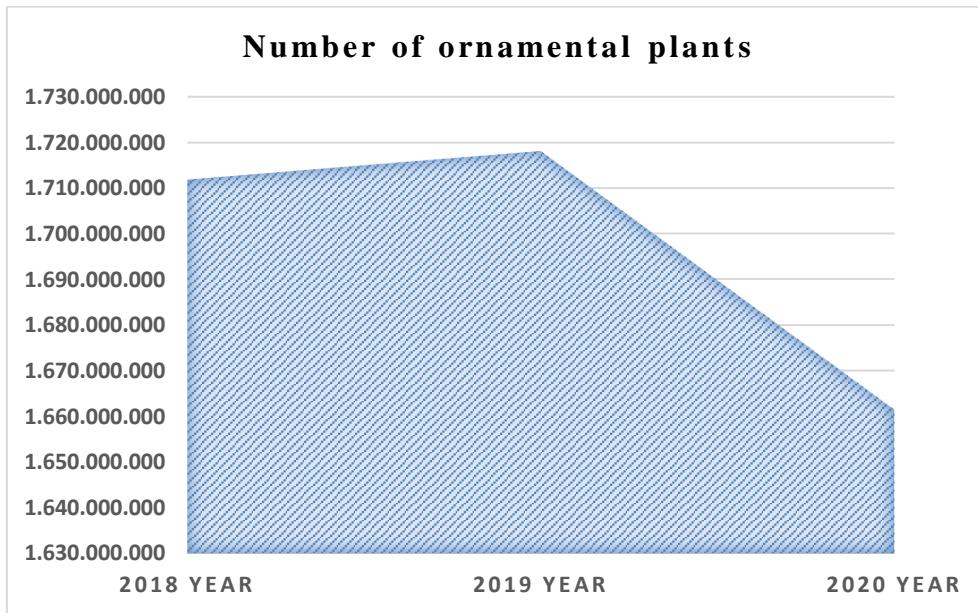
While the production of cereals, vegetables, and fruits increased when compared to the previous year, according to Tuik's (2020) data, the production of ornamental plants decreased by 3.5% in 2020 when compared to 2019. When the subdivisions in ornamental plant production are examined, cut flowers have a share of 60.9% and other ornamental plants have a share of 39.1%. Outdoor ornamental plant

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production increased by 3.6% compared to the previous year, cut flower production decreased by 7.7% and indoor ornamental plant production decreased by 6.2%.



**Figure 3.** Ornamental plants production area (2018-2020) -TUIK



**Figure 4.** Number of ornamental plants production (2018-2020) -TUIK

According to the Ornamental Plants Producers Sub-Union (SÜSBİR), at the onset of the corona virus (COVID-19) pandemic, people eschewed ornamental plants and turned toward basic food and hygiene products. As such, the ornamental plant sector was negatively affected by the situation. It has also been stated that, as people have come to terms with the quarantine in 2021 and the arrival of spring, the demand for ornamental plants has begun to increase. During the pandemic period, the use of ornamental plants in people's homes, gardens, and balconies has grown considerably. People's desire for a piece of nature in their homes has increased the demand for ornamental plants. Due to the lockdown of many countries borders, the export of ornamental plants has declined precipitously and the imports to Turkey to stop. Süsbir's Chairman of the Management stated that: "Just as the sales stopped when the doors were closed, our exports grew rapidly after the curfew was lifted and borders were opened." An increase

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in the demand for the ornamental plant sector in 2021 due to the fact that ornamental plants are an alternative therapy method (Url, 1).

### **EFFECTS OF ORNAMENTAL PLANTS ON ENVIRONMENT AND HUMAN RELATIONS**

Ornamental plants can be divided into four groups: outdoor ornamental plants, indoor ornamental plants, cut flowers, and natural flower bulbs, depending on the usage. The positive psychological effects of outdoor ornamental and indoor ornamental plants on humans has also been noted in the literature. Some of the more remarkable research will be noted here. Montacchini et al. (2017) have determined that indoor ornamental plants play an important role in the psychological health, comfort, and physical health of the occupants as well as the quality of the space. Also, Sezen et al. (2017) determined that plants used indoors in Erzurum have a positive effect on the psychology of individuals, while it has been reported that indoor plants bring vitality to the environment, change the atmosphere, and eliminate monotony. In many studies, it has been stated that ornamental plants used in indoor spaces provide psychological, aesthetic, and physical benefits (Ulrich, 1981; Ulrich, 1991; Ulrich & Parsons, 1992; Ulrich & Simons, 1986). Bringslimark et al. (2007) reported that indoor ornamental plants have psychological benefits in the workplace. Studies on outdoor ornamental plants usually pertain to the green area effect as a whole. Van den Berg et al. (2010) reported in another study that green areas and ornamental plants provide significant psychological contributions to human life.

### **CONCLUSION**

Ornamental plants are an important sector in Turkey as well as in the world due to the fact there is an innate need for green spaces that cannot be filled by any other substance (Yazici and Gülgün 2016a; 2016b). As the living spaces of people are more and more restricted with the increase in population, ornamental plants have come to the fore as an indispensable resource that keeps people dynamic and connects them to life, both indoors and outdoors. The ornamental plant sector as a whole is trying to expand and strengthen its place in its plant production and trade by using its advantages of cheap labor, climatic characteristics, and regional proximity (Süsbir, 2020). The fact that developed countries have very large production areas, record production values, and the quality of their products make it difficult for developing countries to compete in the ornamental plant sector. In Turkey, on the other hand, significant increases in the number of production areas have occurred in all fields of activity in the ornamental plants sector, exports have increased, products have started to diversify and significant developments have been made in the search for alternative markets.

During the pandemic, economic fluctuations have occurred in the ornamental plants sector, as they have in most facets of life and business. However, as people have grown to seek a bit of nature for their homes, ornamental plants have once again become valuable. Cloistered in their homes, people tend to live a solitary existence instead of having a social life. People who spend time at home and on the balcony are oriented towards indoor ornamental plants, and those who have a garden, outdoor. Campaigns associated with the pandemic in the ornamental plants sector are attracting consumers. Unfortunately, the fact that consumers do not know how to grow plants and are worried about wilting causes them to abstain from buying ornamental plants. In order to prevent this situation, it is necessary to provide information on the guarantee, care, and requirements of the plants. Safe shopping for people and ensuring that their plants will not dry out within 15 days are factors that will increase demand.

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**O 30. THE REFLECTIONS OF COVID 19 PANDEMIC ON URBAN LANDSCAPE**

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**ABSTRACT:** City also known as living space where social life is maintained is also the most powerful expression of civilization. As stated in many literatures, space is a whole in the urban system or a multi-dimensional view of the environment which is formed by buildings, perceived by the citizens. City are related all urban events. With the emergence of the Covid 19 pandemic, curfews were imposed in Turkey. This situation caused areas with high human circulation in the urban area to be empty. In this study were emphasized situation and spatial characteristics of parks, squares, gathering and resting areas where social life continues, during the quarantine of Covid 19 pandemic.

**Keywords:** *Visual quality, Pandemic, Social Areas, Urban Areas*

**INTRODUCTION**

Differences in social customs and traditions are also reflected in urban spaces. Therefore, behavioural differences arise in the urban space and spaces are shaped accordingly. People play the most important role in reviving city squares. If the square has enough activity, it will be noticed by people. Because the actions of the people contribute to the vitality of a square rather than the number of people in the square ( Berleant, 1992; Gülgün et al., 2014; Gülgün et al., 2015). For example; A small group singing in one square adds more action to the square than the same number of people sunbathing on the grass in another square. With a rich variety of activities such as sales units, exhibition areas, concert and show platforms, various viewing and seating spaces offered in the square space, it is ensured that the space can be used in all aspects and become a living space. With the activities taking place near the pedestrian axes connected to the square and the entrances and exits of the square, people will have the chance to shift their coming and going activities towards activities that will relax them more (Cakçı and Çelem, 2009; Polat, 2012; Temizel et al., 2017). For the user group; It is important to include areas consisting of having a good time, visual quality, comfort, variety of functions, activities where they can spend their leisure time and not get bored. Thus, it will also be possible to revitalize urban life (Uçak 2000; Çakçı and Çelem, 2009; Aşur and Alphan, 2018; Yazici and Gülgün 2017; Yazici and Ünsal, 2019; Yazici and A. Sağlamer, 2019).

The Covid-19 outbreak, also known as the corona virus, first appeared on November 17, 2019 in Wuhan, Hubei province of China. In the first periods of the epidemic, people did not think that there would be radical changes in their living conditions. The Covid-19 pandemic profoundly affected urban life. The Covid-19 pandemic, also known as the corona virus, first appeared on November 17, 2019 in Wuhan, Hubei province of China. In the first periods of the pandemic, people did not think that there would be radical changes in their living conditions.

It was declared as a global pandemic by the World Health Organization on March 11, 2020, due to the spread rate of the epidemic being 2.5 times more than other epidemics and the serious negativities it caused. As a result, this epidemic, which has a global impact, has caused changes in many areas, especially in health, education, economy, consumption behavior and social life.

While wearing a mask has become mandatory in many countries, restrictions have been imposed on social areas such as restaurants, cafes and cinemas. In the Covid-19 pandemic process, people go to individualization with concepts such as home, indoor space, isolated environment. For this reason, landscape areas such as squares and parks where social life is active in cities have been emptied due to restrictions. In this study, the relation of landscape perception with human density was evaluated. In the study, empty squares and parks were evaluated.

## MATERIAL METHOD

The main material of this study was 15 photographs and satellite images of various city parks and squares. First, a justification for the use of photographs as research material was given, and then the factors considered in the selection of photographs were explained. One of the most used methods in environmental preference studies is photography and slide shows. This method provides many advantages to the researcher both in terms of time and economy (Daniel,2001; Çakçı and Çelem, 2009).

**Table 1.** The codes of the images evaluated

		
<b>Figure 1-İstanbul</b>	<b>Figure 2-İstanbul</b>	<b>Figure 3-İstanbul</b>
		
<b>Figure 4-İstanbul</b>	<b>Figure 5-Antalya</b>	<b>Figure 6- Antalya</b>
		
<b>Figure 7- Bursa</b>	<b>Figure 8-Eskişehir</b>	<b>Figure 9-Tekirdağ</b>
		
<b>Figure 10-Manisa</b>	<b>Figure 11-Antakya</b>	<b>Figure 12-Bursa</b>
		
<b>Figure 13-Konya</b>	<b>Figure 14-Elazığ</b>	<b>Figure 15-İzmir</b>

Used sources for figures Url 1 Url 2; Url 3; Url 4

Thanks to photographs and slides, it is possible to sample many different physical environments. However, they make it easier to control and maintain the conditions of the physical environment (eg weather conditions, light conditions, etc.). One-to-one studies in the field are often uneconomical. In

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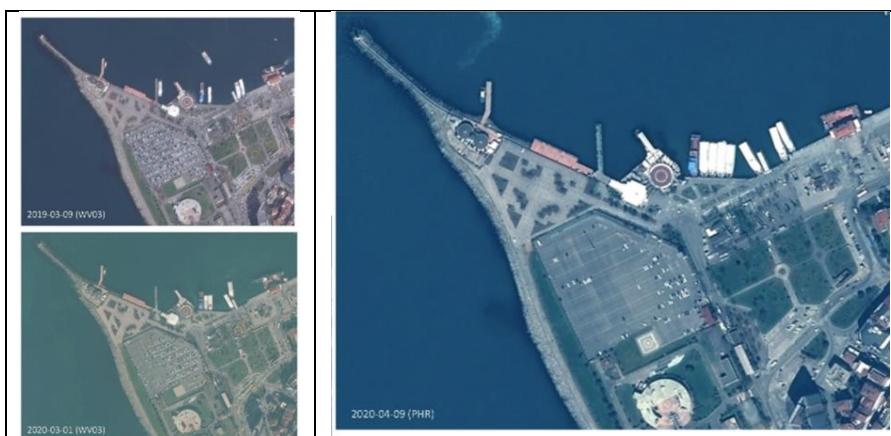
terms of time and working speed, it may be possible to arise adverse conditions for the researcher. In obtaining the literature for the study, environmental psychology, landscape planning, landscape design, urban planning and urban design, covid-19 and landscape issues were researched. Spatial characteristics with expert opinion; regular complex; open closed, well maintained, neglected, simple variety was studied in figures.

## **RESULTS**

Considering the effects of the presence of natural elements in the space on the space preferences, it is concluded that the presence of natural elements, in other words vegetal material, is dominant in the most admired images. This result was consistent with the results of the biological-evolutionary theories described under the Theoretical Bases section of the study and the results of other studies (Schroeder 1982, Nasar 1992, Kaplan et al. 1998). In many studies, individuals prefer places where natural landscape elements are predominant rather than places where structural elements are dominant. In the expert evaluation of the least preferred images, it was concluded that structural elements were dominant. The landscape perception of Turkey's busiest squares, streets and beaches, viewed via satellite after the Covid-19 outbreak, by Istanbul University TÜ Satellite Communication and Remote Sensing Center was given in Figure 1.



**Figure 1.** AŞTİ terminal, Ankara, Turkey in Covid-19 pandemic (Url 1)- (before and after)



**Figure 2.** Kadıköy Coast in Turkey in Covid-19 pandemic (Url 1)- (before and after)

As seen in the satellite images (Figure 2), the landscape areas before the pandemic was not reveal the legibility criterion in the landscape due to the traffic, people and vehicle density. However, with the restriction, attractiveness and legibility criteria come into prominence in areas with landscape value.

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**Table 2.** Evaluation of figures arising in Covid 19 restrictions

	Spatial characteristics.							
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
R1	x		x					
R2	x		x					
R3	x		x					x
R4	x		x					x
R5	x		x		x			
R6	x		x		x			x
R7	x		x					
R8	x		x					
R9	x		x					
R10	x		x					
R11	x		x					
R12	x		x					
R13	x		x					
R14	x		x					
R15	x		x					x

1:Regular, 2:Complex, 3:Open, 4:Close, 5: Well maintained, 6: neglected, 7: Simple, 8: Variety

## **CONCLUSION**

- The existence of a certain level of innovation in the spaces positively affects the preferences of the spaces (Kaplan et al., 1998; Clay and Danie, 2000). For this purpose, it is recommended that planners and designers create different compositions that will arouse the interest and curiosity of the individuals by preserving the character of the space, instead of repeating designs and space organizations in space arrangements.
- Places with a high level of consistency are preferred more. One of the ways to increase the coherence level of a space is spatial compositions in which similar landscape elements or land use types are used in the area (Roth,2006).
- Places with high legibility level are more preferred. Increasing the level of legibility will enable the user to easily find his way or target in a place. For this purpose, triangulations (original focuses) can be used in the space. However, as a result of the frequent repetition of these elements, they will lose their focal point and cause confusion in the field.
- Another preference factor is that the place is well-maintained. After the design and planning studies, maintenance operations and management strategies of the area should be determined during the design and planning process in terms of preserving the character and quality of the space.
- Using natural landscape elements (plant materials) rather than structural landscape elements will both contribute to the city in an ecological sense and increase the preference of the space based on the results of the research.

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**O 31. THE ANALYSIS OF THE CONSERVATION PROCESS AND THE USE OF THE GEDIZ DELTA FROM ECOLOGICAL AND ECONOMIC ASPECTS**

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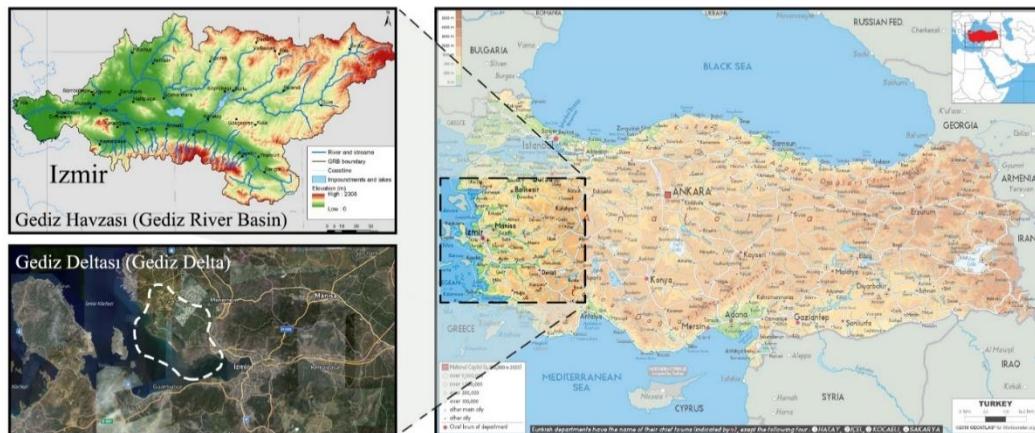
**ABSTRACT:** The Gediz River, which is approximately 401 km long, forms the Gediz Delta with an area of approximately 400 km<sup>2</sup> in the region where it flows into the Gulf of Izmir. Gediz Delta is one of Turkey's largest wetland ecosystems. It is also protected by the Ramsar Convention. Gediz Delta, which has both national and international value, is a major water resource and an environment with high biodiversity. In addition, it is a region where agricultural and industrial activities are carried out. This study aims to discuss the biological functions and economic importance of the Gediz Delta and to mention the preservation process and its current use.

**Keywords:** The Gediz River, Gediz Delta, biological function, economic importance, use of Gediz Delta, Izmir

**INTRODUCTION**

Gediz Delta is one of Turkey's most important wetland systems located in the Aegean Region. This Delta was formed when the alluvium carried by the Gediz River filled the Gulf of Izmir. This delta, which has an area of approximately 400 km<sup>2</sup>, is the largest delta on the Aegean coast in Turkey (Erinç, 1955 as cited in Tiril, 2005). A large part of this area is Natural Site, some of it is in the status of Wildlife Protection Area (Tiril, 2005). This delta, 8000 hectares of which was declared as a Wildlife Protection Area in 1982; It was declared a Ramsar Area in 1998, and then a First-Class (First-Degree) Natural Site in 1999. (Ünal, 2013).

Approximately half of this delta consists of urban and rural settlements and fertile agricultural areas threatened by industrial facilities, while the remaining half contain wetland systems (Tiril, 2005).



**Figure 1.** Gediz River Basin and Gediz Delta Map

**USE OF THE GEDIZ DELTA**

It is possible to see rapid industrial development in this area with high agricultural potential (Kocataş, et al., 2000 cited in Gündoğdu et al., 2007). In addition to having biological diversity and productivity, which are characteristics of wetlands, this area; It comes to the fore with its

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hydrological functions, economic production, and recreation functions. It carries economic values through ways such as salt production, fishing, and ecotourism (Tiril, 2005).

### **Biodiversity and Productivity**

The delta is located where the Gediz River, passing through 4 cities, flows into the sea. It also hosts many creatures in the wetland ecosystem. The main environments that make up the habitat diversity of the area; shallow shores, salt pans, estuaries, old riverbeds and canals, salt-wet meadows, freshwater meadows and reeds, scrub and forested hills, agricultural lands, and rural settlements. In terms of species diversity, includes many living groups such as phytoplankton, zooplankton, aquatic plants, fish, amphibians, birds, and mammals. (Tiril, 2005). The most important reasons for the delta to host many living creatures; rich minerals in the materials carried by the streams, nutrients, and providing suitable shelter conditions (Özkırı and Ürker, 2012; Alevkayalı and Tağıl, 2018). Çamaltı salt marsh, Kırdeniz, Homa, Çilazmak lagoons and Kuş Cenneti (İzmir) of great importance are included in this ecosystem (Yılmaz and Erdem, 2011; Alevkayalı and Tağıl, 2018; Yazıcı, 2019). It is stated that the number of bird species in the delta has reached 290 (İZKUŞ, 2013; Alevkayalı and Tağıl, 2018). It is home to an internationally endangered Dalmatian pelican (*Pelecanus crispus*) and 142 endangered bird species (Sıkı, 2002; Alevkayalı and Tağıl, 2018). Due to the abundance and variety of birds, it has been known as Izmir Kuş Cenneti (Bird Sanctuary) since 1991. (Ünal, 2013). Ünal (2013), It emphasizes the richness of Gediz Delta in terms of species diversity as follows: "Most of the delta and the sea border consists of sand bands covered with sea beans (*Salicornia europaea*) and mussel shells. Every year in the delta, thousands of pairs of seabirds incubate in the sheltered mud islets. Sandwich tern (*Thalasseus sandvicensis*) only in the Gediz Delta in Turkey. In addition, the region is also one of the five areas where this species regularly breeds on the Mediterranean coast. Important mammal species in the area are jungle cats (*Felis chaus*), Mediterranean monk seals (*Monachus monachus*) and otter (*Lutrinae*). " In this regard, Yılmaz and Erdem (2011) stated the following: "There are many lagoons, saltwater and freshwater marshes, as well as the Bird Sanctuary, which is of great importance for ornithotourism, within the delta with a large salt. Having a rich variety of species in terms of flora and fauna, the delta is extremely important for the sustainability of natural life." "Approximately ten percent of the world population of flamingos live in the Gediz Delta of Izmir. It is one of the rare areas where the Dalmatian pelican, Mediterranean monk seal and Caretta caretta sea turtle live together." (Doğa Derneği, 2020). The high photosynthetic production value increases the efficiency of the delta; photosynthetic production increases the living environment value of the delta and provides abundance of nutrients (Tiril, 2005).



**Figure 2.** Flamingos observed in the Gediz Delta (Hellio and Van Ingen akt. Doğa Derneği, 2020)

### **Preserving and Improving Water Quality**

Flowing through Kütahya provincial borders, passing through Uşak and Manisa provinces and pouring

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into Izmir Bay; Gediz River, which is approximately 401 km long, meets the water needs of the basin and Izmir. The river has a 17500 m<sup>2</sup> drainage basin. 12.4% of the water amount in Turkey is in the Gediz River Basin. (Gündoğdu et al., 2007; Ankaya et al., 2018; Gülgün et al., 2014; Gülgün et al., 2017). Delta provides protection and improvement of water quality, which is one of the tasks of wetlands. The Gediz Delta is important in filtering the pollution that does not exceed its carrying capacity, absorption of chemicals, sediment control, oxygen generation, absorption of nutrients and food chain, preservation and improvement of water quality. (Tırıl, 2005).

### **Providing Matter Loops**

Due to the winds and high evaporation rate in the Gediz Delta, the delta has a different microclimate than the general area. In this respect, it provides the climate balance in the urban and industrial ecosystem. There are salty wet meadows that make up the shores of the delta. It also contributes to the cycle of the oxygen produced by green plants and the water evaporating from large water surfaces in the system. They are also important resources that contribute to the nitrogen cycle, sulfur, and carbon cycle by reducing nitrate-nitrogen (Tırıl, 2005).

### **Flood and Flood Risk Reduction**

Wetlands absorb excess water, stabilize the water level and prevent floods. In addition, it has an important role in enriching groundwater by transmitting the water they absorb to the underground. (Tırıl, 2005). As seen in the Atatürk Organized Industrial Zone in the Gediz Delta, ground subsidence has been observed with the withdrawal of groundwater because of the damage to the area (Onmuş, et al., 2002; Tırıl, 2005).



**Figure 3.** Gediz Delta (İz Gazete, 2020)

### **Aquaculture and Salt Production**

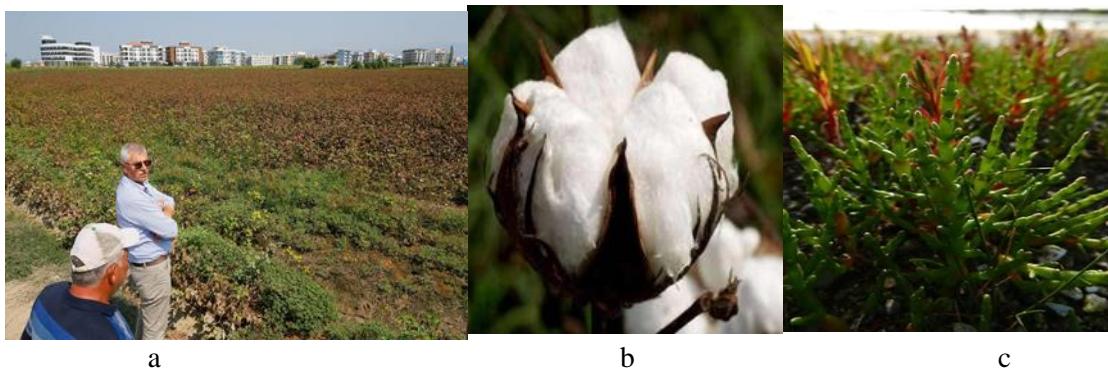
Due to factors such as the abundance of nutrients in wetlands, the rapid warming of shallow waters, and serving as a shelter for many living creatures, Gediz Delta; is a very suitable region in terms of aquaculture production. Fishing is an important source of income for the people in regions with high aquatic life (Tırıl, 2005). The second-largest salt production center in Turkey after Salt Lake is Çamaltı Salt marsh located in Gediz Delta. More than 500,000 tons of salt are produced annually here, and both table salt and industry salt needs are met (Tırıl, 2005).

### **Agriculture**

Wetlands, especially deltas, are known for their agricultural richness. It is fertile soil for cotton (*Gossypium spp.*) and various vegetables. Viticulture and olive cultivation are important sources of income as one goes towards the inner parts of the deltas. Pasture areas play an important role in animal husbandry (Tırıl, 2005). Sea beans (*Salicornia europeae*), grown in the delta are an important food in

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Aegean cuisine. This delta, which provides a source of food to humans thanks to the sea beans, also creates a shelter for many creatures in areas where the plant is together and a breeding environment for many bird species. (Tırıl, 2005).



**Figure 5.** **a** Menemen Plain, **b** Cotton (*Gossypium spp.*), **c** Sea beans (*Salicornia europeae*) (Url 1;  
Url 2; Url 3)

**Recreation and Tourism**

Gediz Delta has many recreational and tourism potentials such as hiking, cycling, horse riding, fishing, bird watching, photography, and agricultural tourism. This area, where urban people move away from daily stressful life, can interact with natural wealth, is a value that has the potential to provide physical and spiritual satisfaction. (Tırıl, 2005).



**Figure 4.** Gediz Delta (dogaaskina.org, 2020)

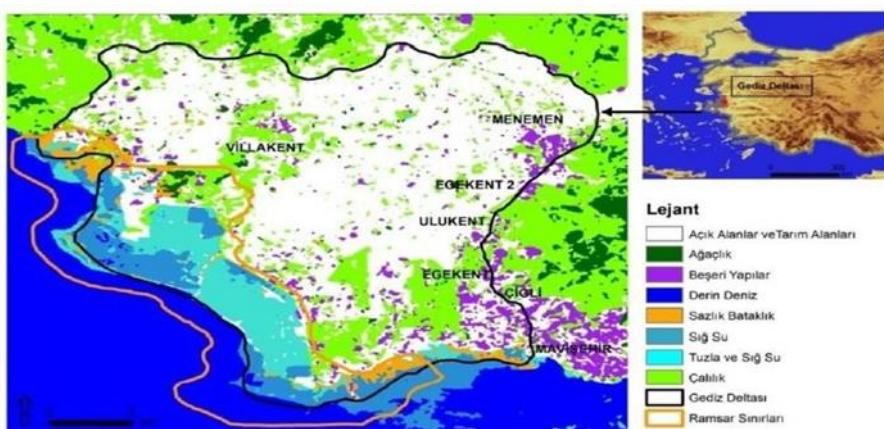


**Figure 6.** (İz Gazete, 2020) Figure 9. Mavişehir - Gediz Deltası proje görseli (İzmir Büyükşehir Belediyesi, 2018)

The following is stated on the website of Izmir Metropolitan Municipality about the Mavişehir - Gediz Delta project, which is planned to be realized within the scope of Horizon 2020 (2018): "Environmentally-friendly solutions will be developed to eliminate the negative effects of urban air temperature in and around Mavişehir Region, where urban development, which is thought to be most affected by climate change, is intense, reducing the risks of sudden floods and make Peynircioğlu Stream more accessible to the public."

## GEDIZ DELTA PROTECTION PROCESS AND USE STATUS

Çamaltı Salt Marsh, which is the first protected area in the delta, and the area that constitutes 1/3 of the wetland was obtained by the Ministry of Agriculture and Forestry General Directorate of Forestry as "Water Birds Protection and Breeding Site" in 1982. This area is currently in the status of "Wildlife Protection Area". In 1985, a small area in the Gediz Delta by the Ministry of Culture and Tourism; I. and II. It has been declared a Natural Site. (Tırıl, 2005). "İzmir Master Plan dated 1973 has chosen Gediz Delta as an urban-industrial development area (Kaplan, et al., 1997), The implementation of plan decisions accelerated in the 1990s." (Tırıl, 2005).

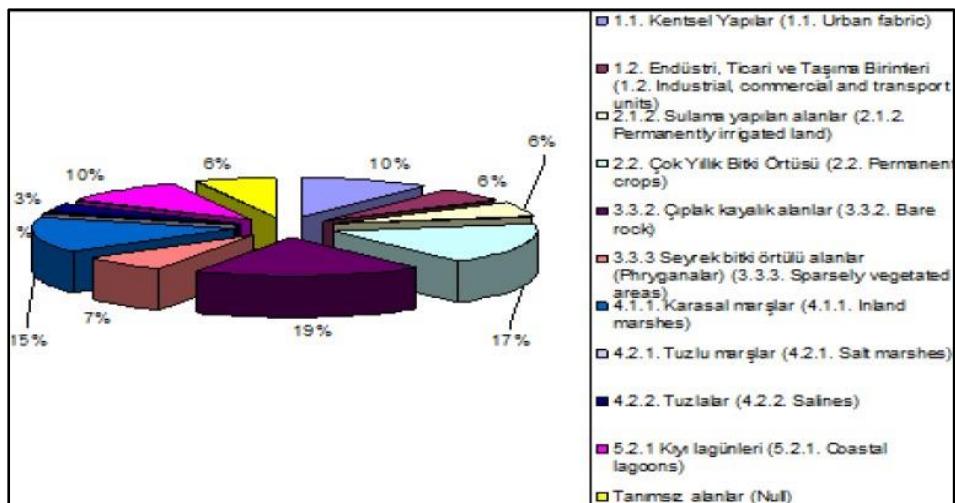


**Figure 7.** Gediz Delta area and borders of Ramsar (Alevkayalı and Tağıl, 2018)

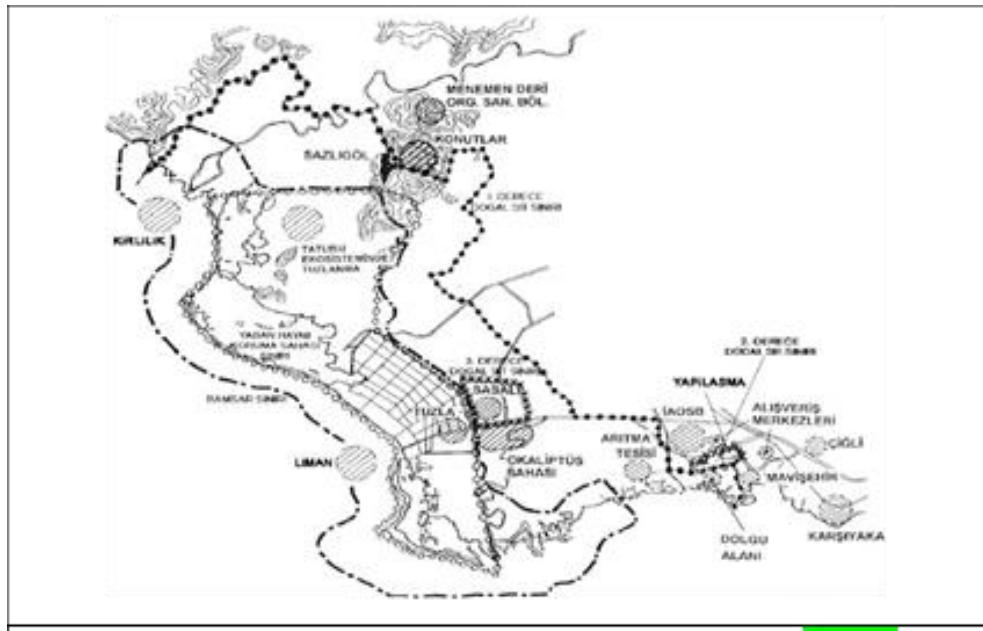
Yılmaz (2011), Today's Gediz Delta has classified its usage areas as follows:

"It has been determined that the total area of urban structure, industrial, commercial, and transportation units constitutes 16% of the total area with an area of 12570 ha. The sum of irrigated agriculture areas and perennial vegetation areas, which constitute agricultural use, was determined to be 18107 ha. It has been determined that areas with sparse vegetation (frigana), which are extremely important for the continuation of natural life, cover an area of 7% with an area of 5218 ha. It has been determined that the total area of the terrestrial, salty, and coastal lagoons, which are important as wetlands, covers an area of 20020 ha. Considering that the amount of wetland, which constitutes 26% of the entire area, may change seasonally, it should be noted once again that these data are for September 2007." The area was declared a Ramsar Area in 1998 and a 1st Degree Natural Protected Area in 1999 (Ünal, 2013)

Considering the historical process, it is seen that construction interventions towards deltas are also applied in Gediz Delta. Almost all the interventions such as changing the direction of the stream, drying works, and accumulation of dredging materials in the terrestrial environment has been implemented in the Gediz Delta. The river in the form of a residue that emerged because of changing the delta was filled, and Izmir Ataturk Organized Industrial Zone was established in this area in 1980 (Alevkayalı and Tağıl, 2018). The negative effects of the conservation efforts in the past on the area, as well as the industrialization and urbanization phenomena, continue today. This negatively affects the land and poses a threat.

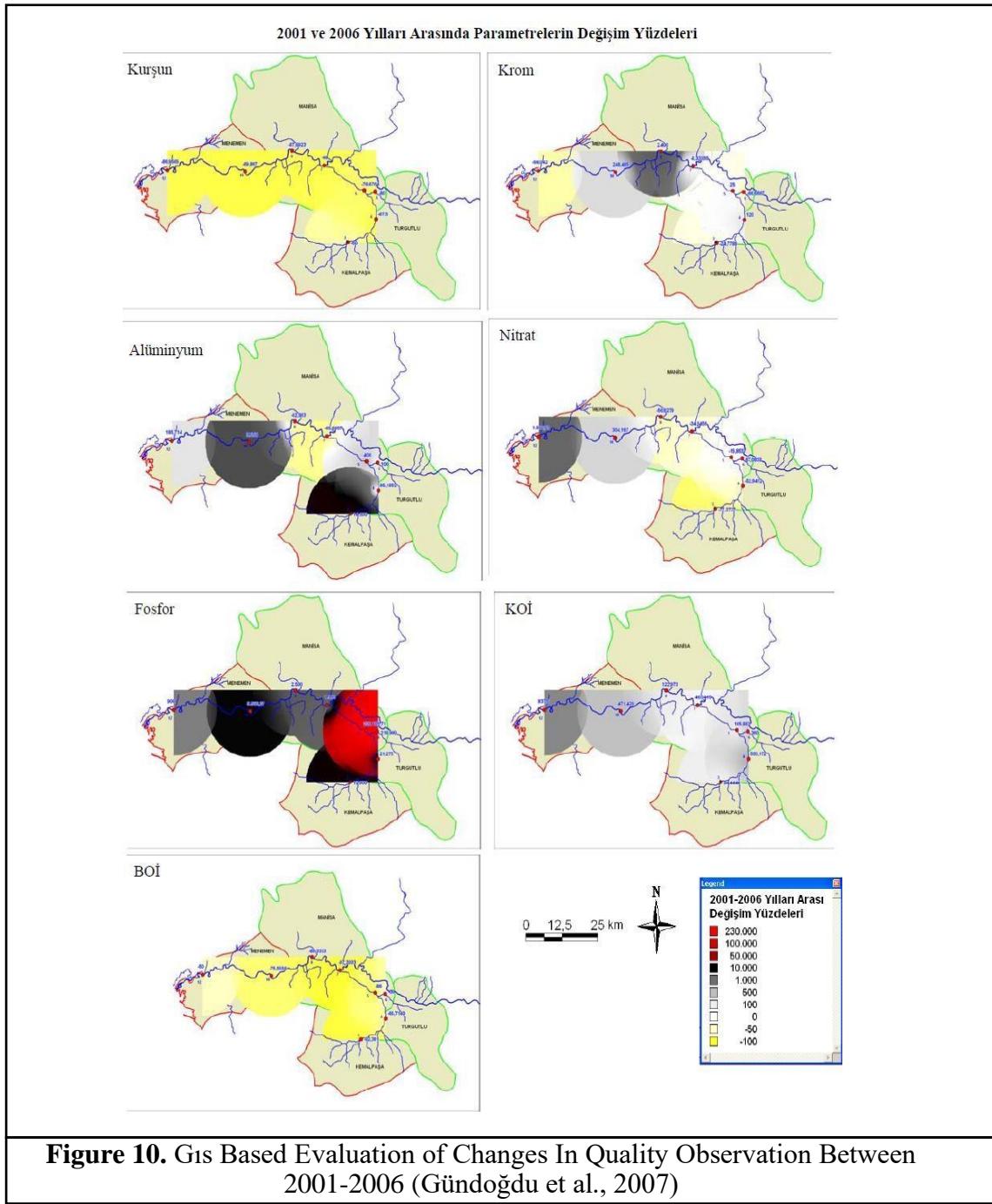


**Figure 8.** Usage areas distribution (Yılmaz, 2011)



**Figure 9.** Protection areas and major threats in Gediz Delta (Onmuş, et al., 2002 cited in Tırıl, 2005)

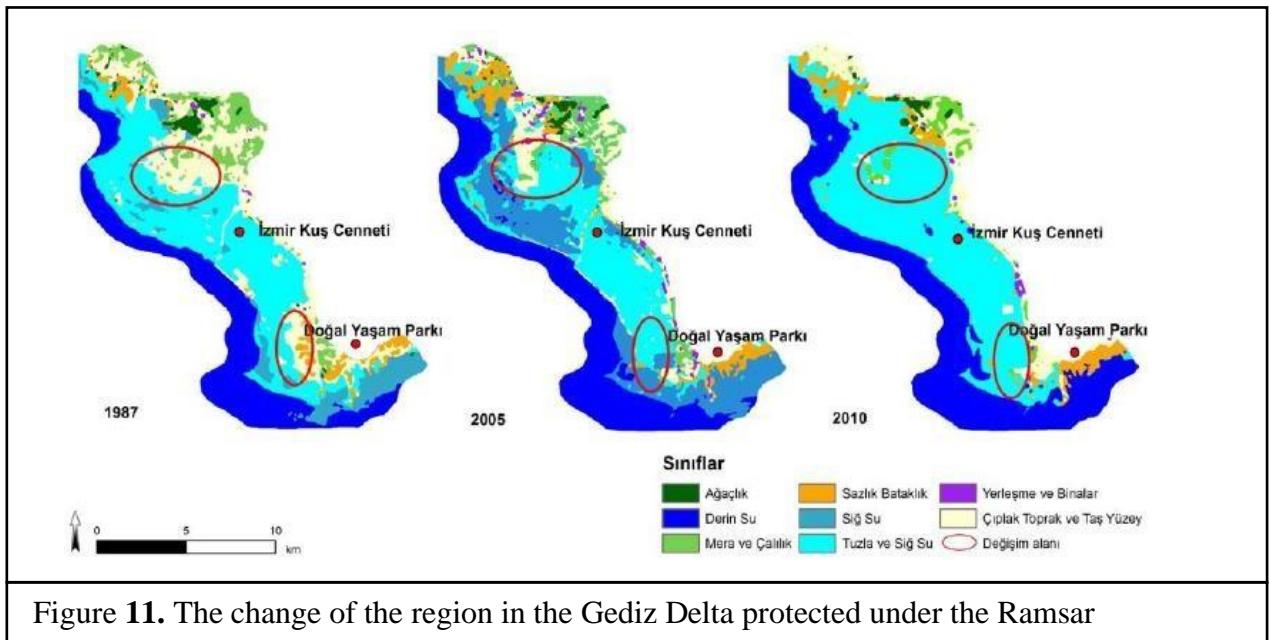
The Gediz River carries many domestic, industrial, and agricultural wastewater from Kütahya until it pours into Izmir. Nif Stream, coming from Kemalpaşa Plain, is the most polluted area. This pollution adversely affects the wetland ecosystem (Anonim, 1997; Gündoğdu et al., 2007) Gediz River significantly increases the pollution because of the domestic, industrial, and agricultural facilities discharging their wastewater to the river. In order to prevent this destruction, it is aimed to determine and prevent the pollution in the part of the Gediz River within the borders of Izmir with the project initiated by the Izmir Metropolitan Municipality IZSU General Directorate. Within the scope of the project, the stage of establishing the geographic database of the basin by creating an Environmental Information System was realized. With the model created with the GIS technique, many data, especially pollution data, were collected from the region and some results were obtained from the analysis of these data (Gündoğdu et al., 2007).



**Figure 10.** Gis Based Evaluation of Changes In Quality Observation Between 2001-2006 (Gündoğdu et al., 2007)

Gündoğdu et al. (2007) The study concluded that:

"Inorganic pollution in the Gediz River is quite high, and the river water quality is around the worst quality, 4th class water quality. However, it has been determined that other pollution prevention works, especially treatment facilities and infrastructure, carried out by the Izmir Metropolitan Municipality IZSU General Directorate in the basin are effective. In addition, it has been proved by the decreases seen in pollution parameters in 2006." Alevkayali and Tağlı (2018), in their study, they talked about the tragic land losses in the area. They stated that land losses are seen in reeds, bare soil surfaces, and shrubs, emphasizing that this loss is 35% of the total area. Land losses occur in the form of extinction or turning into salt marsh.



**Figure 11.** The change of the region in the Gediz Delta protected under the Ramsar Convention between 1987-2010 (Alevkayalı and Tağıl, 2018)

They stated that one of the uses that negatively affect the area is the high-rise buildings nearby Alevkayalı and Tağıl (2018). In addition, the presence of the Izmir Wildlife Park on the Gediz Delta has seen another factor threatening the continuity of the ecosystem in the delta.



**Figure 12.** Buildings close to the delta, a photo where flamingos can be seen (Alevkayalı and Tağıl, 2018)

## CONCLUSION

Gediz Delta is an ecosystem of great value both nationally and internationally. The area, which hosts many living species, is also a water source. In addition to its ecological features such as keeping the climate balance in balance, it is important in terms of economy and production. In addition to production based on water resources such as fishing, salt production; agriculture is carried out in its fertile plains and livestock breeding in its pastures. Despite all these areas of use, the area has been subjected to many damages such as loss of land, salinization in the soil, water, and soil pollution. Since Gediz Delta is located near a big city like Izmir, it offers people the opportunity to integrate with nature.

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The delta, which was declared a Ramsar Area in 1998 and a 1st Degree Natural Protected Area in 1999, is one of the leading wetland ecosystems that need to be protected in Turkey.

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**O 32. THE DETERMINATION OF ALOE VERA PLANT CULTIVATED IN ARID AREAS  
AND ITS APPLICATION IN LANDSCAPE ARCHITECTURE**

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**ABSTRACT:** Natural resources have been led to be disappeared gradually from the surface of the earth by time, besides, the increase of drought caused by warming of the ground has also happened. The applications used in landscape architecture have some problems such as gradual decrease in the number of natural water reserves, insufficient water in agricultural fields. In this case, since there has not been much solutions found for applying against desertification issues, the need for the application of Landscape Architecture methods such as designing of new irrigation schemes, consideration of some soil measurements and studying of plants grown in arid areas especially Aloe Vera, as the most important part, are very essential methods which have been taken to account. In this study, Aloe, which is a very valuable aromatic plant as well as a useful plant in landscape architecture, has been considered and 56 species of this plant cultivated in Izmir city of Turkey has been evaluated in the point of landscape architecture.

**Keywords:** *Aloe, Arid Landscape, Landscape Architecture, Natural Resources*

**O 33. WINTER GARDENS**

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**ABSTRACT:** The term of winter garden winter gardens has started to emerge with the increase in construction and the gradual decrease in our ability to touch nature. Winter gardens are an important opportunity to reduce the stress and fatigue brought about by intense living conditions. It will be easier for us to increase morale and motivation in our lives with winter gardens. Within the scope of this study, information will be given about the meaning, importance, design criteria, styles of winter gardens, and place selection in winter gardens. In addition, information about plants that can be used in winter gardens will be given and sample winter garden visuals will be included.

**Keywords:** *Landscape, Winter plants, Greenhouse*

**INTRODUCTION**

Winter gardens can have a design associated with not only hobby spaces, greenhouses, but also living and resting rooms. Winter gardens, which are mostly seen in houses, are intertwined with sitting groups. The reason for this is the desire to spend time in nature (Gülgün et al., 2014; Yazici et al., 2018). Winter gardens built with the aim of hobby gardens and greenhouse cultivation are more functional applications in terms of land use. It often appears as designs that are directly linked to the home (main building). Most of the winter gardens designed independently from the main building function as greenhouses and hobby gardens. One of the most basic features of winter gardens is that it takes the light directly into the space. Thus, while providing the light that plants need, it protects the environment from adverse weather conditions outside.

Winter gardens are a type of garden that allows people to approach nature in all seasons, where we can enjoy open air during the summer and spring months and communicate with the environment during the winter months. Glasses used instead of walls in winter gardens bring the house and people together with the garden and provide psychological relaxation by being together with the nature, which is the essence of the human being. At the same time, winter gardens, where you can spend pleasant time with the family, provide great comfort to family life.

**WINTER GARDEN**

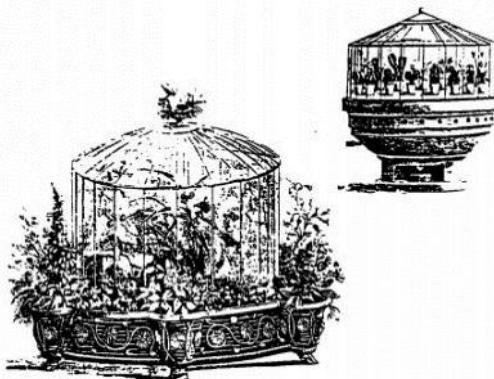
The winter garden is a living space that is located between the house and the garden, created in order to live the garden and green feeling in cold seasons and to protect the plants from the cold, more than one third of the roof area and more than half of the side surfaces are made of transparent material. These places have emerged as a combination of people's desire to benefit from solar energy and be in touch with nature. Winter gardens are places where the aesthetic and recreational needs of people and the functional use of the sun are provided (Özkır, 2004).

Winter gardens protect plants and green tissue from the negative effects caused by external effects and are transparent spaces whose basic material is glass, transparent plastic, etc., which aims to carry the green texture that human beings always need to the interior. (Durmus, 2006).

Winter gardens, which were designed to protect plants that are not resistant to cold in previous years, have now become a part of the interior and are designed as different areas of use.

## **HISTORICAL PROCESS OF WINTER GARDENS**

Winter gardens first emerged in Europe with the desire to grow various plants in times and places without season and climate. The first reason for this phenomenon to occur is to create an artificial environment for plants and keep them alive in different seasons. Early winter gardens created for this purpose are found in Greece in the 5th century before Christ. The gardens called "Garden of Adonis", designed to keep plants alive in all seasons, are regarded as the first winter gardens. After the 16th century, winter gardens have become an increasingly important place, especially in France. The search for new solutions in order to grow vegetables and fruits that are not out of season in all seasons has enabled the design of ovens that will guide today's greenhouses. These cellars, which were developed to be able to grow all kinds of flowers and plants in all seasons before winter gardens and buried in the ground, are called "ovens", which are considered the ancestors of today's greenhouses. The first of the ovens developed for this purpose was built in 1624 in the garden of Versaille Palace, in cellars buried in the ground. (Durmus, 2006).



**Figure 1.** (Uysal,1997)

In the 19th century, winter gardens began to be used in daily life as a symbol of luxury life and associated with housing, as well as plant growing activity. With the advancement of technology, winter gardens of various types and characteristics, adjacent to the building or serving different purposes of use, started to be created. Winter gardens are not limited to private residences, but are built for most of the public. The first large conservatory was built in Regent's Park in London in 1842–46 and was used in the evenings, large flower shows and social gatherings. Other winter gardens, such as Sir Joseph Paxton's Crystal Palace in 1851, were soon built and used for various purposes. (Arik, 2020).

## **The Emergence and Development of Modern Conservatories**

With the industrial revolution, important progress has been made in the field of winter gardens, as in all areas of the building sector. The materials used in the construction of the winter gardens have begun to change, and new roof systems have been developed, which are stronger than the old construction systems. Walls were built on certain parts of the building to cut off excess light. Ventilation systems have been developed in the ceilings in order to eliminate the dirty air created in the interior. The ventilation in the summer months was provided through the windows opening to the exterior, as before. The history of winter gardens, which first appeared as conservatories in Europe, dates back to the 17-18th centuries. One of these examples is the former headquarters of the Worcester Horticultural Society, the "Tower Hill" botanical garden in Boylston, Massachusetts, which was incorporated in 1842.



**Figure 2.** CrystalPalace inside view

One of the most important examples of the 19th century is the Crystal Palace structure, which was designed by architect Joseph Paxton in 1851 in the Sydenham region. It is a structure that has gone beyond its period in terms of technology and technical details.

### **The Emergence and Development of Winter Gardens in Turkish Society**

The application of winter gardens started in the first half of the 19th century in the Ottoman Empire. The purpose of use of the buildings, which were originally built to grow plants, has changed over time. The first known example of winter gardens in the Ottoman Empire is the "Limonluk (Lemon Garden)" in the Maslak Pavilions.



**Figure 3.** Maslak Pavilion and Lemon Garden

### **WINTER GARDEN STYLES**

Winter gardens should be in harmony with the architectural style of the main building and integrate with that building, whether as an extension of an existing building or independent of the existing building. Macro and micro climate, main existing structure and budget are the main factors that are effective in choosing the place of the winter garden, creating its form and determining the materials to be used. (Özkır, 2004).

In group arrangements, the relations of the plants with each other should be compatible and in accordance with the basic design principles. A hierarchy of measurements should be made between tall plants and groundcovers. It should not be forgotten that the size of the plant will change over time. If a permanent effect is desired, mature plants should be used in the design. Plants that are not fragrant reduce the aesthetic value of the environment. Plants can be evaluated as an architectural element such as roof, ceiling, wall and barrier in the interior by using their properties such as volume, texture and color. When it is aimed to give the feeling of closedness in the space, the plants in round form should be placed in a way to enclose and define the space (Arik, 2020).

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### **Victorian Style**

Victorian-style winter gardens have a polygonal architecture rather than the usual rectangular living spaces. It adds a very romantic atmosphere to homes and gardens. It has glass roofs and windows, unlike the systems made by building walls from bricks.



**Figure 4.** Victorian Style Winter Garden (Url 1)

### **Nordic Style**

The minimalist style that dominates the decoration of Scandinavian countries can be easily reflected in the design of winter gardens. A warm atmosphere can be added to winter gardens by taking an idea from the Scandinavian lifestyle Hygge, which is based on creating a comfortable space in homes especially on winter days.



**Figure 5.** Scandinavian Style Winter Garden (Url 1)

### **Modern Style**

If the patio or terrace of the houses is covered, it is a very easy process to turn these areas into a winter garden. By choosing any of the closed balcony systems, the sides opening to the exterior facades can be closed practically. This winter garden design, which is frequently encountered in modern architecture, gives the feeling of continuation of the houses and helps to capture an intimate atmosphere.



**Figure 6.** Modern Style Winter Garden (Url 1)

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### **AIM AND DESIGN CRITERIA OF WINTER GARDENS**

Today, winter gardens appear in various forms and purposes due to the development of technology and the diversity of human needs. Winter gardens can be designed either by adding them to the buildings later or during the formation phase of the building. Winter gardens can be applied in various shapes, various colors and for various purposes depending on the user needs and flexibility of use. This differentiation of winter gardens creates the need for an arrangement according to the place where it will be constructed rather than the building. (Durmus, 2006).

#### **Form Criteria in Winter Garden Design**

- Goal
- Aesthetic
- Building and roof harmony
- Harmony with the garden
- Heading to the landscape
- Wind
- Non-residential location
- The angle the sun's rays make with the roof
- Harmony with the residential environment
- Accessibility from the house and garden
- Durability
- Permanence
- Light transmission, appears with the above titles.

#### **Winter Garden Approaches in Terms of Location Selection**

Winter gardens can be set up in very different places and directions in terms of location. They can be located on the north-southeast-west facades of the building, or they can be positioned separately from the building at the entrance of the building, on a flat roof in the building, in a space setting in the building, on open terraces or balconies, in the garden. Many factors should be taken into consideration when choosing a place inside or outside the building for the winter gardens. Some of these factors are the level of light reception, availability of the winter garden, aesthetics, external air balance, regulation of heat loss, lighting of the building. (Durmus, 2006).

#### ***Winter Gardens Outside the Building***

Winter gardens located separately from the building are not as useful and advantageous as the spaces built inside the building or adjacent to the building. As a matter of fact, winter gardens positioned separately from the building do not provide any benefit to the heating and enlightenment of the building. (Durmus, 2006).



**Figure 7.** Outdoor Winter Garden (Url 2)

#### ***Winter Gardens Inside the Building***

Winter gardens are frequently implemented within the building. Independent spaces can be allocated to winter gardens within the building, both in living spaces, on balconies and in roof spaces.

### ***Winter Garden as a Living and Recreation Space***

Living spaces where glass is used abundantly and where daylight penetrates too much are more relaxing and useful than other conventional forms. The ventilation of winter gardens used in living spaces is provided through doors and windows. Natural materials are used to make the floors simple and natural. For example, ties or carpets are used on floors. Along with these, many other flooring materials such as ceramic, stone, rubber or wicker are also found. In order to ensure naturalness in furniture, we focus on fabric-covered furniture as well as wood, iron, plastic, wicker or bamboo furniture. (Harding, 1995).



**Figure 8.** Winter Garden as a Living Space (Url 3)

### ***Winter Garden as a Bath and Sleeping Space***

Usually, the sleeping area and the bathroom are designed as a whole or arranged in the last floors or penthouses of private residences by providing a terrace or a hall passage in between. Frosted or filmed glass, stained glass or glass bricks are used to ensure privacy on the facades in cases where the bathroom and the sleeping area are designed one within the other. (Durmus, 2006).



**Figure 9.** Winter Garden as a Bedroom (Url 4; Url 5)

### ***Winter Garden as a Working Space***

The basic elements to be considered in a winter garden to be built as a working space; It is the creation of a useful and spacious environment for the daylight to illuminate the space correctly and adequately, creating an efficient and comfortable working environment. In winter gardens to be built in places where

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daylight is not sufficient, sufficient light level should be provided by using artificial lighting elements. In addition, in order to control the natural light entering the space, roller blinds, frosted glasses or film-drawn glasses can be used. In these spaces, flooring and wall materials are as important as light. (Durmus, 2006).



**Figure 10.** Winter Garden as a Working Space (Url 6)

### ***Winter Garden as a Kitchen***

By designing the kitchens as winter gardens, it is possible to make use of the interior space with more daylight. Thus, integrity is created between the interior and the exterior. While designing such a space, certain criteria should be taken into account as in other spaces. One of the most important of these is the cleaning of bad odors and dirty air that may occur indoors. While hoods or aspirators can be used in some places, this problem can be solved with doors and windows with a fan or natural ventilation method in others. (Durmus, 2006).



**Figure 11.** Winter Garden as a Kitchen (Url 1)

### ***Winter Garden as a Swimming Pool***

The fact that the pool is located in the winter garden ensures that this pool can be used in four seasons. Winter gardens are ideal places to use the swimming pool in all seasons in cold climates or regions with less hot months. Swimming pools can be designed within the building or independently from the building, together with the winter gardens. The most important factor in these spaces is the choice of material to be used in the flooring. Moisture resistant, non-slippery flooring materials should be chosen around the pool. (Durmus, 2006).



**Figure 12 (Url 7)**

### **Winter Gardens on the Balcony of the Building**

The most important feature of winter gardens in balconies is that they can be solved and used more easily in multi-storey buildings. When the winter garden resolved on the balcony is associated with the kitchen or dining room, it becomes more advantageous in terms of usage and functionality. (Durmus, 2006).



**Figure 13. Winter Garden on the Balcony of the Building (Url 8)**

### **PLANTS THAT CAN BE USED IN WINTER GARDENS**

While deciding on the use of plants in winter gardens, basic design principles should be used. The plant's measure, shape, texture, color, line, sequence, rhythm, balance, emphasis, composition and harmony features should be used appropriately (Arik, 2020). It should create a composition with the color of the plant material, surrounding elements (wall color, pattern, furniture, etc.) and the color of the plant container. Color selection should be made to strengthen the desired effect in the space (Arik, 2020).

Provided the appropriate environment is provided, it is possible to keep every plant alive in the winter garden. However, attention should be paid to plant selection. Fast growing and very tall plant species should be avoided. Stinging and poisonous plants should not be preferred in environments where children and pets are present.

The horizontal form plants to be used in the area where the winter garden is created are effective in gaining width, and vertical form plants are effective in gaining height. If the purpose of use is to create a more intimate and dark environment; They may prefer round-shaped plants that will completely surround the space. If there is a winter garden adjacent to a roof, terrace or another space, screening can be made by using tall plants frequently. If there are too many tall structures around the building, using dangling types in the area will help to make the height effect slightly less felt.

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Of course, personal preferences will come to the fore in plant selection. However, obtaining an effective and aesthetic appearance depends on the harmony of the plants and the demands of the environment. For example; Those who want a humid environment and those who want a dry environment should not be used together. Based on this, plants that can be used in winter gardens; Temperate Climate Plants, Humid Tropical Climate Plants, Arid Tropical Climate Plants were examined in three groups. (Beyde, 2016)

### **Winter Garden Temperate Climatic Plants**

In this winter garden, the heating system is adjusted so that the temperature inside the garden does not fall below 0 C. When choosing plants, cold-resistant plants are used. Broad-leaved plants and palm species that do not require warmth in winter can be used in these gardens to increase the visuality and create a tropical effect. Some plant species that can be used in temperate winter gardens

### **Winter Garden Humid Tropical Climate Plants**

In this winter garden, the heating system must be absolutely necessary. Tropical and subtropical plants can be used easily. Since the plants to be used here are species sensitive to cold, the garden temperature should not fall below 10 C. Humidity compatibility and air circulation are very important in these types of gardens. While preparing the planting soil, in addition to the peat and pumice stone, fertilizers rich in organic matter and leaf rot should be added to the mortar.



**Figure 14.** Wet Tropical Climate Plants (Beyde, 2016)

### **Dry Tropical Climate Plants**

In the construction of this type of winter garden, plants and cacti that are extremely sensitive to water, low-maintenance, succulent, are used. There is very little irrigation in the garden, especially in winter. Humidity is the biggest enemy for dry garden plants. Therefore, attention should be paid to ventilation and air circulation. It is desired that the temperature does not fall below 10 C. Thorny plants to be used here may pose a danger to children or pets (Beyde, 2016). Therefore, plant selection should be made according to those who will use the living space. While preparing the planting soil in this garden, peat, fertilizers rich in organic matter and pumice stone should be mixed as well as sand as much as 1/2 of the mortar. While establishing the winter garden, it should be designed to make the best use of the sun. It should not be forgotten that the plants to be used here require a lot of sunlight. (Beyde, 2016)



**Figure 15.** Dry Tropical Climate Plants (Beyde, 2016)



**Figure 16.** Dry Tropical Climate Plants (Beyde, 2016)

## WINTER GARDEN SAMPLE FIGURES



**Figure 17.** Winter Garden Sample Figures (Url 9: Ur 10).



**Figure 18.** Winter Garden Sample Figures (Url 11: Ur 12).

## CONCLUSION AND RECOMMENDATIONS

We started to hear the term winter gardens more frequently with the increase in construction and the decrease in our ability to touch nature. Especially in big cities; We spend it among the crowd, in the shade of the buildings and among the green space that is decreasing every day.

In order to relieve the **stress and fatigue** brought about by this busy life, winter gardens, which we can design according to our own taste and usage needs, come to our aid and add a quality living space to our lives. Together with the winter gardens, we can add **motivation and energy** to our daily life, and we can combine plants suitable for our taste with the decoration of our dreams. (Selek, 2020)

The most important feature of the winter garden is that all environmental conditions are controlled by people. In recent years, climate-regulating and heating aspects of winter gardens have also come to the fore. Lighting has been one of the solution methods in maintaining the balance between heating and ventilation in living spaces, arrangements suitable for these purposes have gained importance and various techniques have been developed. (Durmuş, 2006; Ankaya et al., 2018).

The use of winter gardens in buildings has a relaxing and relaxing effect. Winter gardens have been relaxing and peaceful for people with the green colors of the plants they contain. Natural light in these structures, on the other hand, provides a more balanced development of people and the order of their mental health as it is the strongest force in nature. In addition to regulating the physiologic and psychological health of people, winter gardens do not create environmental and energy problems with their limited energy use. In today's world where zero energy consuming buildings are designed, winter gardens have become places that cannot be ignored in terms of storing solar heat and preserving building heat. (Durmuş, 2006).

When all these researches are considered; Winter gardens are places that are in every person's dream, making them feel happy and peaceful when they think about themselves. Even if people are in their own homes, they need a private space where they want to be alone and rest their heads. Winter gardens are a good alternative for this special area.

The plants considered and selected for this alternative, as well as let people breathe, instill a sense of inner relaxation with the peace of the green color.

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**O 34. THE PLANT SPECIES ALTERNATIVE TO GRASS IN GREEN AREA**

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**ABSTRACT:** Especially in the current period, various problems such as drought, deterioration of ecological balance, climate crisis are experienced. For this reason, we need to contribute to a more livable world. We should consider important points within the scope of landscaping works; The most important of these is the economical use of water. For this, it is necessary to use less water and to consume the water economically. Grasses, which are widely used in landscape architecture studies, are plants that need frequent watering. Within the scope of this study, alternative plants were handled instead of grass plants, which are frequently used in landscaping studies but have a high water consumption. Information has been given about alternative plants, and their various features and areas of use, which consume much less water, can be produced easily and quickly, spread quickly, and require much less cost.

**Keywords:** *Landscape plants, grass, environment and green area*

**INTRODUCTION**

Grass is a term generally used for plants that are very close to the ground, that grip and cover the soil firmly.

It refers to the artificially established green field surfaces that cover the soil surface, tightly growing, have a homogeneous appearance, are constantly cut and kept short. In some conditions legumes or rarely species from other families are used (Gülgün et al., 2015). In the grass areas, the mixture formed as a result of mixing at least 2 or more 3-5 species that complement each other's properties is applied (Özsafak and Öner, 2021). It is important plant for light green areas. Many studies reported grass plants were importance in landscape area (Temizel et al., 2017; Yazici and Gülgün, 2017; Akça and Yazici, 2017; Yazici and Ünsal, 2019; Yazici and A. Sağlamer, 2019).

**MAINTENANCE NEEDS OF GRASS AREAS**

**Water Requirement of Grass**

- Grass cannot survive without water. They meet their water needs, especially when rainfall is intense. However, the water needs of the grass increase in the late spring and summer months when the rainfall decreases.
- The areas where the best turf yield is obtained are the areas where intensive irrigation is made at intervals.
- The average weekly water need of a lawn is 2.5-3 cm. This need can be doubled in summer. (<https://www.uzmangrupcevre.com.tr/cevredetay/100>)



**Figure 1.** Grass irrigation and cooling (Url 1)

- According to the season, 25 to 40 liters of water per square meter is required in an irrigation period.
- Grass areas are separated from other green areas due to the high amount of water need.
- Calculation of the amount of water to be used for the lawn areas, the labor cost required for irrigation and the cost of the equipment needed for irrigation of the grass areas reach high costs.

## FERTILIZATION

Since the grass areas are irrigated frequently, they quickly lose the organic substances they contain. Because the shape of the grass is densely made, their fertilizer needs are higher than other plants. It is necessary to do the fertilization process three times in spring, early summer and autumn. When we consider the ecological and economic aspects, it would be more logical to make alternative applications instead of grass areas (Url 2).



**Figure 2.** Fertilization (Url 3)

## PLANTS THAT CAN BE USED IN PLACE OF GRASS

- Since the lawn needs frequent irrigation, we should prefer to use alternative plant species in order to save water and reduce maintenance costs.
- We need to take precautions especially in the current period, with the droughts, deterioration of the ecological balance, climate crisis and similar situations.
- Using ground cover plants, which are an alternative to grass, will support the existence of an economical, ecological, environmentally friendly and sustainable nature.
- At the same time, it will support and develop wildlife.
- It is the right way to prevent the extinction of many plant species.

*Cerastium tomentosum* (Summer snow plant)

- It is a herbaceous plant with an average height of 5-10 cm.
- It develops well in well-drained soils. It can also grow in dry soils.
- It is resistant to frost.
- It can grow in sunny and semi-shaded areas.

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- Water demand is low.
- There is no format request.

It can be used in rock gardens, curbs, while creating natural gardens (Url 4)



**Figure 3.** The use of *Cerastium tomentosum* in herbal design (Url 5)



**Figure 4.** The use of *Cerastium tomentosum* in herbal design (Url 6)

*Ajuga reptans* (Yeast Herb)

- It is a perennial evergreen ground cover with an average length of 20 cm.
- Flowers begin to open in March.
- It is a temperate climate plant.
- Likes sunny and bright places, but can also grow in semi-shaded areas.
- It is sensitive to frost.
- Is content with soil, but develops better in moist soils.
- Water demand is low.
- Can be used as ground cover, border border in rock gardens (Url 7).



**Figure 5.** *Ajuga reptans* stepping stone use (Url 8)



**Figure 6.** Use of *Ajuga reptans* in herbal design (Url 9)

*Trifolium repens* (White Clover Plant)

- It is a short, perennial herbaceous plant that covers the surface of the soil.
- They spread by forming a stolon.
- They bloom white and pink in summer.
- It is a cool climate plant. It is resistant to cold and frost.
- It is resistant to compression.
- It can grow in shady areas.
- They are preferred in pastures due to their high nutritional value.



**Figure 7.** *Trifolium repens* (Url 10)



**Figure 8.** *Trifolium repens* (Url 11)

*Vinca major* (Algerian Violet Plant)

- It is a perennial herbaceous plant that can grow 15-20 cm.
- It starts to spread from its shoots in the spring.
- It is covered with purple flowers for a long time of the year.
- It is a cold climate plant, resistant to frost.
- It can adapt to any climate.
- Resistant to shade and satisfied with soil.
- It can be evaluated in terms of softening the curbs.
- Can be used under trees.



**Figure 9.** *Vinca major* (Url 12)



**Figure 10.** *Vinca major* (Url ,13)

*Pachysandra terminalis* (Japanese Broom Plant)

- It is a perennial herbaceous ground cover that can grow 15-20 cm in length.
- It blooms with green flowers in winter and summer and not showy white flowers in spring.
- It is highly resistant to shade, cold and drought.
- It needs less water.
- It is not suitable for printing.
- It can be used under trees, in rock gardens and borders.



**Figure 11.** *Pachysandra terminalis* (Url 14)

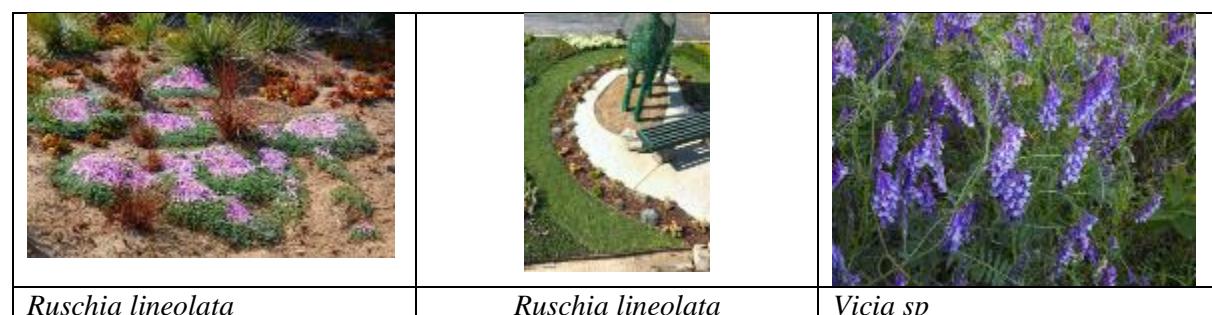
**Figure 12.** *Pachysandra terminalis* (Url 15)



**Figure 13.** *Pachysandra terminalis* (Url 16)

#### *Ruschia lineolata* (Star Carpet Plant)

- It is an evergreen, perennial succulent type ground cover that can grow 5-10 cm in length.
- Purple flowers bloom in spring.
- It is a hot climate plant but resistant to cold weather.
- It develops well in permeable soils.
- Highly resistant to thirst.
- It is resistant to short presses.
- Can be used in rock gardens, arid areas and to prevent weeds.



**Figure 14.** (Url 17; Url 18; Url 19).

#### *Arenaria verna* (Irish Moss)

- It has 10-15 cm long dark green leaves resembling moss.
- It is a herbaceous perennial plant that blooms with small, not very effective white flowers in summer.
- It can adapt to many climates.
- It grows well in sunny areas.
- It is a very durable species.
- Since its roots are on the surface, irrigation should be done less and continuously.
- It can be used as an emphasis between step stones, in rock gardens, borders and woodland environments.



**Figure 15.** (Url 20; Url 21; Url 22)

*Oxalis acetosella* (Sour clover)

- It can be lengthened up to 30 cm. It shows rapid development.
- It can develop in congested soils. It does not need aeration of the soil.
- It is resistant to arid and semi-arid conditions.
- It grows well in both sun and half shade.
- It is an invasive plant species. Therefore, there is no need to fight weeds.
- Water demand is low.
- It can remain green in dry seasons as it has deep roots.
- It does not need to be cut.
- It meets the nitrogen need of the soil.
- Produces white or pink flowers that attract beneficial pollinators such as bees and butterflies (Url 23).



**Figure 16.** (Url 24; Url 25)

*Sedum sp.* (Roof Grove)

- Succulent, spreading by soil shoots, is an evergreen perennial plant.
- Their height does not exceed 5-8 cm.
- Leafy succulent, in various forms and sizes.
- It thrives well in well-drained, full sun or slightly shaded areas.
- It is very resistant to drought.
- It grows well in soils that are poor in nutrients.
- It should be watered less.
- Highly resistant to cold (Url 26)



**Figure 17.** (Url 27; Url 28)

### SAMPLE STUDIES WITH COVER PLANTS

	
Garden in Greece (Url 29)	Plants Used <i>Oryzopsis sp.</i> , <i>Hyparrhenia sp.</i> (Url 30)
	

**Figure 18.** (Url 31;Url 32)



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<b>High Line</b>	Plant used; <i>Arenaria verna</i> Eye-catching designs can be created by using wheatgrass, ground cover plants, shrubs and trees together.

**Figure 19.** (Url 33;Url 34; Url 35)

There are 4 different Sedum and 11 different Allium species in the area. It hosts a total of 354 plant species. The plants in the area are mostly irrigated with rain water and they do not need irrigation systems much. It has a great riot of colors every season.

	
Shop & Trade Complex, PLANT USED IN PICTURE; <i>Stipa sp.</i> (Sorbet Grass) It is resistant to extreme cold and heat. Likes sunny environments, gives dynamism to the design. If it is pruned, it gives thicker shoots.	PLANT USED; <i>Perovskia atriplicifolia</i> (Russian sage) can grow up to 2 m in length. <ul style="list-style-type: none"> <li>•They like hot climates.</li> <li>•It has the ability to clean contaminated soils.</li> <li>•Likes sunny and semi-shaded places.</li> <li>•It has fragrant flowers.</li> </ul>
	
Hermes Company Building, Plant Used; <i>Panicum virgatum</i> <ul style="list-style-type: none"> <li>•Perennial, hot climate wheat.</li> <li>•2 years after planting, it becomes able to fight with weeds.</li> <li>•It is a good fodder plant.</li> </ul>	PLANT USED; <i>Phyla nodiflora</i> (Libyan grass) <ul style="list-style-type: none"> <li>• It is a perennial herbaceous ground cover.</li> <li>• It is blooming from April to August.</li> <li>• Sun-loving, semi-shade resistant.</li> <li>• It can grow in any type of soil.</li> <li>• It needs less maintenance.</li> </ul>

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Plant used; <i>Geum triflorum</i> <ul style="list-style-type: none"> <li>• It is a plant native to North America.</li> <li>• It can be 15-45 cm tall.</li> <li>• It is a plant that attracts bees.</li> <li>• It grows well in sunny areas.</li> </ul>	

**Figure 20** (Url 36; Url 37; Url 38; Url 39; Url 40)

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**O 35. THE OLD TREES OF LANDSCAPE ARCHITECTURE**

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**ABSTRACT:** Although humanity has destroyed the world faster than Mother Nature could recover. Fortunately, there are still natural wonders in this world that have survived for thousands of years. These are known as memorial trees. Monumental trees are among our indisputable riches that connect the past to the future due to the long life. In the world, it has many natural resources that are highly protected or need to be protected with both cultural and scientific values. In these, monumental trees are among the least interesting. Monumental trees, the oldest and silent historians living in nature, help us gain information about many natural events from the past. The old trees are also possible to associate with cultural events. In this study, information was given about the general characteristics of the plants, whether they are alive or not by conducting a literature research on the oldest trees.

**Keywords:** *Live elements, Sekoya, Memorial tree*

**INTRODUCTION**

Throughout the known history of humanity, trees and forests, which have affected the economic and cultural lives of societies, were regarded by the ancient societies as a sign of glory, honor, wealth and greatness (Ankaya et al., 2018; Gülgün et al., 2014; Yazici et al., 2015). At the beginning of the historical ages, some peoples made the old and magnificent trees that they believed to direct their destinies directly totems, while the societies living in ancient Egypt, Lebanon and Iran considered the tree species such as Cedar, Cypress and Juniper and all kinds of items and materials made from these trees were used in palaces, tombs. and they saw them as indispensable elements of their temples (Meyer Sevim, 1959; Evcimen 1961; Aytuğ, 1970; Asan, 1987; Gülgün et al., 2015).

It can be said that there is no other being that is as close to human as a tree, that constantly changes its appearance, exhibits almost four unique paintings during four seasons, and who constantly beautifies the environment in which the human life span exceeds twenty or thirty times. The relationship between man and tree begins with human existence. Few of the beings on earth have left no traces in the human soul, human personality as deep as the tree. With the developing civilization, the tree has developed in humans as an aesthetic feeling for centuries until it comes to the present day. (Gülersoy 1984; Sarıbaş, 2015).

Monument trees, which are considered as the oldest trees among living beings, are scientifically long, having dimensions above the usual dimensions of their own species in terms of age, diameter and height, have a special place in local folklore, culture and history, and are long enough to communicate between the past and the present, the present and the future. can be defined as trees that have a natural life. (Asan, 1992; Yaman and Sarıbaş, 2007).

Monumental trees are among our indisputable riches that connect the past to the future due to the long life that nature has bestowed on them. The preservation of these trees both improves the feelings of devotion to soy in young minds and helps to root the love of nature and environmental awareness. These monumental trees, which are the living representatives of cultural heritage, witness some historical events that are almost milestones in the history of the country during their 900-1000 years of life, and sometimes inspire poets and composers by interpreting individual feelings. Preserving these living cultural heritages, which act as a bridge between generations by keeping the social memory alive, is an important task that should be done for future generations. Since monumental trees are living creatures, it is very important to protect these trees, which are the common heritage of the society, to be identified and registered (Asan, 2008; Palabaş Uzun ve ark., 2011).

In terms of their features, Monument trees are collected under 4 main groups.

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- ✓ Historical Monumental Trees: These are monumental trees that have witnessed historical events.
- ✓ Mystical Monumental Trees: These are monumental trees that have a mystical feature in folk culture.
- ✓ Folkloric Monumental Trees: These are monumental trees that have a traditional value in folk culture.
- ✓ Dimensional Monumental Trees: They are prominent monumental trees within the same species with their dimensional characteristics (age, height, trunk diameter or crown diameter) (Genç ve Güner, 2001; Genç vd., 2002; Sabuncu ve ark., 2013).

Famous Traveler Evliya Çelebi (1611–1682) also included depictions of monumental trees in his travel book for the first time. It was seen that Evliya Çelebi recorded the monumental trees between Tavas (Turkey) and Muğla (Turkey) with their names, shapes and features, which he described as "trees to be exemplified" (Baytop 2003; Saribaş, 2015).

Monument trees are an important part of our history that shed light on the past, present and future with their longevity found in various parts of the world. This study was carried out in order to determine the monumental trees in the world, to have information about them, to know their value by transferring them to future generations and to ensure that they are taken under protection.

## **RELATION OF MONUMENT TREES WITH THE ENVIRONMENT**

Monumental trees; Due to its scientific, cultural and psychological functions, it has become one of the indispensable parts of both nature tourism and folkloric and mystical tourism in recent years. On the other hand, monumental trees are one of the items most affected by the destruction of nature for many years. Necessary maintenance and protection measures must be taken so that monumental trees can be passed on to future generations without any damage (Özçelik, 2006).

They are dendroclimatological and dendro-ecological as well as dendro-chronological materials, as they are developed and shaped according to the climatic-edaphic-biotic conditions of the environment in which they grow. Since monumental trees and stands can represent rare habitats (biotopes) and rare genotypes of the species or species in question; they also have bio-genetic reserve value. Memorial trees are important archives for phytological and archaeological, dendrological and paleobotanical research (Genç ve Güner 1993; Saribaş 2015).

These old trees, which we frequently encounter in the mystical and sacred places around us, in the old complexes, mansions and palace gardens, evoke certain symbols in the memory of the individual and society due to the interesting pathological formations that emerged over time in their huge trunks. Thus, sometimes there is hope for people, miracles are expected from it, and sometimes it becomes the representative of the mystical feelings it evokes in the depths of the human soul and the otherness and tranquility (Asan, 2005).

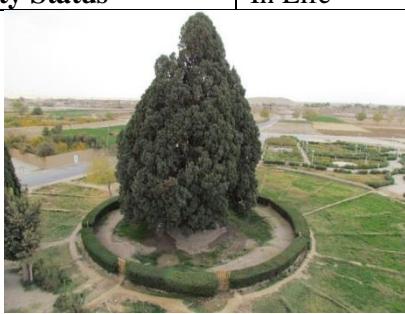
Huge-sized old trees have attracted the attention of societies throughout human history. Primitive clans accepted such trees directly as totems. Thus, he believed that the life span of his own tribes would be as long as that tree. This approach was accepted by the Lebanese and the flag of the country was decorated with an old cedar tree (Asan, 2005).

Monumental trees are among the important visual elements of the urban and rural landscape due to their size and magnificent habitus. An aesthetic appearance is gained with the plastic values they exhibit in their growing environment. They contribute to nature tourism as well as cultural tourism based on folkloric and mystical values due to their high interest rates (Yaltırık 1993; Saribaş, 2015).

Monumental trees are of great importance in terms of being the natural and cultural heritage of a geography. These beings, which serve a unifying function between generations, at the same time transfer very valuable information in terms of botany, history, tradition and legends to the future. Since the monumental tree and forest pieces are of great importance in terms of national culture, local history and folkloric, their currency is increasing day by day. This vibrant heritage, which adds privilege to its location, has an important resource value for the phenomenon of "Rural Tourism", whose trend has risen markedly today, when the passion to protect the green has reached the level of worship and environmental protection activities are at the forefront (Bobat, 2017).

## THE OLDEST TREES IN THE WORLD

**Table 1.** The oldest trees in World

			
<b>Latin name</b> <i>Ficus religiosa</i>	<b>Latin name</b> <i>Sequoiadendron giganteum</i>	<b>Country of Location</b> Sri Lanka	<b>Country of Location</b> California- ABD
<b>Age</b> 2.305	<b>Age</b> 3.200	<b>Diameter of</b> -	<b>Diameter of</b> 8 m
<b>Length</b> -	<b>Length</b> 75 m	<b>Vitality Status</b> In Life	<b>Vitality Status</b> In Life
		<b>Latin name</b> <i>Olea europaea L. var. europaea</i>	<b>Latin name</b> <i>Fitzroya cupressoides</i>
<b>Country of Location</b> Portugal (Portekiz)	<b>Country of Location</b> Chile (Şili)	<b>Age</b> 3.350	<b>Age</b> 3.646
<b>Diameter of</b> -	<b>Diameter of</b> -	<b>Length</b> -	<b>Length</b> -
<b>Vitality Status</b> In Life	<b>Vitality Status</b> In Life		
		<b>Latin name</b> <i>Taxus baccata</i>	<b>Latin name</b> <i>Cupressus sempervirens</i>
<b>Country of Location</b> Britanya	<b>Country of Location</b> Iran (İran)	<b>Age</b> 4.000-5.000	<b>Age</b> 4.000
<b>Diameter of</b> -	<b>Diameter of</b> 18 m	<b>Length</b> 10.75 m	<b>Length</b> 25 m
<b>Vitality Status</b> In Life	<b>Vitality Status</b> In Life		

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<b>Latin name</b>	<i>Taxus baccata</i>	<b>Latin name</b>	<i>Pinus longaeva</i>
<b>Country of Location</b>	Turkey	<b>Country of Location</b>	California- ABD
<b>Age</b>	4.112	<b>Age</b>	4.845
<b>Diameter of</b>	-	<b>Diameter of</b>	-
<b>Length</b>	-	<b>Length</b>	-
<b>Vitality Status</b>	In Life	<b>Vitality Status</b>	In Life
<b>Latin name</b>	<i>Pinus longaeva</i>	<b>Latin name</b>	<i>Picea abies</i>
<b>Country of Location</b>	Nevada, ABD	<b>Country of Location</b>	Sweden (İsveç)
<b>Age</b>	4.862 – 4.900	<b>Age</b>	9.558
<b>Diameter of</b>	-	<b>Diameter of</b>	-
<b>Length</b>	-	<b>Length</b>	-
<b>Vitality Status</b>	Not Alive	<b>Vitality Status</b>	In Life
<b>Latin name</b>	<i>Quercus palmeri</i>	<b>Latin name</b>	<i>Populus tremuloides</i>
<b>Country of Location</b>	California- ABD	<b>Country of Location</b>	Utah- ABD
<b>Age</b>	13.000	<b>Age</b>	80.000
<b>Diameter of</b>	-	<b>Diameter of</b>	-
<b>Length</b>	-	<b>Length</b>	-
<b>Vitality Status</b>	In Life	<b>Vitality Status</b>	In Life

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<b>Latin name</b>	<i>Taxodium Ascendens</i>	<b>Latin name</b>	<i>Pinus longaeva</i>
<b>Country of Location</b>	Longwood- Florida	<b>Country of Location</b>	California- ABD
<b>Age</b>	3.500	<b>Age</b>	5.071
<b>Diameter of</b>	10.7 m	<b>Diameter of</b>	-
<b>Length</b>	36 m	<b>Length</b>	-
<b>Vitality Status</b>	Not Alive	<b>Vitality Status</b>	In Life

## **CONCLUSION**

Trees, which are natural elements of the landscape, in urban and rural landscapes; It provides ecological, economic, social and visual benefits (Hah, 2011; Polat, 2017). With all these benefits, monumental trees that support the living spaces of people for centuries are faced with problems due to the lack of planning experienced in protection, registration and management activities (Polat, 2017).

Monumental trees or stands have an important role in examining the ecological conditions of the region where they grow and revealing the intended ecological conditions complex. In order for monumental trees to be passed on to future generations, they must first be recorded for protection and preservation (Özçelik, 2006).

Practices regarding the protection of tree roots are very important in the management of monumental trees. Professional studies on this subject should be carried out, especially in infrastructure works, and successful implementation strategies should be evaluated (Costello and Jones, 2003; Polat, 2017).

In order to keep a memorial tree alive, it is very important to support its ecological environment. Soil, water resources, effects of climatic conditions etc. ecological elements are the source of life for the plant. Soil quality deterioration, changes in groundwater resources, physical and chemical effects, etc. Negative climatic conditions that will directly affect the trees and limit the life of the monumental trees and even make them disappear. The unconscious approach of the public, local governments and practitioners, cutting, scraping, plucking, rotting, desertification, pollution of air, soil and water resources, etc. are very serious threats for monumental trees. The measures to be taken against these pressures and threats will form the basis for monumental tree protection plans (Polat, 2017).

The trees that are identified as monumental trees need to be cared for by experts so that they can continue their life in a healthy way and shed light on future generations. In this context, the diseased and damaged parts of the tree should be cleaned, disinfected and then coated with a special paste. In addition, spraying should be done against fungi and insects. With these maintenance works, the life of the trees will be extended and future generations will be able to see these trees. The necessary procedures should be initiated as soon as possible for the registration of these individuals with the feature of monumental trees by the High Council of Monuments. In addition, necessary measures (informative plate, protection strip, etc.) should be taken to protect these trees. An introductory brochure should be prepared for monumental trees to contribute to the awareness of the local people ( Palabaş Uzun ve ark., 2011).

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**O 36. THE FLOOD CONTROL WITH OUTDOOR PLANTS IN LANDSCAPE RENOVATION**

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**ABSTRACT:** Flooding could occur almost anywhere in the world, including the driest (desert) and most humid (tropical) areas. Floods are defined in many different ways and a great majority of floods actually occur as a result of events that occur within the self-protection mechanism of nature. As long as the flood does not harm the living and non-living environment, it is accepted as a normal "hydrometeorological" event. Landscape restoration are also applied in order to respond to problematic areas such as floods. Necessary studies are carried out by considering the principles determined as the basis for all landscapes that have been intervened in the landscape restoration process. Planting is also important in flood control studies. The root structure of the plants, the water requirement of the plant, the attachment of the plant to the soil and survival status is important when flood occurs. In this study information was given about plants which have an important place in flood control.

**Keywords:** *Landscape repair, Hydrological Planting, Disaster, Outdoor Plants*

**INTRODUCTION**

Landscape (Nature) restoration is the work that includes restoration (restoration, bioremediation), rehabilitation, or reclamation works applied in natural areas whose structure and function properties have changed as a result of degradation or intervention (Avci and Sunkar, 2015; Dewan et al., 2006; Gülgün et al., 2014a; Yazici et al., 2018; Yazici, 2019;). Floods and submergence are also disasters that occur with the deterioration of natural areas. In terms of the losses they suffered, floods are natural disasters that cause the most damage in Turkey after earthquakes. Between 1975 and 2009, 695 floods occurred in the country, causing 634 deaths and approximately \$ 100 million in economic damage each year. The EU's Flood Risk Analysis and Management Directive aims to reduce the negative effects of floods. However, in order to fulfill the requirements of this directive fully, the laws and approach in Turkey should be developed (Delegation of the European Union to Turkey).



**Figure 1.** Flood (excerpt: website of the EU Delegation to Turkey)

Plants adapt to their ever-changing environment in many ways, leading to a wealth of growth forms of varying complexity. Certain habitats demand exceptional adaptations, especially when one or more essential resources are scarce or absent. The conditions prevailing in wetlands are an example of such an extreme environment since the highly water-saturated soils exclude oxygen, one of the fundamental requirements for plant life (Visser et al. 2003; Bodur, 2018; Ceylan et al., 2015; Gülgün et al., 2014b; Ankaya et al., 2018; Gülgün et al., 2017). The definition of flood and submergence can be made as follows;

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Flood is the phenomenon of rising or coming from elsewhere, covering surfaces that are usually dry. Floods are classified as slow-growing, fast-growing and sudden floods, depending on their rate of occurrence. Floods that usually occur within a week or more are called slow floods, floods that occur within a day or two are called rapid floods, and floods occurring within an hour are called sudden floods. In terms of the place of occurrence, floods are called coastal floods, city floods, dry stream floods, dam / pond floods and streams (stream and river) floods (Annotated Disaster Management Terms Dictionary, 2014).

Submergence, on the other hand, is an event where a stream overflows from its bed for various reasons, damaging the surrounding lands, settlements, infrastructure facilities and living creatures, causing a flow size that interrupts normal socioeconomic life in the impact zone (Annotated Disaster Management Terms Dictionary, 2014).

In order to be prepared for floods and submergence, it is necessary to do the following;

### **General Precautions To Be Taken Against Floods**

- For all types of meteorological disasters, early warning units working with radar systems and satellite data, which are used very effectively in determining precipitation areas and precipitation intensities, should be established.
- Rescue units should be established in provinces and districts that will work in coordination with this warning unit.
- Regional radios should inform the public in case of any danger and warn them about the methods to be implemented.
- Local administrations should take care not to settle in stream beds and prevent settlement there.
- The blockages that may occur over time in the stream beds and drainage channels passing through the settlements, as well as in the canals at the points where streams and rivers meet the sea, should be cleaned regularly and it should be ensured that they are always open.
- Stream beds passing through the settlements should be rehabilitated.
- Erosion and floods should be prevented by protecting and increasing the surrounding green areas.
- Terracing and afforestation should be done on slopes with flood risk.
- Since there is a high risk of flooding in the basement floors of the buildings in hollow areas, a basement should not be built in such places and the basement level should be kept high.
- There should be enough rainwater channels in cities and these should be maintained continuously.
- Flood warning signs and warning systems should be learned in our settlements.
- Houses should be insured against flood as in other disasters (Afad)

In this study, information is given about plants that are partially or completely resistant to water in areas where floods and floods occur. It should not be ignored that increasing green areas is another factor that prevents floods and overflows, as green areas need to be protected. Planting studies should be carried out in problematic areas, taking into account the functional characteristics of the plants instead of their aesthetic features. In this study, water resistant trees with roots are emphasized.

## **MATERIAL and METHOD**

In this study, landscape restoration technique, literature research has been done within the scope of disasters. There is not enough data on plants resistant to floods and submergence. In this study, using the study of Güngör et al. (2006), a list of plants that can withstand floods, submergence and stagnant water for 1-2 months was created. Its use in disasters and areas with floods (partially-fully resistant) is rated.

## **RESULTS**

Thanks to the planting design, we can make the most of the environment we live in, because with the help of a well-made planting design, it is possible to create landscapes for versatile use and benefit,

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instead of very limited utilization and utilization. In addition, planting design helps to restore the balance between man and nature (Yazici and Gülgün, 2017; Yazici and Ünsal, 2019; Yazici and A.Sağlamer, 2019). A very well and successfully planting design is the most appropriate expression of the function and usage needs.

**Table 1.** The flood resistant plants 1

			
<b>Latin Name</b>	<i>Ailanthus altissima</i>		
<b>Turkish Name</b>	Kokarağaç		
<b>General Characteristics</b>	Ailanthus altissima is a foul-smelling tree species of the Simaroubaceae family that blooms with greenish yellow flowers between May and June. Its homeland is the Far East. From here it spread to Europe and Anatolia.		
<b>FloodResistance</b>	Durable		
<b>Usedlinks</b>	Url,1; Url,2; Url 3; Güngör ve ark., 2006.		

Good design is the design that usually performs the functions of planting by keeping the interventions to the natural development process to a minimum. Water-resistant plants are important in disasters such as floods. The functional performance and ecological compatibility of planting can be evaluated with more objective criteria than its aesthetic value.

**Table 2.** The flood resistant plants 2

			
<b>Latin Name</b>	<i>Alnus glutinosa</i>		
<b>Turkish Name</b>	Sakallı kızılağaç		
<b>General Characteristics</b>	Alnus glutinosa is a species of birch (Betulaceae) family that can reach 20-30 m with brown bark and sparsely branched. It is quite soft, but durable when submerged, so it is used for underwater structures and smaller boats.		
<b>FloodResistance</b>	Durable		
<b>Usedlinks</b>	Url,1; Url,4; Url 5; Güngör ve ark., 2006.		

**Table 3.** The floodresistantplants 3

  	
<b>Latin Name</b>	<i>Eucalyptus camaldulensis</i>
<b>Turkish Name</b>	Okaliptus
<b>General Characteristics</b>	It's homeland is Australia. Mersingillers (myrtaceae) family. It can reach 45 meters in length and 3 meters in diameter in its homeland. It can live for an average of 500 years.
<b>FloodResistance</b>	Durable
<b>Usedlinks</b>	<a href="#">Url,6</a> ; <a href="#">Url,7</a> ; <a href="#">Url 8</a> ; Güngör ve ark., 2006.

**Table 4.** The floodresistantplants 4

 	
<b>Latin Name</b>	<i>Fraxinus angustifolia</i>
<b>Turkish Name</b>	Sivri Meyveli Dişbudak
<b>General Characteristics</b>	The pointed-fruited ash ( <i>Fraxinus angustifolia</i> ) is from the Oleaceae (Oleaceae) family whose homeland is Southern Europe, North Africa and Southwest Asia. It can withstand stagnant water for 1-1.5 months
<b>FloodResistance</b>	medium-low
<b>Usedlinks</b>	<a href="#">Url,9</a> ; <a href="#">Url,10</a> ; Güngör ve ark., 2006.

**Table 5.** The floodresistantplants 5

  	
<b>Latin Name</b>	<i>Fraxinus excelsior</i>
<b>Turkish Name</b>	Adi dişbudak
<b>General Characteristics</b>	<i>Fraxinus excelsior</i> is a type of ash from the Oleaceae (Oleaceae) family, native to Europe and Turkey. It grows up to 40 m. The body shell is pale yellow in color. Buds are black, hairy leaves, 7-11 leaflets.
<b>FloodResistance</b>	Durable
<b>Usedlinks</b>	<a href="#">Url1</a> ; <a href="#">Url 4</a> Güngör ve ark., 2006.

**Table 6.** The floodresistantplants 6

		
<b>Latin Name</b>	<i>Populustremula</i>	
<b>Turkish Name</b>	Titrek kavak	
<b>General Characteristics</b>	Populustremula is a type poplar from Salicaceae family that can be sized upto 25 m, with a cylindrical stem, dense branching and a wide conical top. It is mildly demanding and requires bare, preferably wet soils, devoid of vegetation competing for natural regeneration	
<b>FloodResistance</b>	Durable	
<b>Usedlinks</b>	Url,4; Url,11; Güngör ve ark., 2006.	

**Table 7.** The floodresistantplants 7

		
<b>Latin Name</b>	<i>Salixalba</i>	
<b>Turkish Name</b>	Ak Söğüt	
<b>General Characteristics</b>	Salixalba, from the Salicaceae family, 25–30 m. It is a willow species in size. It is seen in creeks, meadows and wetlands.	
<b>FloodResistance</b>	partially	
<b>Usedlinks</b>	Url,12 Url,13; Url 14; Güngör ve ark., 2006.	

**Table 8.** The floodresistantplants 8

		
<b>Latin Name</b>	<i>Salixfragilis</i>	
<b>Turkish Name</b>	Gevrek Söğüt	
<b>General Characteristics</b>	Salixfragilis is a Salix species from Salicaceae family that is native to Europe, Asia and Turkey. It is an important plant for marsh rehabilitation. It can be used in flooded areas	
<b>FloodResistance</b>	Durable	
<b>Usedlinks</b>	Url 3; Güngör ve ark., 2006.Url 1	

**Table 9.** Thefloodresistantplants 9

  	
<b>Latin Name</b>	<i>Taxodium distichum</i>
<b>Turkish Name</b>	Bataklik Servisi
<b>General Characteristics</b>	It's homeland is North America and Mexico. Swamp is in the family of Taxodiaceae. It can grow in flooded areas, wetlands.
<b>FloodResistance</b>	Durable
<b>Usedlinks</b>	<a href="#">Url 3</a> ; <a href="#">Güngör ve ark., 2006</a> . <a href="#">Url 1</a> ; <a href="#">Url 15</a>

**Table 10.** Thefloodresistantplants 10

	
<b>Latin Name</b>	Bambusa aurea
<b>Turkish Name</b>	Sarı Bambu
<b>General Characteristics</b>	Bamboo (Bambusoideae) is a member of the Poaceae family and a subfamily of up to 1,200 plant species that sometimes look very different from each other. Bamboo species are found in Asia, South and North America, and Africa.
<b>FloodResistance</b>	Durable
<b>Usedlinks</b>	<a href="#">Url 16</a> ; <a href="#">Güngör ve ark., 2006</a> . <a href="#">Url 17</a>

**Table 11.** Thefloodresistantplants 11

 	
<b>Latin Name</b>	<i>Tamarix parviflora</i>
<b>Turkish Name</b>	llgn
<b>General Characteristics</b>	<i>Tamarix parviflora</i> is a plant species of the Tamaricaceae family seen in salty soils. The members of the wild genus, which have around 90 species growing all over Eurasia, bloom white or pink flowers. Various species are grown as hedge plants or as ornamental plants in gardens. It is resistant to floods and injuries
<b>FloodResistance</b>	Durable
<b>Usedlinks</b>	<a href="#">Url 18</a> ; <a href="#">Güngör ve ark., 2006</a> . <a href="#">Url 19</a>

## **CONCLUSION**

With this study, it is aimed to restore these areas to nature by giving examples of plants resistant to extreme conditions such as floods, submergence and stagnant water. Urban floods will continue in the future, as they do today. However, measures can be taken to reduce their harms. Geographers and different disciplines can come together to produce solutions, and engineering sciences can put them into practice. In this sense, there is a need for Urban Risk Management Units, including landscape architects and agricultural engineers. In addition to the dissemination of units such as AKOM (Disaster Coordination Center) in Istanbul, these occupational disciplines play an important role in taking measures such as the improvement of the area by planting the areas that are not opened to housing, and where the priority is to open and where not to be opened during urban development.

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Url 5: [https://species.wikimedia.org/wiki/Alnus\\_glutinosa\\_subsp.\\_glutinosa](https://species.wikimedia.org/wiki/Alnus_glutinosa_subsp._glutinosa)  
Ur 6:<https://katanninglandcare.org.au/product/eucalyptus-camaldulensis-ssp-obtusa-wa/>  
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**O 37. STUDY OF DIFFERENT BUILDING RETROFITTING TECHNOLOGIES ON ENERGY SAVINGS**

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**ABSTRACT:** Retrofitting building envelope and heating ventilation and air conditioning plants, is crucial to reduce energy consumption. This research work deals with a building where an underfloor heating system, water radiators, and natural ventilation are the main systems used to maintain comfort condition throughout the majority of the building areas. This work involved developing a 3D model relating to building architecture, structure, occupancy & heating ventilation and air conditioning (HVAC) plants operation. Different energy retrofit technologies such as building envelope, lighting, heating, cooling and ventilation, as well as the use of solar energy were analysed. The objective of this research work was to develop a methodology that start by comparing various energy retrofit technologies and then continues to identify the most suitable in terms of energy savings and cost of investment. Result of the analysis on selected best retrofit technology shows that a reduce cost of investment in 15% was obtained compare to other technologies. Furthermore, electricity consumption savings and heat released can vary between 20 and 30% on monthly basis.

**Keywords:** *Energy Efficiency, Building Retrofitting, Building Energy Simulation, Cost of Investment*

**INTRODUCTION**

Environmental concerns and the recent increase in energy costs open the door for innovative techniques to reduce energy consumptions. Buildings account for about 40% of the energy consumption in the European Union (EU) [1]. Energy Efficiency Directive was formally adopted by the Council of Ministers and European Parliament in October 2012. The main objective of the Directive is to promote the improvement of the energy performance of buildings within the EU through cost-effective measures [2].

The aim of an energy retrofit is to improve energy efficiency by implementing the most optimal mix of technologies at a reasonable investment. Energy retrofits of existing buildings are important because buildings tend to undergo system degradation, change in use, and unexpected faults over time. It is well known that the efficiency of buildings and their equipment degrades over their service life, and even faster when they are not maintained appropriately. Building components can also under-perform when they are not properly designed or installed.

In 2008, the Royal Institute of British Architects (RIBA) and the Chartered Institution of Building Services Engineers (CIBSE) launched CarbonBuzz, a free online platform allowing practices to share and publish building energy consumption data anonymously [3]. It enables designers to compare predicted and actual energy use for their projects, whilst also allowing for comparison against benchmarks and data supplied by other participating practices. In particular, Hamilton et al. [4] compared the predicted and actual electricity consumption in three building sectors: schools, general offices and university buildings. They demonstrated that the measured electricity demands are approximately 60–70% higher than predicted in both schools and general offices, and over 85% higher than predicted in university campuses. The European research group Ecofys for EURIMA [5], conducted long-term research on the efficiency and economy of different retrofit methods, based on various climate conditions across different countries in Europe and put forward the most appropriate energy-saving technologies for particular regions. Their results analysis focused on energy-saving methods for building envelope only. Griffith et al [6] selected 4820 measured data points based on real investigation and calculated some technologies' greatest energy-saving potential. They concluded that U.S. commercial buildings could achieve 43% energy savings. The research took into account the energy savings possible for buildings and the economic impact of each energy-saving technology. Chidiaca et

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al [7] established three basic building models according to survey data on nine typical office buildings in Canada and studied the efficiency and application of some retrofit methods.

They calculated the payback and efficiency of retrofit methods applied in different climate zones. Mills et al. [8], has shown that improving existing buildings will yield median energy savings of 16% in the United States.

The main objectives of this research works included: firstly the development of a methodology for increasing the accuracy of energy model capable of reducing the gap between predicted and real energy consumption. Secondly, different energy retrofit technologies such the replacement of lighting and motors was explored. In addition, the time of the heat pump system was analysed. The estimated total annual saving related to the proposed energy retrofit solutions was determined.

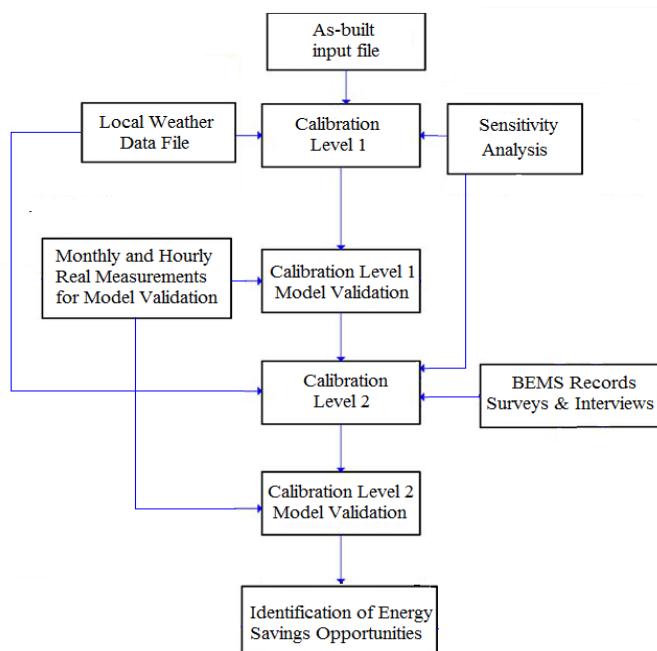
The layout of this paper is as follow: Section II presents the two levels of the calibration methodology. Section III, gives an overview of the demonstration building and HVAC plants. Section IV describes the building simulation for comparing various energy retrofit technologies to identify the most suitable in terms of energy savings and cost of investment. Finally, Section V provides a conclusion with future research works.

## **OVERVIEW OF CALIBRATION METHODOLOGY**

In our calibration methodology, input parameters are specified by an analyst and used by energy simulation programs to reproduce a building's thermal processes, while outputs are energy performances simulated by energy simulation programs, given certain input parameters. Two levels of calibration are performed and use a combination of building, system and measurement data.

Building energy models were developed using EnergyPlus Version 8.2 [2]. The adequacy of this calibration was evaluated against the ASHRAE Guideline 14 [9].

Figure 1 shows the procedure for model calibration and identification of energy savings opportunities and is composed by the first and second level of calibration. Finally, detail analysis related to building calibration methodology and result analysis can be found in Mustafaraj et. al [10].



**Fig. 1.** Algorithm for model calibration and energy saving opportunities [10]

## **Overview of Building and HVAC plants**

The Environmental Research Institute (ERI) building in Cork is a three-storey 4500 m<sup>2</sup> research building containing offices, computer laboratories, wet laboratories, a clean room and controlled temperature rooms. Figure 2 shows a 3-D view generated with DesignBuilder [11] using design documents.

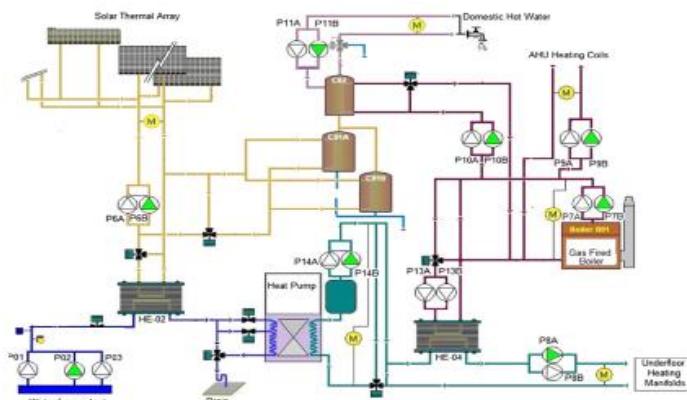
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The building is a reinforced concrete structure providing high levels of thermal mass to allow for natural and mechanical ventilation with night cooling as required. The build-up of the floors, roof, external facades, internal partitions and windows were constructed from as-built structural drawings. The build-up thermal properties were taken from CIBSE [12] and ASHRAE [13].



**Fig. 2.** ERI building 3-D view of design model [10, 11]

Apart some areas of the building that occupy the central core of the building space (such as WCs, cold rooms, clean rooms and stores) which are mechanically ventilated by five air handling units (AHUs), the rest of the building is naturally ventilated. Figure 3 is a schematics overview of the HVAC system. The building is heated by an underfloor heating system that is primarily supplied by a geothermal heat pump that taps into a water supply fed from a culvert running adjacent to a nearby river. For more detail about the building structure and description of HVAC system refer to Mustafaraj et. al [10]. Finally, total annual building electricity consumption is 221,225kWhr.



**Fig. 3.** Schematic of the HVAC system [10]

## **Analysis of Results**

After completing the calibration process (see G. Mustafaraj et al. [10]), reductions in energy consumption was made by implementing a certain number of energy retrofit technologies. The energy retrofit technologies includes: modifying the time schedule of the heat pump, replacement with high efficiency lighting & occupancy sensors, substituting old motors with high efficiency motors, installation of variable speed drivers on water pump and high efficiency air conditioning systems. Cost of investment was used as a key constraint of the study and selection of energy retrofit solutions was limited to total investment of €3000.

Other energy retrofit technologies such as building external insulation, variable speed drivers and solar panels were investigated, but the cost of investment for applying these technologies was deemed to be high. Three energy retrofit technologies were identified. The total cost savings were calculated based on

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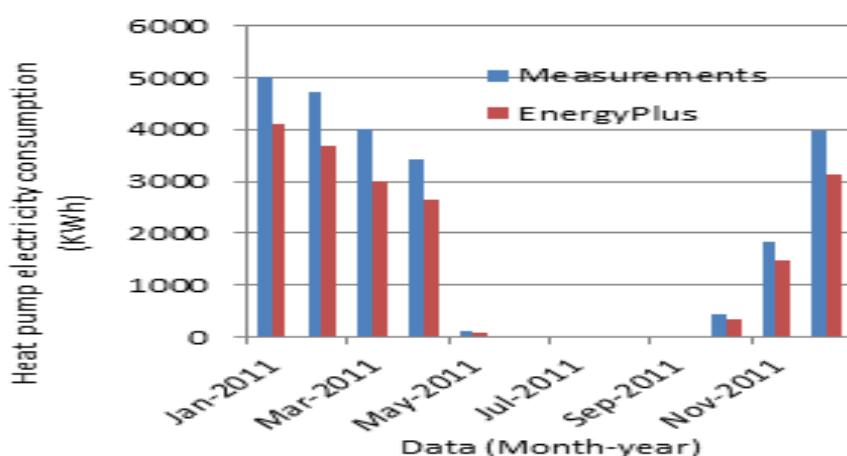
the average cost electricity in Ireland that was fixed at 0.18 €/kWhr. The result of the analysis on the implementation of the proposed inventions is outlined below.

### **Time schedule heat pump modification**

The floor material structure is a concrete base and has a thickness of 70 cm. Therefore, each floor presents a slow thermal response. The duration during which the heat pump is turned “ON” can vary between 6 to 12 hours and depends on the weather conditions. This is managed by the Building Management System (BMS) technician, who based on his experience and weather forecast conditions decides in advance how many hours it will be turned “ON” during the following week. Consequently, the “ON”/“OFF” time schedule of the heat pump (which supplies 80% of heat to the building), is not regulated efficiently because is not based on real weather condition and the thermal behaviour of the building. Its electricity consumption is higher compared to what is required to provide optimal thermal conditions throughout the building.

Alternatively, the present research analysis used EnergyPlus to turn the heat pump “ON” and “OFF” based on the real thermal behaviour of the building and weather condition supplied by the weather data file. Results have shown that the time required to keep heat pump “ON” varies from 4 to 8 hours at night time in order to maintain satisfactory comfort conditions inside the building. Consequently, less time is required compared to that managed by the technician on the BEMS (from 6 to 12 hours).

Figure 4 presents the heat pump’s measured and EnergyPlus model output monthly electricity consumption. It was verified that energy savings can vary between 20 and 27% on monthly basis.



**Fig. 4.** Monthly comparison of electricity consumption between manual (Measurement) and automatic (EnergyPlus) control of the heat pump

Finally, total electricity savings were calculated to be 5050 kWhr/yr (i.e. corresponding to a total savings of 290€/yr). The payback period is immediate because there is no cost on investment for implementing this energy retrofit technology.

### **Lighting efficiency improvements & luminosity sensor**

The existing lighting in the building was analysed and we recommend the replacement of standard efficiency lamps with high-efficiency lamps. Furthermore, luminosity sensors were installed with the aim of adjusting the intensity of artificial lighting based on the intensity of natural lighting. Thereby, electricity savings can be obtained by installing luminosity sensors. Table 1 presents the results analysis (on yearly based) obtained in EnergyPlus by replacing the existing standard lamps with high efficiency lamps and luminosity sensors. The energy savings from high-efficiency lighting also includes a savings of 2200 kWhr/yr due to the reduced heat load on the air-conditioning system. Table 2 shows the costs and payback for spot relamping and group relamping program which also includes the cost of luminosity sensors

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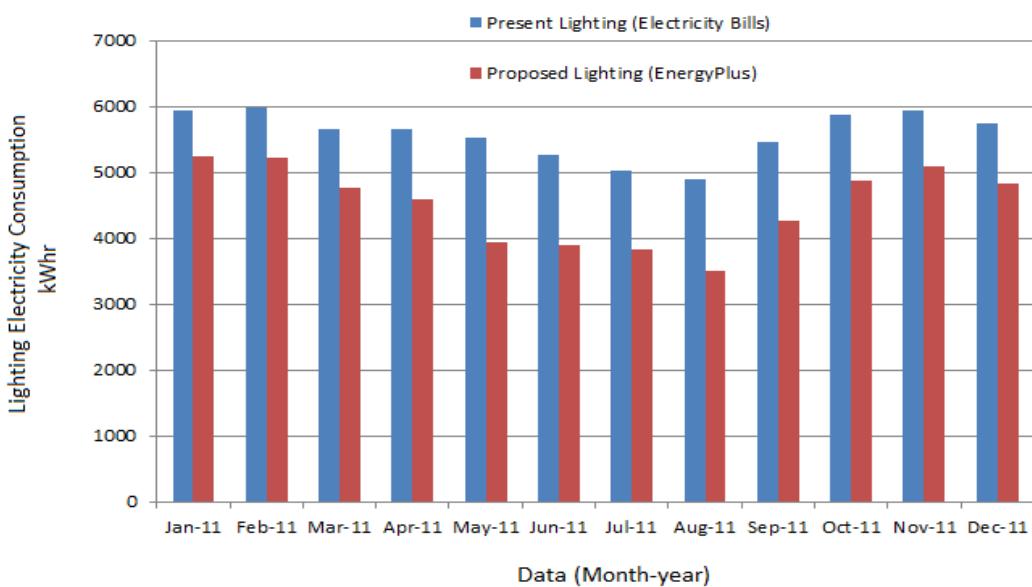
**Table 1.** Energy Use and Energy Cost Comparison: Standard Lamps vs. High-efficiency Lamps with luminosity sensors

Number of Lamps in building	Present Lighting			Proposed Lighting with Luminosity sensors		
	Lamp Type/Wattage (W)	Total energy used (kWhr/yr)	Total energy cost (€/yr)	Lamp Type/Wattage (W)	Total energy saved (kWhr/yr)	Total cost savings (€/yr)
100	CF40	14304	2574	HF34	2436	438.48
27	CF35	15546	2798	HF60	2109	379.62
9	IL100	2470	444	CMF27	903	162.54
7	IL75	3656	658	CMF13	1222	219.96
10	MV400	34212	6158	HMV325	3657	658.26
	Totals	70188	12632	Totals	10327	1858.86

**Table 2.** Comparison of implementation cost and simple payback period for spot and group relamping

Proposed Lamp Type	Spot Relamping		Group Relamping	
	Implementation Cost	Simple Payback Period	Implementation Cost (with rebate)	Simple Payback Period
HF34	265	0.6	452	1.1
HF60	110	0.3	350	0.9
HMV325	505	0.8	1077	1.7
CMF13	143	0.7	137	0.7
CMF27	123	0.8	114	0.7
Totals	1146	0.6	2130	1.2

Figure 5 presents a monthly comparison between electricity consumption obtained by the EnergyPlus model simulation data for high efficiency lamps against that obtained from real measurements taken from standard lamps actually installed in the building. Finally, total energy savings by spot relamping of standard lighting with high efficiency lighting was estimated to be 1858€/yr, with an average payback period of 6 months.



**Fig. 5.** Monthly present lighting v proposed lighting electricity consumption

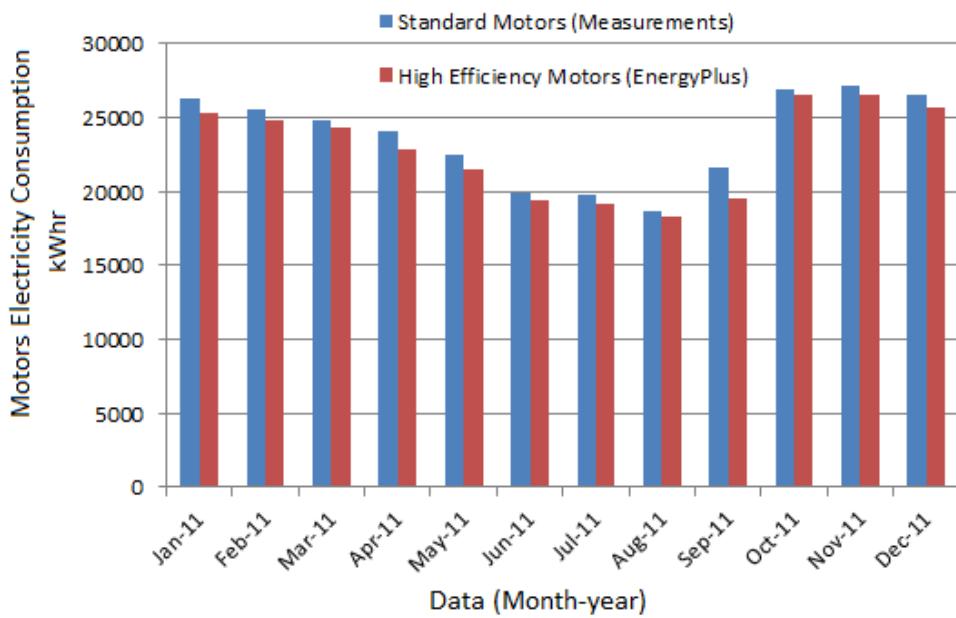
### High efficiency motors

The operating efficiency of electric motors has been improved in recent years. Depending on the horsepower rating, the operating efficiency of high-efficiency motors can be from 1-10 percent higher than the operating efficiency of standard motors. The audit analysis inventoried the motors at this facility and determined that it would be cost-effective to replace 14 of the 19 motors with high efficiency as the existing motors failed. For very small motors or seldom-used motors, the simple payback period is too high to make replacement cost-effective. Table 3 presents the results analysis (on yearly based) obtained in EnergyPlus by replacing the existing standard motors with high efficiency motors.

**Table 3.** High efficiency motors: Summary of savings and costs

kW	Number of motors	Motor Efficiency		Energy Savings (kWhr/yr)	Energy Cost Savings (€/yr)	Implementation Cost (including rebate)	Simple Payback period
		Standard	High				
3.73	2	0.839	0.89	1936	348.48	174	0.4
5	3	0.886	0.923	3649	656.82	378	0.5
7	4	0.901	0.931	4012	722.16	752	0.6
10	1	0.908	0.934	1643	295.74	286	0.7
<b>Totals</b>				11240	2023.2	1590	0.6

Figure 6 presents a monthly comparison of electricity consumption between standard motors and high efficiency motors. Total energy savings estimated by replacing standard motors with high efficiency motors is 2023€/yr, while the average payback period was approximately 6 months.



**Fig. 6.** Monthly standard motors v high efficiency motors electricity consumption

Table 4 summarizes the energy retrofit recommendation obtained. Changing the heat pump time schedule from manual to automatic based on the real thermal behavior of the building was estimated to provide a saving of around €290 per year without any cost of implementation and the payback is immediate. Replacement of lighting and motors with more efficient alternatives, could provide potential cost savings of €3881 but would include an implementation cost of €2736. Finally, it was estimated that

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the implementation of the recommended measures could provide an annual electricity savings of 22,117kWhr corresponding to projected cost saving of €4170.

**Table 4.** Energy Retrofit Technologies: Summary of Savings and Costs

Description of Energy Retrofit Technologies	Potential Savings (€/yr)	Implementation Cost (€)	Simple Payback Period (yrs)	Energy Savings (kWhr/yr)	Demand Reduction (kW)
<b>Process Improvements</b>					
1. Time schedule Heat Pump Modification	290	0	Immediate	5050	0
2. Replacement with High Efficiency Lighting	1858	1146	0.6	10327	0.241
3. Replacement with High Efficiency Motors	2023	1590	0.6	11240	1.757

## **CONCLUSIONS**

This research work presents firstly a brief overview of the calibration process developed in previous research work [10]. Using a previously validated energy model that complies with ASHRAE guidelines [9], three different types of energy retrofit technologies were investigated. Secondly, the time schedule of the heat pump was modified based on real thermal behavior of the building where the potential energy saving was calculated to be 5050 kWhr/yr with a potential cost savings of €290. Thirdly, the proposed replacement of standard lighting with high efficiency lighting incorporating luminosity sensors would deliver a potential of €1858 which includes a simple payback period of 6 months. In this scenario, the cost of implementation was calculated to be €1146. Fourthly, the replace of standard motors with high efficiency motors was estimated to result in potential cost savings of €2023.

The total electricity saving on early basis subject to implement of recommended solutions was estimated to be 22,117 kWhr corresponding to approximately 10% of the total building electricity consumption per year. The findings of this research illustrate the importance of using an accurate and calibrated building energy model. This allows energy auditors, building owners and ESCOs (Energy Service Companies) to compare technologies and approaches, estimate the potential savings and the potential return on investment period prior to actual installation of optimal energy retrofit solutions. Finally, future research could explore the extension of the developed approach to other types of buildings including commercial facilities.

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**O 38. DOES FOOD PREFERENCE AFFECT MOVEMENT: TARAXACUM OFFICINALE CONSUMPTION IN DROSOPHILA MODELS?**

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**ABSTRACT:** *Taraxacum officinale* Weber (dandelion) can grow in urban environments on metal-polluted sediments deposited in the gutters. We hypothesized that food choice affects motor actions in climbing *Drosophila* in order to understand its adaptation to polluted environments. Polluted environments alter food choice, climbing and locomotion in response to bitter compounds in the diet. In our study, commercial dry plants at different ways (powder-0.025 to 1 g/L and brew- 100 to 200 microliter/ml) were added to insect diet. It was found that flies prefer food prepared with powder groups more than the control. While the first group (0.025 g/L of powder) was increased mobility, there was no statistically significant difference in climbing behavior between the groups except the first group.

**Keywords:** *Bioaccumulator plant, Dandelion, Drosophila, Climbing ability, Two-way choice.*

**INTRODUCTION**

*Taraxacum officinale* Weber (dandelion: Asteraceae) is a wide geographic distribution, and often found in degraded soils in urban environment (Benvenuti, 2004; Keane et al., 2005). Some authors reports, dandelion is able to take up a variety of metals into their tissues, and proven to react quantitatively to pollution as bioindicator plant (Bini et al., 2012). Pollution induces oxidative stress producing reactive oxygen species (ROS). Therefore, to counteract this damage, plant and animal cells deactivate this metal stress inducing highly efficient antioxidant defense mechanisms or dead (Bretzel et al., 2014).

Heavy metals have been a problem due to bioaccumulation in a worldwide. Exposure to heavy metals may be one of the main causes of health problems, such as nervous system diseases, and enter by the digestive system (Lisiak-Zielińska et al., 2021). The climbing assay with model organisms has proven useful in the study of many nervous system diseases (Triphan et al., 2010; Madabattula et al., 2015). *Drosophila* is a model organism used for diseases and nutrition, and behavioral responses can be easily observed in generations. In addition, *Drosophila melanogaster* is mostly used to evaluate the potential of pollutants (do Amaral et al., 2005; Zamberlan et al, 2020). In the heavy metal / pollutant environment, the individual either changes the food preference or improves the continuation of her life and generation. Based on these opinions, commercial dry dandelion (powder 0.025-1 g / L and brewing 100-200 µl / ml) was added to the insect diet in different ways, and food preference and climbing behavior were evaluated.

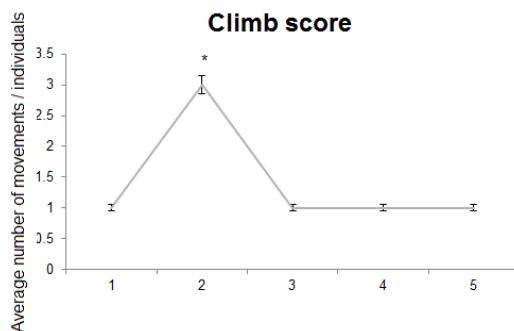
**MATERIAL AND METHOD**

*D. melanogaster* (W<sup>1118</sup>) culture is fed in the University laboratory with a standard culture medium (SM) at incubator ( $25 \pm 2^\circ\text{C}$  and 60–70% humidity for 12/12 dark/light photo periods, Güneş and Büyükgüzel, 2017). Culture foods are renewed every 3-4 days. Commercially available dandoline was added to food by powder (0.025-1 g / L) and infusion (100-200 µl / ml). Groups: Control (1) consists of 0.025 g / L powder (2), 1 g / L powder (3), 100 µl / ml infusion (4) and 200 µl / ml infusion (5) (Güneş et al, 2017). Climbing experiments were carried out according to Grover et al. (2019), taste orientation experiments were performed by revising from Dus et al. (2011). For climbing and taste orientation, 5 female / 5 male individuals were taken into two opposite tubes with control and experimental groups in taste experiments and their feeding was monitored for 24 hours.

One-way "Analysis of Variance" (ANOVA) was used to determine the within-group variation, and "LSD Test" was used to determine the significance of the difference between averages.

## **RESULTS AND DISCUSSION**

It is known that movement increases in response to stress and resistance (Curtis et al., 2007). Under environmental stress and pollution conditions, ROS production, lipid peroxidation and antioxidant enzyme activity are increased in flies (Dhar et al., 2020). The aggression and climbing behavior may increase due to the increased stress on the flight muscles of the insect. And aggressive behavior is associated with the gustatory, olfactory, and hearing ability of fruit flies (Versteven et al., 2017). While the second group (0.025 g/L of powder) was increased the flies mobility, there was no statistically significant difference in climbing behavior between the other groups compared with control ( $p < 0.05$ ; Figure 1).



**Figure 1.** A food-dependent climbing behavior of flies

The taste and smell in the food can trigger the insect's disgust behavior, but due to the odor substances in heavy metals, the insects may be exposed to toxicity by decreasing their memory ability (Zamberlan et al., 2020). Thus, even if the result ends with death, the insect may want to feed on indicator food. It was determined that the food preferences of flies were mostly 5 and the second group compared to control (Table 1).

**Table 1.** A two way choice taste preference table of flies

Groups	First-last weighing (control/experimental group)	Food preference
1 or 2	1.03/1.05	Second group
1 or 3	1.02/0.97	First group
1 or 4	0.82/0.52	First group
1 or 5	0.72/1.09	5 <sup>th</sup> group

In accordance with the fact that the low dust applied according to previous studies (Güneş et al., 2017) does not have a negative effect on the development of the insect's survival; In this study, the second group showed that although they may cause some disgust, they can be chosen in terms of food preference.

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**O 39. AIR POLLUTION DATA ANALYSIS OVER VAN CITY**

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**ABSTRACT:** Air pollution exhibits a very complex and non-linear behaviour as a result of positive and negative changes in time and space, depending on the meteorology and topographic structure, in the transportation of the emissions released into the receiving environment as a result of the activity of air pollution sources. The aim of the study is to monitor the behaviour of air pollutants over VAN in 2019 through statistical analysis of data, to contribute to increasing air quality. PM<sub>10</sub> and SO<sub>2</sub> parameters have been observed to have the highest average hourly value of 72.5-25.1 µg / m<sup>3</sup>, and the lowest value (24.8 µg / m<sup>3</sup> at 22:00 hours, 11.4 µg / m<sup>3</sup> at 16:00 hours) respectively. It can be seen 64% of the measured PM<sub>10</sub> data were observed in the range of 0.1-40.7 µg / m<sup>3</sup>. 80% of the same data is less than 56.4 µg/m<sup>3</sup> and 91% of the data has the highest density observed in the range 1.1-82.1 µg / m<sup>3</sup>, while 77% of the measured SO<sub>2</sub> data was observed in the range of 1.5-22.7 µg / m<sup>3</sup>. 80% of the same data is less than 25.1 µg / m<sup>3</sup> and 90% of the data has the highest density in the range of -4.7-37.8 µg / m<sup>3</sup>. The results also showed Wind plays an effective role in the horizontal transport of pollutants in the atmosphere. If the wind is calm, the polluted air stays where it is, and the precipitation help collapse Pollutants in the atmosphere. Because of this feature, precipitation is described as the cleaner of the atmosphere.

**Keywords:** *Air pollution, Van, meteorology*

**INTRODUCTION**

Air pollution happens when gases, solid and liquid particles substances in the air we breathe are in a density and time that will harm living health and the earth's environmental. Air pollution is one of the biggest and most important problems of humanity. Air pollution exhibits a very complex and non-linear behavior as a result of positive and negative changes in time and space, depending on the meteorology and topographic structure, in the transportation of the emissions released into the receiving environment as a result of the activity of air pollution sources. Air pollution is caused by natural causes such as forest fires and volcano eruptions, as well as growing human activities today. Today, air pollution is mostly caused by motor vehicles, industrial facilities and heating. Air quality is very important in terms of the security and sustainability of human health. Increasing worldwide industrial activities and inefficient use and waste can lead to pollution threatening human health in many parts of the world (Toros, 2000; Toros & Anbarci, 2018; Ouyang et al., 2019; Venter et al., 2020; Dursun et al., 2021, Öztürk et al., 2021). Unal et al. (2021; Fu et al. 2020). Following the COVID-19 outbreak that started in 2019, changes in human activities and behavior necessarily led to significant reductions in air pollution within the framework of efforts to limit their exposure to the infectious virus (Dursun et al., 2021; Öztürk et al. 2021; Tunç and Taurus 2020; Kılıç et al. 2020; Bilgin and Toros 2020; Yiğiter and Toros 2020; Leg et al., 2020; Dündar et al., 2020; Kara et al., 2020).

There is no more study about air pollution of the Van city so there are more study about it to understand level, behavior and changes of air pollution city of Va. Öztürk and Bayram (2019) studied temporal and seasonal distribution of air pollutant parameters, concentrations, and the relationship of pollutant parameters with temperature in the city center of Van were discussed according to the allowed limit values and solutions for the city were given. They concluded that the topographic and geographical location of the city, the winter season is harsh, and the average temperature of the city is lower than the country average. Tekin Ö.F. (2021) evaluated the air pollutants (PM10 and SO2) in the first year of the COVID-19 in the province of Van compared to the previous year.

In this study, the 2019 air pollution analysis was made for the Van province of Turkey. In this article, the behavior, source, etc. of the pollutants are analyzed by analyzing the data that has passed the quality control process with statistical techniques. It is aimed to create a systematic structure in these matters

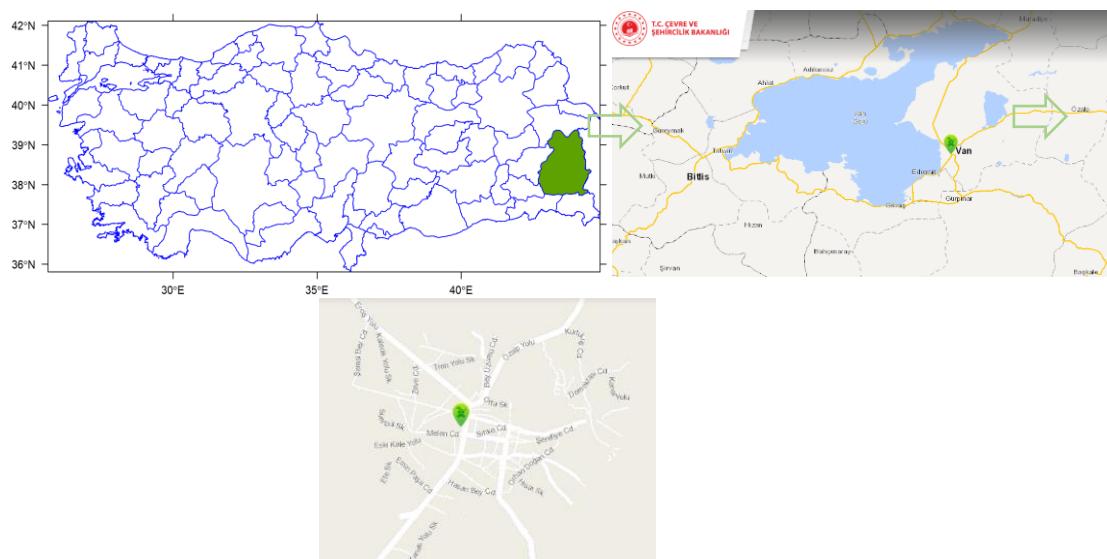
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and thus contribute to the increase of air quality, which is extremely important for human health, to create socio-economically sustainable and safe of tomorrows.

## **DATA AND METHOD**

Hourly PM<sub>10</sub> and SO<sub>2</sub> parameters data for 2019 were obtained from the Ministry of Environment and Urbanization air quality monitoring stations (Figure 1). Air pollution and meteorological data are obtained from the Ministry of Environment and Urbanism of Turkey and the Turkish State Meteorological Service.

The study area is located in the eastern sites of the Lake Van region, Eastern Turkey with a population of approximately 1 million 150 thousand. The city center of Van is located at latitude 38.497 N and longitude 43.3816 E. The continental climate is dominant in the province located in the east of Turkey. Therefore, it is dry and hot in summer and cold and snowy in winter. However, Lake Van, Turkey's largest lake, makes the continental climate of the city slightly more humid (ÖZTÜRK and BAYRAM 2019)



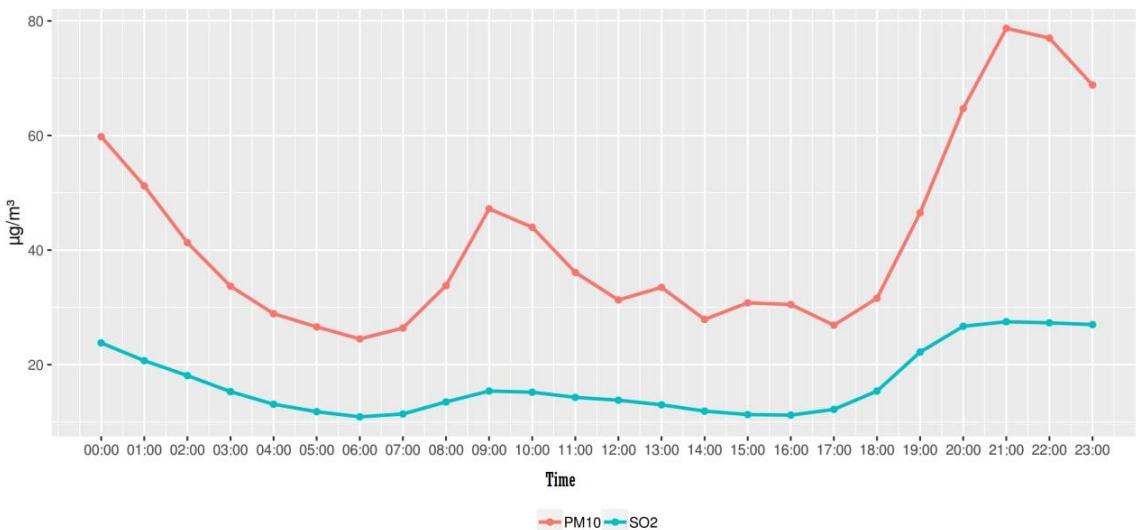
**Figure 1.** The location of Van on the map of Turkey

The temporal variation of each pollutant (according to density and index values), the largest, smallest, average values over time, temporal variation of meteorological data, and the relationship between meteorological data and pollutants were examined.

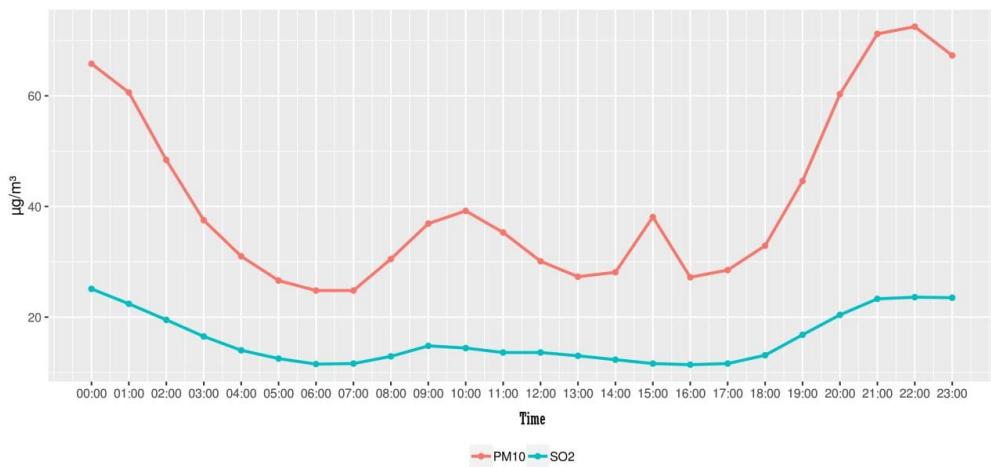
## **RESULT**

It is very important in analysis to see how pollutants have changed over time. The situations where the pollution intensity increases, decreases or reaches the highest level can be observed with the help of graphs. In addition, the simultaneous increase and decrease of two different pollutant parameters is also very important in terms of determining the pollutant source.

the change parameters PM<sub>10</sub> and SO<sub>2</sub> at weekdays the highest hourly average value of (78.7 µg / m<sup>3</sup> - 27.5 µg / m<sup>3</sup>) at 21:00 hours respectively , and the lowest value of (24.5 µg / m<sup>3</sup> - 10.9 µg / m<sup>3</sup>) at 06:00 hours respectively, as seen in Figure 2. while see in Figure 3 at the weekend the highest average hourly value of PM<sub>10</sub> and SO<sub>2</sub> parameter (72.5 µg / m<sup>3</sup>, 25.1 µg / m<sup>3</sup>) , and observed the lowest value of (24.8 µg / m<sup>3</sup>, 11.4 µg / m<sup>3</sup>) at (22:00,16:00 hours) respectively.

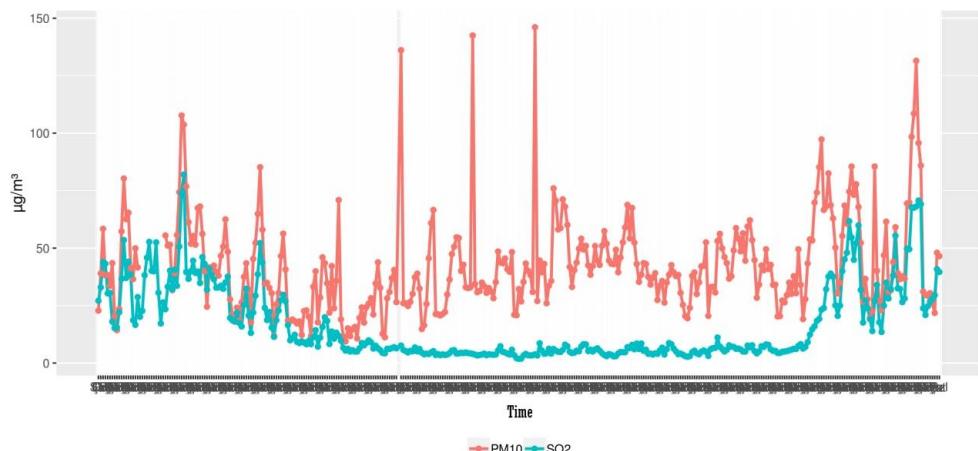


**Figure 2.** Time change graph of pollutants during the week.



**Figure 3.** Time-change graph of pollutants over the weekend.

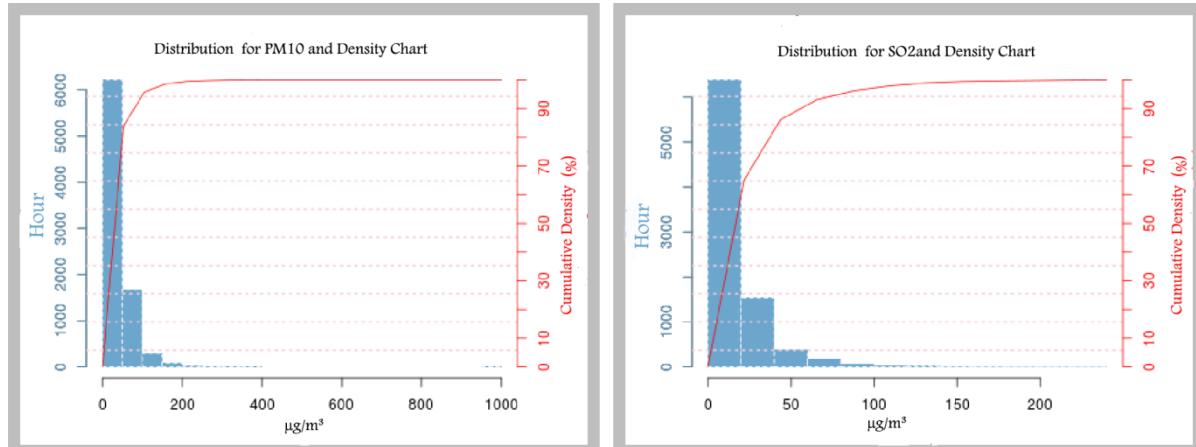
The high daily average change of pollutants PM10 and SO<sub>2</sub> of (146.1 µg / m - 82 µg / m<sup>3</sup>) was observed (on Tuesday, July 09 - on Thursday, February 07) respectively, but the lowest daily average of (9.4 µg / m<sup>3</sup> - 1.8 µg / m<sup>3</sup>) value was observed (on Thursday, April 18- on Tuesday, July 02) respectively as seen in Figure 4.



**Figure 4.** Daily average change graph of pollutants.

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Figure 5 show 64% of the measured PM10 data were observed in the range of 0.1-40.7  $\mu\text{g} / \text{m}^3$ . 80% of the same data is less than 56.4  $\mu\text{g} / \text{m}^3$  and 91% of the data has the highest density observed in the range 1.1-82.1  $\mu\text{g} / \text{m}^3$ , and also 77% of the measured SO<sub>2</sub> data was observed in the range of 1.5-22.7  $\mu\text{g} / \text{m}^3$ . 80% of the same data is less than 25.1  $\mu\text{g} / \text{m}^3$  and 90% of the data has the highest density in the range of -4.7-37.8  $\mu\text{g} / \text{m}^3$ .



**Figure 5..Histogram and density graphs of pollutants.**

The average values of PM10, SO<sub>2</sub> parameters were measured as 41.6, 16.5  $\mu\text{g} / \text{m}^3$ , respectively. The extreme values corresponding to 75 percent were measured as 50.3 and 21  $\mu\text{g} / \text{m}^3$ , respectively show in Table 1.

**Table 1.** Measurement data summary information

Type	NM	Daily%	Min.	%25	Avg.	Median	%75	Max.	SD.
PM10	8697	96	0.1	20.7	41.6	32.9	50.3	1000	40.5
SO <sub>2</sub>	8697	100	1.5	4.6	16.5	7.7	21	232.1	21.2

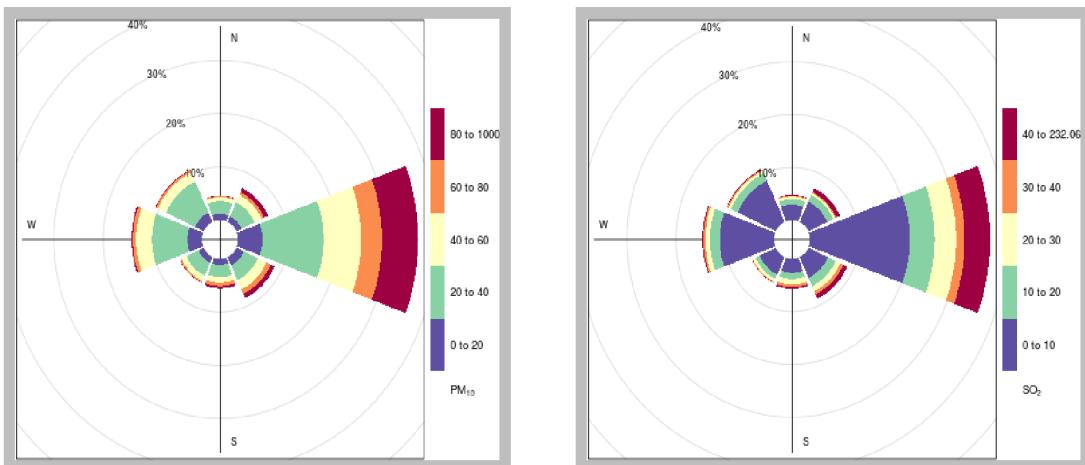
Table 2, shows the ranges for the air quality index applied in our country. When the PM10 measurement values were examined as a percentage, it was observed that 73% was in the GOOD class, 25% in the MIDDLE class, and 2% in the SENSITIVE class.also, SO<sub>2</sub> measurement values are examined as a percentage, it is observed that 99% is in the GOOD class and 1% is in the MIDDLE class.

**Table2.** National Air Quality Index

Index	Air Quality Index	SO <sub>2</sub> [ $\mu\text{g}/\text{m}^3$ ]	PM10 [ $\mu\text{g}/\text{m}^3$ ]
		1 Hour Cover.	24 Hours Cover.
Good	0 – 50	0-100	0-50
Middle	51 – 100	101-250	51-100
Sensitive	101 – 150	251-500	101-260
Unhealthy	151 – 200	501-850	261-400
Bad	201 – 300	851-1100	401-520
Dangerous	301 – 500	>1101	>521

Wind plays an effective role in the horizontal transport of pollutants in the atmosphere. In the presence of wind, the pollution is moved from one place to another. If the wind is calm or slightly intense, the polluted air stays where it is. Therefore, air pollution is most intense in areas that are closed to the wind. In this case, dilution of the pollutants in the air occurs in direct proportion to the increase in wind speed. Figure 6 as show, the pollution rose graph is examined, depending on the wind direction For PM10 and SO<sub>2</sub> pollutant parameters, the direction with the highest pollution frequency was observed as East.

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**Figure 6.** Pollution rose graph.

## **CONCLUSION**

The main concluding remarks obtained from this study are summarized as follows:

- The parameters PM<sub>10</sub> and SO<sub>2</sub> are highest on a weekday and decrease on weekend .
- The high daily average parameters PM<sub>10</sub> and SO<sub>2</sub> of (146.1 µg / m<sup>-3</sup> - 82 µg / m<sup>3</sup>) was (on Tuesday, July 09 - on Thursday, February 07) respectively.
- PM<sub>10</sub> and SO<sub>2</sub> pollutant parameters, the direction with the highest pollution frequency was observed as East.

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**O 40. RESEARCH OF THE EFFECTS OF DAMS AND HYDROELECTRIC POWER  
PLANTS ON ECOSYSTEM AND TOURISM ACTIVITIES**

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**ABSTRACT:** In Turkey, dams are built for energy production outside to drinking water and irrigation needs. Numerous river-type (dam-free) hydroelectric power plants (HPP) are built on every stream in Anatolia. However, these power plants cause negative environmental impacts on a regional and global scale. These environmental impacts can be listed as the extinction of species and natural habitats, the melting of the deltas, the decline or depletion of groundwater, the drying up natural lakes, the affection of the physical and biological environment, economic inefficiency, and deteriorating socio-economic structure. Due to HPP underwater ancient cities have been increasing recently. Because of when compared to thermal and nuclear power plants, cause less damage to the environment and produce electricity at low cost, HPPs are more preferred. However, disappeared cultural heritage and biodiversity can destroy the benefits of project. In this study was shown the importance of the HPPs negatives effects on ecosystem and tourism. Also was emphasized location selection for HPP should be evaluated with parameters such as negative environmental impacts that may source from the dam, protection the country's resources and the socio-economic structure. In addition, alternative energy resources were also proposed evaluating the existing natural resources of the regions.

**Keywords:** HPP, dam, Biodiversity, Underwater City

**INTRODUCTION**

In globalizing world, as a result of rapid population growth and industrialization, the need for energy is increasing day by day and also the need for new energy resources emerges. One of the most important energy resources is "Hydroelectric Energy" obtained from power of water. (Gökdemir et al. 2012; Gülgün et al., 2017a). Hydroelectric has an important market potential as green energy in renewable electricity generation.

Dams are as old as human history and humans have built dams for to satisfy their drinking and irrigation water (Ankaya et al., 2018; Yazici et al., 2018). However, today dams are built for energy production besides drinking water and irrigation. In recent years, there has been a significant increase in the number of hydroelectric power plants in Turkey. Everywhere Anatolia numerous "river-type" (without dams) hydroelectric power plants are being built in rivers and on each stream. However, these power plants cause negative environmental impacts on a regional and global scale. These environmental effects can be listed as; the extinction of species and natural habitats, the melting of deltas, the depletion of groundwater, drying of natural lakes, affecting of physical and biological environment, economic inefficiency and socio-economic deterioration (Mayor et al. 2017; Gülgün et al., 2014; Gülgün et al., 2017b). In addition, damaging of fish populations, loss of aquatic habitat, changing in natural flow regimes, flooding of historical buildings and degradation of the landscape are among the negative impacts (Turhan and Çağatay, 2015). HPPs are more preferred because of to cause less damage to the environment and produce electricity at low cost compared to thermal and nuclear power plants. However, the benefits provided by the project cannot be compared with formed negative environmental impacts.

The purpose of this study is to evaluate the negative effects of HPPs on ecology and tourism and to present the necessary precaution for to stopped of these effects. Anatolian lands have a semi-arid (subtropical) climate and streams flow irregularly in deep valleys. Therefore, while choosing the location for the HPP structures, the adverse environmental impacts that may occur due to the dam should be revealed and the protection of the country's resources should be evaluated. In addition, instead of

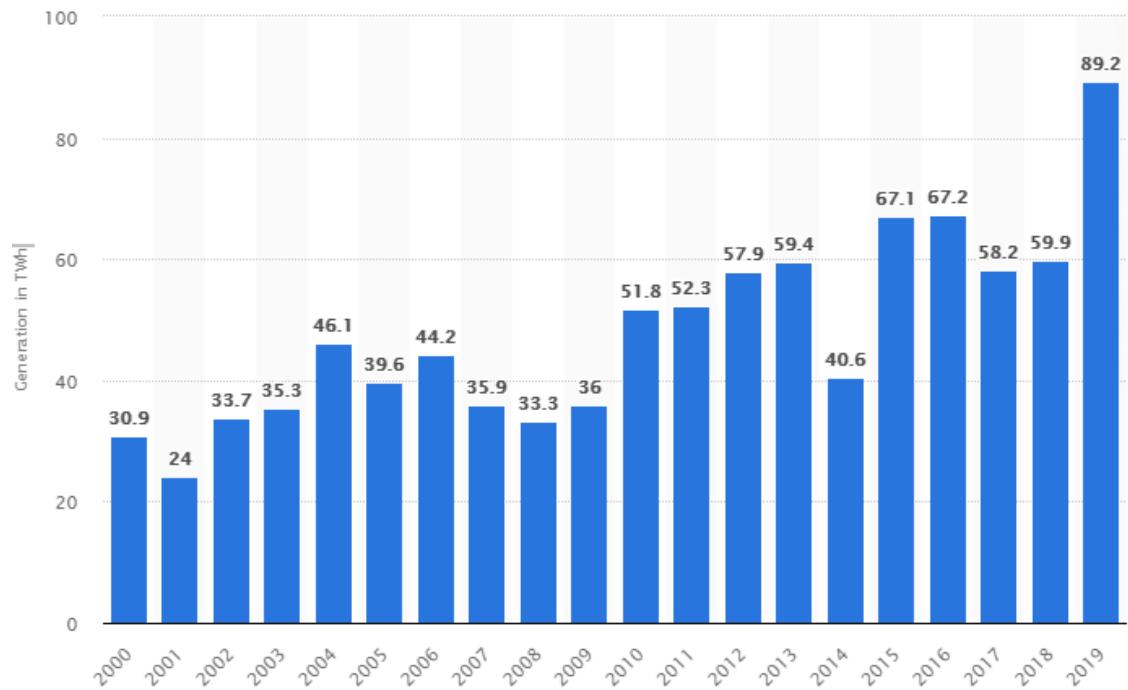
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HPPs the use of alternative energy sources like solar, wind, biomass and geothermal should be increased. The main criteria that determine pollution in aquatic environments are physicochemical and biological factors. Physicochemical parameters should be measured continuously in rivers where HEPPs are located and it is necessary to examine how changing parameters affect water quality.

## **RESULTS**

### **Hydroelectric Power Plants in Turkey**

In Turkey the total installed power of the Hydroelectric Power Plants is 31.336 MW. The General Directorate of State Hydraulic Works (DSI) defines hydroelectric power plants as environmentally, clean, renewable, highly efficient, without fuel expense, long life, very low operating cost and non-dependent domestic resource (Ürker and Çobanoğlu, 2012). The number of large and small-scale HPP projects, whose number has started to increase rapidly, has been calculated to be 1700 by 2023 (Bobat, 2012). In Turkey, 596 HPPs are actively operational, 83 HPPs are under construction and 639 HPPs are planned to construction. (Yaman and Hasıl, 2018). Hydro-energy production in Turkey from 2000 to 2019 is given in Figure 1 as terawatt-hour (Jaganmohan, 2021). Due to the geographical location of Turkey, hydroelectric power is used considerably and it can be seen that HPP projects have increased recently in Figure 1.

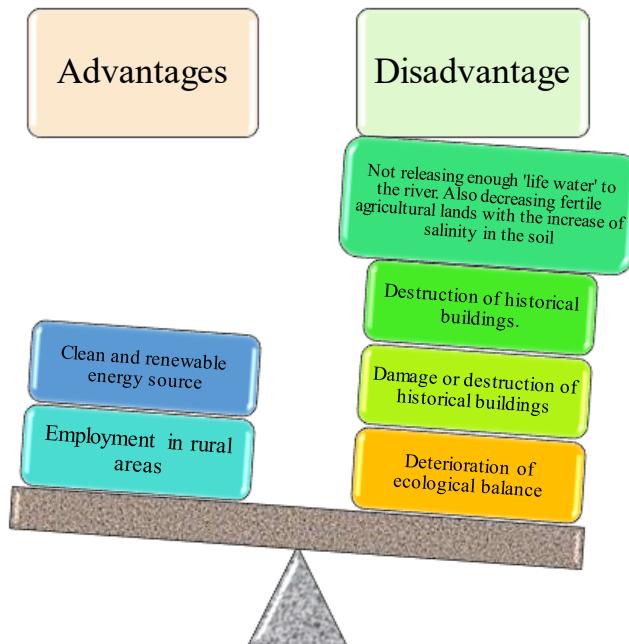


**Figure 1.** Hydro power generation in Turkey from 2000 to 2019 (Jaganmohan, 2021).

### **Effects of Hydroelectric Power Plants**

Although hydroelectric power plants seem to be environmentally friendly, they can cause many negative effects. For example; because of HEPPs plants can decay in underwater, which may result in to release of large amounts of greenhouse gases into the atmosphere (Hook, 2015).

In Figure 2 shows that HPPs are increase employment, enrich commercial life and make significant contributions to the local economy. However, for these reasons, its environmental effects should not be ignored. Ecological diversity, which constitutes the natural resources of countries, is necessary for the continuation of human existence. Since the economy is generally dependent on natural resources, biodiversity and tourism are also great importance in the development of countries. However, HPPs are cause the extinction of plant and animal species. (Keleş and Hamamcı, 2005).



**Figure 2.** Advantages and disadvantages of HPP.

### The Impact of Hydroelectric Power Plants on Historical Artifacts

Turkey is very rich in rivers and rivers. The villages and ancient cities where the dams built into the waters of these rivers were flooded and continue to remain. For example; Atatürk and Birecik Dams on the Euphrates River, Ilısu and Dicle Dams on the Tigris River, Seyhan Dam on the Seyhan River, Yontalı Dam on the Bergama Yontalı Creek have caused the formation of underwater ancient built. Table 1 includes some examples of historical artifacts that sink due to dams (Özdil, 2020). It has also been reported that the 3500-year-old Lycian bridge remains were destroyed during the construction of the HPPs. (Turhan and Çağatay, 2015).

**Table 1.** Important historical buildings under the dam lakes.

<b>Historical place City</b>	<b>Dam that Caused</b>	<b>Photo</b>
Lidar Mound Şanlıurfa	In 1987, it was remained completely under the Atatürk Dam Lake.	
Samsat City Adıyaman	It was remained under the Atatürk Dam.	
Tille Mound Adıyaman	It was remained under the Atatürk Dam.	
Zeugma Ancient City Belkıs-Gaziantep	It was remained under the Birecik Dam.	
Horum Mound Gaziantep	It was remained under the Birecik and Karkamış Dam.	

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Rumkale Gaziantep	It was remained under the Birecik Dam.	
Savaşan Village Şanlıurfa	It was remained under the Atatürk Dam.	
Hasankeyf Batman	It is in danger because of the Ilısu Dam on the Tigris River.	
Çattepe Mound –Motit Castle - Siirt	It is in danger because of the Ilısu Dam.	
Eğil Ancient City Diyarbakır	It was remained under the Tigris Dam.	
Augusta Ancient City Adana	It was remained under the Seyhan Dam.	
	It was remained under the Yontalı Dam.	

**The Impact of Hydroelectric Power Plants on the Ecosystem**

Exploding dynamite during the construction of HPP projects causes air and soil pollution, and generated noise seriously affects wildlife. Therefore, it has emerged necessary to consider the effect of noise on wildlife.

During the construction of the HPP, the leaves are covered with dust so the light transmittance of the plants decreases and the speed of photosynthesis and the growth level of the trees are negatively affected. During the operation periods of HPPs, when the amount of sediment transported from rivers to the seas decreases, biodiversity is affected and the risk of coastal erosion is increased (WWF-TR, 2013). For example; the flora and trees around the Alakır River were seriously affected, and the mortality rates of wild animals started to increase. And also the habitat of the endangered red spotted trout living in the Alakır River have restricted because of HPP. In Figure 3, photographs of the Alakır river are seen on the left side before the HPPs and on the right side after the HPPs. (<http://www.bilim.org/kus-seslerinden-kepce-seslerine-alakirda-hidroelektriksantraller/>).



**Figure 3.** Photographs of the Alakır river are seen on the left side before the HEPPs and on the right side after the HPPs.

### Different Renewable Alternative Energy Sources

Turkey's natural renewable energy resources are quite varied, such as hydro, geothermal, biomass, biomass waste, plant waste and solar. In Table 2, renewable energy resources potentials (natural, technical and economic) of Turkey are given. (Demirbas and Bakıs 2004).

Turkey's hydroelectric capacity has the highest potential in Europe, but only one-third of this capacity is used. Turkey is also one of the richest countries in Europe in terms of wind energy potential. Although the geothermal industry is highly developed, excellent geothermal resources are still underdeveloped in Turkey. Because the cost of a new natural gas power plant is only half that of a new geothermal power plant. However, if Turkey uses all of its geothermal potential, it will be able to satisfy 14% of its total energy demand (Benli, 2013).

Hydroelectric power plants have negative effects on the environment both during the construction and during the operation (ETKB, 2016). HPP projects are based on water, but water is more important than energy. Therefore, the use of alternative energy sources instead of HPP should be widespread.

**Table 2.** Renewable energy resources potentials of Turkey (Demirbas and Bakıs, 2004)

Renewable energy source	Usage kind of energy	Natural potential	Technical potential	Economic potential
Solar energy	Electrical energy (TWh/year)	977,000	6105	305
	Heat (mtoe/year)	80,000	500	25
Hydraulic energy	Electrical energy (TWh/year)	433	216	127.4
Wind energy				
Direct terrestrial	Electrical energy (TWh/year)	400	110	50
Direct maritime	Electrical energy (TWh/year)	—	180	—
Sea wave energy	Electrical energy (TWh/year)	150	18	—
Geothermal energy	Electrical energy (TWh/year)	—	—	1.4
	Heat (MW <sub>t</sub> )	31,500	7500	2843
Biomass energy	Fuel (classic) (mtoe/year)	30	10	7
	Fuel (modern) (mtoe/year)	90	40	25

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### **Physicochemical Parameters of River Waters**

Because of for HPPs was used most of the water from rivers, the flow rate, depth of the river and bottom structure could change greatly. As the flow rate of the river decreases, the amount of dissolved oxygen in the water decreases. When the oxygen falls below a certain value, a lot of fish deaths can occur. In addition changing of water temperature also adversely affect the life of species sensitive to temperature. Also a different effect; after a certain amount of suspended solids, it usually causes physical contamination of the water, clouding of the water and increased toxicity. In this case, light transmittance and oxygen amount decrease, aquatic organisms are damaged.

To determine the effect of a HEPP in operation on water quality were investigated some chemical parameters such as; temperature, pH, total dissolved solids (TDS), sodium, ammonium nitrogen, chloride, nitrate nitrogen, nitrite nitrogen, fluoride, sulphate, dissolved oxygen (DO), biological oxygen demand ( $BOD_5$ ), anionic surfactants, chemical oxygen demand (COD), heavy metals (Pb, Zn, Cr, Mn, Fe, Cu, Cd, Co, Ni, Al, Ar, Se, B), phenol, total phosphorus, nitrate and nitrite (Akyüz and Şencan, 2017). Knowing the water quality is necessary to protect or improve the existing quality and also to determine the purpose of water use. Therefore, samples taken from different parts of the rivers where HPPs are located should be measured parameters of physico-chemical and compared according to water quality standards.

## **CONCLUSION AND DISCUSSION**

As a result, hydroelectric energy is a necessary type of energy since the construction of HEPPs is inevitable, but renewable energy sources cannot always be sustainable. Especially, HEPPs have significant and irreversible effects on the nature and life in the construction and operation state. Therefore, the extend of the destructions caused by the environmental and social impacts of HEPP investments should not exceed the benefit of energy generation.

The suggested preventions to eliminate and avoid the negative effects of HEPP are listed below;

- HEPP investments should be planned and performed in a way that takes into account the ecological characteristics of water resources, protects historical and architectural buildings and ensures that they are sustainable.
- Apart from HEPP, alternative energy potentials according to the regions in Turkey, it should be used that biomass, geothermal, solar and wind energies with maximum efficiency. In addition necessary investments should be made to encourage these renewable resources.
- Especially in rivers where HPPs are located, water flow, water depth, dissolved oxygen, water temperature, pH, electrical conductivity and turbidity should be measured routinely. In order to improve and protect the current situation, it is necessary to periodically check the physicochemical effects that may arise from the HEPP activities and make recommendations to the relevant official units to tak

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**O 41. WATER BUDGET IN TURKEY UNDER THE IMPACTS OF CLIMATE CHANGE**

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**ABSTRACT:** Since the industrial revolution (the mid-19<sup>th</sup> century), the intensive increase in greenhouse gases released and accumulated into the atmosphere, as a result of anthropogenic and natural activities, have caused global warming, and the world have faced with the challenges of climate change that has political, social, cultural and economic impacts and that is expected to be more intense in the future. Weather events with the expected increase in temperature, evaporation, and changes in rainfall patterns have raised the question of "Are we running out of water?". It is observed that the potential water budget in Turkey was between 350-550 billion m<sup>3</sup> in the period of 2000 – 2019. According to the intermediate (RCP4.5) and high emission (RCP8.5) scenarios, it is expected that there will be an increase in the average temperature and changes in the amount of rainfall for the period of 2016-2099. From the high emission scenario, it is expected that Turkey's annual water budget will be more than 300 billion m<sup>3</sup> at the end of the 21<sup>st</sup> century. In this study, protective and sustainable measures, which will ensure that the potential water budget in Turkey is sufficient at the end of the century against the threat of drought that may occur with the expectation of increased temperature and changes in rainfall, have been evaluated.

**Keywords:** *Climate Change, Climate Projections, Water Budget*

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**O 42. QUALITY EVALUATION OF TECHNICAL REVIEWS OF CONSTRUCTION  
PROJECTS DESIGN AND CONSTRUCTION MATERIALS IN ALBANIA**

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**ABSTRACT:** The aim of this research was the analysis of the institutions concerned in policy making and legality implementation, related to the safety of construction works, with the aim to ensure the community, the possibility of utilization of guaranteed civil engineering structures and high-quality construction materials. The main institution which guarantees the quality of the construction projects design and the quality of construction materials used in Albania territory, is the Albanian Institute of Construction. The Ministry of Infrastructure and Energy has failed to complete the legal framework, where quality of construction materials and construction projects design issues, should be entrusted to a competent institution, where its activity, in this case the Albanian Institute of Construction, has to be guaranteed by law. The lack of qualified staff, the recruitment employees without the necessary experience, as well as the lack of a non-accredited laboratory in ALIC, has led to the provision of low-quality technical reviews and lack of quality control of construction materials.

**Keywords:** Technical review, Construction Project, Design, Materials

**INTRODUCTION**

The Albanian Institute of Construction is under jurisdiction of the Ministry of Infrastructure and Energy and must provide a high level of protection of the citizens, to guarantees the sustainability of construction works in our country, and at the same time to protect the health of citizens and the environment.

The continuous increase of demand to replace the existing Albanian design codes with Euro codes, will lead to the improvement of design methods, with direct impact to quality and safety of construction projects.

The Control of implementation of construction public projects remains a basic requirement not only for the protection of health, but also has a great impact on sustainability development of the country.

In this context, the analysis of the activity of the Institute of Construction, in order to increase the quality assurance of construction design, is an issue that after the earthquakes of September and November 2019, should be addressed with high priority.

**METHOD**

During the study phase and onwards, a considerable amount of numerical data has been collected, such as: Organisation breakdown structure and quality management system; number of inspections by year, activity of the IC directorate of technical reviews and laboratories, number of technical reviews divided according to the level of risk; the number of construction companies resulting has violated the rules; laboratory samples; questionnaires, etc., which require careful statistical analysis, to reach accurate and clear conclusions. In this way, we used the quantitative approach.

Interviews with specialists of AIC and NGO interested in the field of quality assurance of construction project.

Field visits/ laboratory and observations of:

Management procedures, technical procedures, work instructions and relevant forms of the management system of the Laboratory Department and in general of AIC (DL-PM-01).

Quantitative and qualitative analysis of information provided by the AIC.

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### **RESEARCH FINDINGS**

#### **Legal basis which regulate the safety of construction facilities.**

-The legal basis for the functioning of the Albanian Institute of Construction is insufficient. The establishment of this institution, by Decree No.225 DT 29.06.2004 of the Minister of Construction, as well as its functioning according only to the regulation approved only by the General Director, has created the possibility of inadequate functioning of the IC.

-The rules and steps approved, mandatory to be followed during the compilation of the technical review is not detailed and fails to serve the provision of a quality and professional technical review of the construction designs.

-The legal basis Law No. 8402, dated 10.9.1998 on "On the control and discipline of construction works" as amended", has undergone some changes, but this legal basis must be adapted to the dynamics of construction development in recent years. Different central and local self-government institutions have different approaches to the same problems, due to the gaps in this legislation.

The "Manual of Prices of Construction Works" and their technical analysis, has not been updated from 6 years (approved MPCW with DCM is No. 629, dated 15.07.2015), although there are numerous requests from the institutions and entities, that has required to update it with new items, or to clarify some existing items.

#### **The impact of technical reviews given by the AIC to improve the design and increasing the safety of construction projects.**

The technical reviews compiled by the Institute of Construction are generally presented as an inventory of project file documentation, and in most cases have some superficial recommendations, which are generally not taken into account by the institutions and entities. The recommendations given for each project category should have been reflected in the final conclusion. In cases where deficiencies and deviations from the standards of the projects has been ascertained, the technical review should have given negative assessment and the projects should have been rejected. This has resulted a practice not used by the AIC.

#### **Quality of laboratory tests of the AIC Laboratories.**

-Laboratories of the AIC, for a significant amount of construction materials perform tests with AL-SS standards (Albanian State Standard) not harmonized with those of the European Union. Generally the test methods are prepared according to the laboratory standard and the DL-PT-03 procedure and the specialists have the proper instructions for processing the test samples, as well as the manuals for the use of the equipment. The laboratories of the laboratory directorate use equipment which has been subjected only to internal calibrations and the maintenance process through maintenance programs, without making calibrations from external entities.

-The number of tests nationwide for the years 2016-2017-2018, gives an overview of the performance of the activity of the Directorate of Laboratories in the AIC. According to the analysis of the data, which refers to the documentation data held by DL, it resulted that for the year 2016, 429 tests were performed; for the year 2017, 346 tests were performed and for the year 2018 (until November) 301 tests were performed, neither shown in annexes in Table No.1, Table No.2 and Table No.3

The Albanian Institute of Construction during the testing activity of construction materials/ products, for the period 2016-2018, has issued test reports generally in accordance to S SH ISO/IEC 17025, but not with all components according to international laboratory test standards. Legal inconsistencies found in 47 cases identified in 2016; in 108 cases identified in 2017 and in 55 cases identified in 2018, has shown that it's not the right trend for reporting test results, according to the standard SSH ISO / IEC 17025 and quality manual (MC) (DL- MC-01).

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### **Conformity of laboratory equipment at the disposal of AIC according to the calibration standards.**

A large number of tests are performed with un-calibrated equipment's, by the laboratory directorate of the Albanian Institute of Construction. External calibrations are incomplete and not for all equipment's, in compliance with the requirements of ISO / IEC 17025: 2005, point 5.5, of MC and DL-PT-07 procedure. For devices that affect the quality of the tests, a valid calibration status is not maintained. The universal equipment's used for strength / traction tests or digital testing machines, do not have a calibration certificate where is identified the last date of calibration and the planned date for the next calibration (in terms of calibration frequency) and consequently cannot be judged on the corrective maintenance of equipment, through the implementation of annual internal and external calibration programs and preventive maintenance programs.

### **Quality of materials used for construction of publicly funded civil engineering structures.**

The quality control of construction materials and their application in construction projects is completely out of control. In several construction projects build with state and donor funds, it has been ascertained the use of materials of very poor quality and not according to the standards, starting from the: concrete works in road infrastructure, stones for paving the city squares, materials for facade cladding, plastering and painting materials. While in the works for doors and windows of school infrastructure structures, no standard is maintained for thermic isolation and acoustic insulation.

In terms of road infrastructure, the construction projects realized from the Albanian Road Authority and the Albanian Development Fund, has significant deficiencies in the quality of all elements used for road signage, starting from the lines, information boards, lighting, etc, which in the time span of 2 years , in most cases turn out to be obsolete.

### **Entities implementation of the recommendations of the technical reviews issued by AIC.**

No official document were found where the AIC has requested and received information regarding the implementation of the recommendations left in technical reviews. The AIC has no knowledge whether the recommendations given for the improvement of construction design through technical reviews, are taken into account by the entities before obtaining development permits.

Regarding the Albanian Development Fund, only in 2018, it has started to carry out technical reviews of the design process of the construction projects that implements. While the Albanian Road Authority has regularly conducted technical reviews for civil engineering structures according to the DCM No. 1055, Date 22.12.2010 "Obligation for the realization of projects technical reviews". In the construction projects realized in the Albanian Road Authority, it is ascertained that for the unforeseen engineering works, realized with additional contracts (over 100 million ALL value) no technical reviews have been performed. In some cases the recommendations of technical reviews are taken into account, but the initial projects commissioned by important institutions such as the Albanian Road Authority and the Albanian Development Fund undergo changes during implementation, where in some cases these changes are essential, the revised design and bill of quantities, has not been send to be technically reviewed again to the AIC.

## **CONCLUSIONS**

The activity of Institute of Construction in general should provide assurance regarding the quality of the construction projects design process. If this issue is not sufficiently controlled, remains a major cause for the realization of poor quality engineering works such as roads, hydropower's, schools, hospitals, residential building, etc.

Quality assurance issues for the construction design and projects should be entrusted to a competent institution and guaranteed by law. Even though the construction products are tested by various private accredited laboratories, there is no certified public or private body to assess the conformity of products. The development of an effective and reliable system to control the construction materials, with a high trust from stakeholders, is still considered far from International standards in this field. Direct or indirect costs, which derive by poor quality of the construction, are too high even for developed countries and

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no longer for Albania, considered as a developing country. For this reason, an effective quality assurance system of design and realizing the construction projects is very important, to prevent damage to health and the environment, as well as to reduce the costs associated with it.

The Albanian Institute of Construction as an important institution with long experience in the field of construction control, and it is legally charged to make a direct contribution to the evaluation of various construction projects and on the quality of construction products.

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**O 43. THE PARAMETERS AFFECTING FORCED CONVECTIVE MASS TRANSFER OF LIQUID BENZENE AND TOLUENE**

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**ABSTRACT:** Benzene and toluene are two of the important chemicals which have adverse effects on environment and human health. These chemicals may be used in dyes, cleaning products, and glues etc. They are in the class of volatile organics and they naturally evaporate easily at room temperature. These chemicals may be also evaporated with the help forced convection flow. This process is called as forced convective mass transfer and important indicator of volatile organic pollutants in ambient air. Forced like an air flow may increase the concentration of ambient volatile organic pollution originating from home appliances and cleaning products. In this study, forced convective mass transfer of liquid benzene and toluene was evaluated accordingly the parameters such as temperature, mixing state of chemicals, air flowrate and diameter of liquid container. The experiments were conducted in laboratory environment and the concentrations of evaporation gases were analysed with the gas chromatography with a flame ionization detector (GC-FID). Results of the study indicate that the most important parameter affecting the amount of gas phase concentration has been determined as the air flowrate applied on liquid surface. Furthermore, the diameter of liquid container and the ambient temperature have been found as significant parameters affecting the convective mass transfer of liquid benzene and toluene.

**Keywords:** *Forced convective mass transfer, benzene, toluene, air flowrate, temperature*

**Proceeding Book of ISESER 2021**

**O 44. A NEW MODEL FOR THE UTILIZATION OF PARKING SYSTEMS IN ALBANIA**

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**ABSTRACT:** Car parking problem has been always a major contributor in congestion of traffic and still remains a major problem, due to the increasing of vehicle sizes in the most loaded segments, confining parking spaces in urban cities. The rapid growth in the number of vehicles worldwide is raising the problem of the lack of parking space. As the global population continues to urbanize, without a well-planned, convenience-driven retreat from the car, these problems will worsen in many countries. The current unmanaged car parks and transportation facilities make it difficult to accommodate the increasing number of vehicles in a proper, convenient manner so it becomes indispensable having an efficient and smart parking system. Smart parking management systems are capable of providing extreme level of convenience to the drivers. In this paper, it is proposed a web application system, named "Park Easy", which is based on the usage of smart phones, sensors monitoring techniques with a camera, used as a sensor to take photos and to show the occupancy of cars parks. By implementing this system, the utilization of parking spaces will increase. It allocates available parking space to a given driver to park their vehicle, regenerate the availability of the parking space. Smart parking "Park Easy", will also enable most important techniques to provide all the possible shortage route for parking from any area of the city mainly, helping to envisage accurately and sense spot/vehicle occupancy in real-time.

**Keywords:** Smart Parking System, Application, Sensing Camera, Vehicle, Driver

**INTRODUCTION**

The searching of a parking space in a parking lot in commercial areas is so much frustrating for many people. More problem increases with the high growth rate in the registration of new cars worldwide. There are many parking places of modern technologies existing but many drivers don't know about the parking blocks or about parking system. To overcome from these problems of congestion of traffic and save the fuels from it, the unique step of solution is smart parking. According to a report used as reference for this paper, can result that smart parking can save fuel consumption, (Happiest Minds), if is implemented successfully, as shown in Figure 1. The intelligent or smart parking system must be proposed for searching the vacant, or about to vacant parking space (Happiest Minds). The proposed system based on image processing technique, which apprehend and processes the rounded image drawn at parking lot, produces the information of the empty car parking spaces, with the help of the Android App, called "Park Easy". This App is used on the mobile phones by the existing data records, or by searching the spaces through App.

In smart parking system, users can access data to determine the availability of spots for parking and then pay for them with their mobile phones. Also, the App provides all possible shortage routes for the parking from any area of the city. Thus, smart parking improves the utilization of existing parking, leading to greater revenue for parking owners. It also benefits for the environment and plays a major role in creating eco-friendly environment.

Smart parking programs are now being deployed many countries like in San Francisco, Los Angeles, Stockholm, Beijing, Shanghai, São Paulo and the Netherlands.

Few years back, individual parking systems efforts so far have been locally successful but uncoordinated, operating in their own entrepreneurial vacuums, without taking advantage of universally-applicable insights to scale their operations citywide or globally. The gap between existing parking programs and more widespread transportation system planning is, at the global scale, a massive missed opportunity for cities to reduce transportation-related emissions. The concern of mobility in urban areas in recent decades has become an increasingly serious problem and difficult to manage: the quality of life, not only of drivers, is strongly influenced due to inefficiencies and diseconomies of urban congestion. This raises also serious problems of pollution and noise and wide spaces of the city are

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occupied by parked cars (Al-Kharusi, H. 2014). However, it is possible to overcome all of the issues of collaboration, from this technique using the sensors, real time data collection, data operators and smart phones (Science Research Group 2014). Thus, from this purposed “Park Easy” App, the user can occupy data, tend to have many owners and is not standardized or accessible in a way that will allow software developers to turn it into user-friendly applications.

With smart phones, capturing more and more of the global telecommunications market in both developing and developed nations, software entrepreneurs are able to collect and analyse data and deliver insights and information to consumers in brand new ways that do not require installation of new hardware.

### **NEED AND BENEFITS ANALYSIS OF SMART PARKING**

Optimize parking space usage;

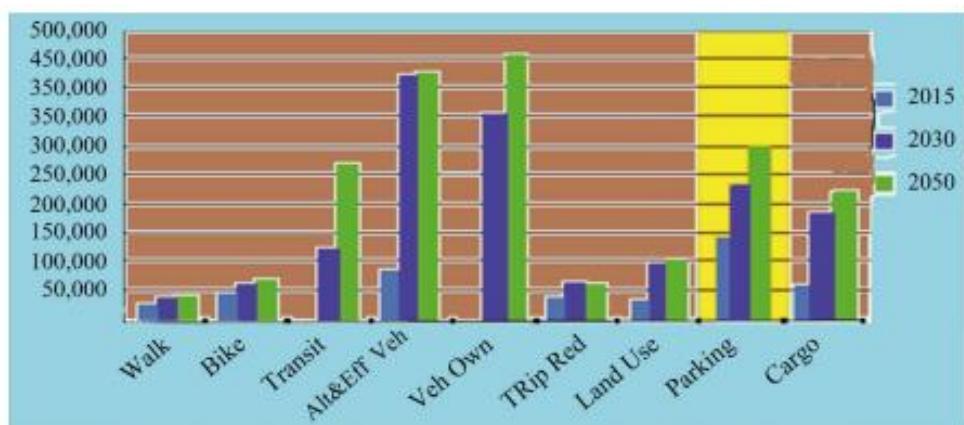
Help traffic in the city flow more freely;

Guide's residents and visitors to available parking;

Accurately predict and sense spot/vehicle occupancy in real-time.

Enables intelligent decisions using data, including real-time status applications and historical analytics reports;

Smart parking plays a major role in creating better urban environment by reducing the emission of CO<sub>2</sub> and other pollutants



**Figure 7.** Assumption of saving fuel consumption

### **METHODOLOGY**

Smart parking helps one of the biggest problems on driving in urban areas, finding empty parking spaces and controlling illegal parking (Happiest Minds). When dispose as a system, smart parking thus reduces car emissions in urban centres by reducing the need for people to needless circle city blocks searching for parking. It also permits cities to carefully manage their parking supply. Smart parking systems typically obtain information about available parking spaces in a particular commercial area and process available positions for vehicles, it involves using sensors, real-time data collection, and mobile-phone-enabled automated payment systems that allow people to reserve parking in advance or very accurately predict where they will likely find a spot (Happiest Minds). Generally, the use of smart phones is so common for the peoples with having the internet. So, this proposed app named, “Park Easy” as android web App that helped local residents, as well as, peoples of other cities travel or visitors for finding the parking spaces. In the “Park Easy” App, users can enter the area’s address of a spot where they wanted to reach or the parking place in a particular area, or places from which they reach his destination by walking, as shown in Figure 2, and the flow chart of the process is shown in Figure 3. It provides the easy parking spaces by using this technique that allow people to reserve parking in advance or very accurately predict where they will likely find a spot. When dispose as a system, smart parking reduces the emission of fuel wastage by reducing needless circles in city blocks for searching parking (Happiest Minds). By using this app, other users nearby will see that spot vacancy on the mobile phones

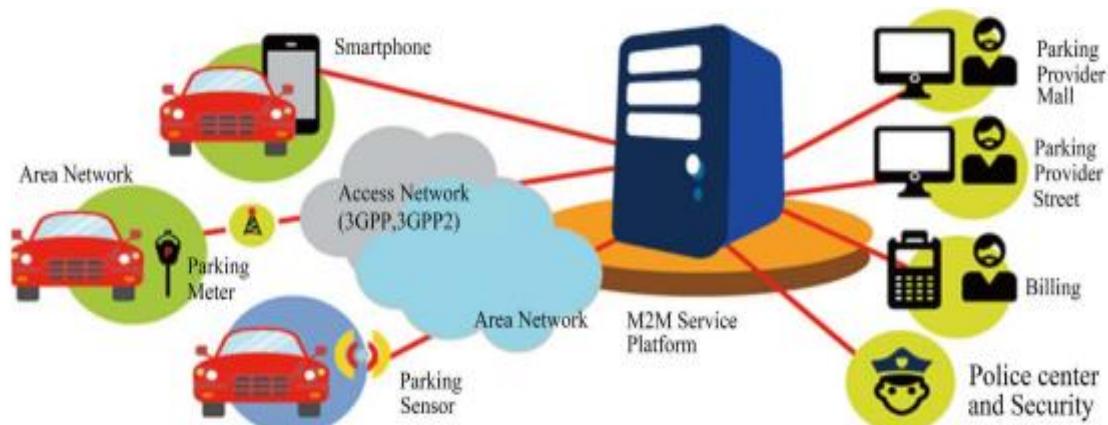
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or laptops, with leaving time of the first user, if they search the area. The pictures with detail of entire procedure of the parking system are given below in Figures 5-8. The app can expand to cities nationwide and provides transit information about schedules, delays, accidents and also the condition of the traffic of the route, and provide the alternative routes of the parking. The typical flow chart of the using process of Smart parking system is shown in the Figure 4. This purposed technique of using android app present a system that will be detect the availability of car parks and shows the driver where the car parking spaces are available. In this work, a camera is used with a sensor to take photos to show the occupancy of car parks. The camera can detect the presence of many cars at once. Also, the camera can be easily moved to detect different car parking lots. By having this image, the particular car parks vacant can be known and then the processed information was used to guide a driver to an available car park rather than wasting time to find the space (Science Research Group 2014). The camera detects the vacant space of parking and shown on the screen with Green circles are placed on the vacant car parks. Green circle helps users so that users can easily differentiate whether a car is parked in a spot or not. If there is a car on the spot then the green circle will not be seen (Al-Kharusi, H. 2014). The proposed system has been developed in both software and hardware platform as shown the working process of this technique in Figure 4. Whether you are at airports, railway stations, shopping centres, hotels, or in commercial doesn't matter created for the parking by using this android app. This technique will guide easily from app and provides shortage solution for the parking. It provides reliable information about the occupancy of all parking spaces (Siemens, A.G. 2015). Developing smart parking solutions within a city require standardized data and management; mobile phone integration; hardware and software innovation; and coordination among various stakeholders such as: parking facility owners, municipalities, transportation authorities, customers, and software developers. These technical solutions and stakeholders are the same data structures and development groups integral to making a smart phone-enabled, multimodal, fully integrated transportation solution a reality.

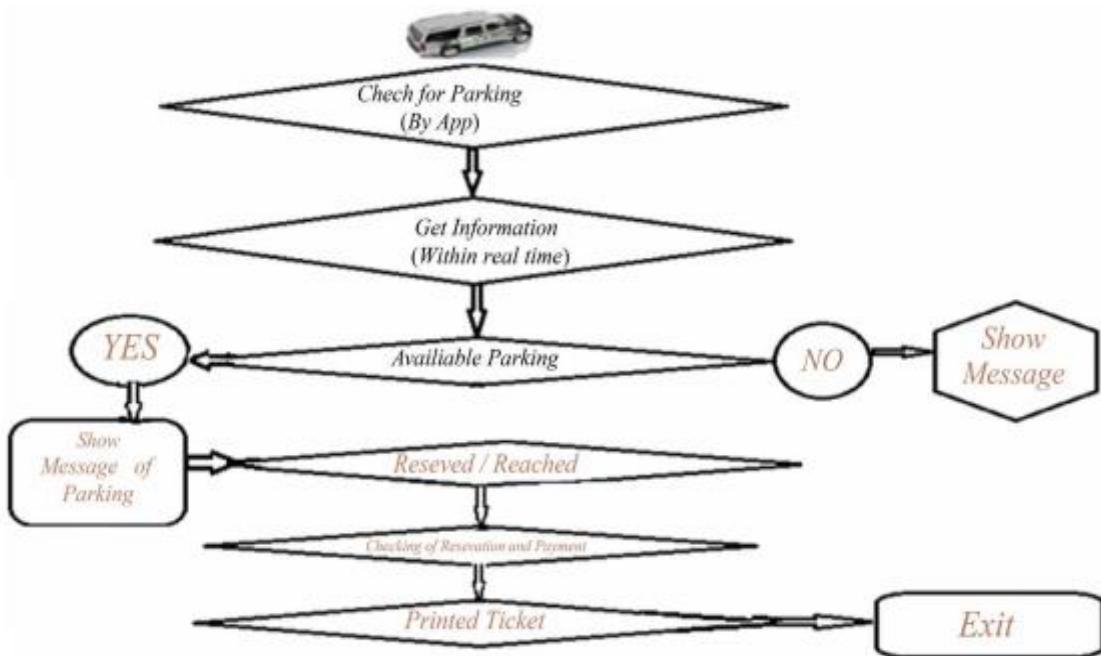
The smart parking can actually transform of our urban landscapes, making them more amenable to people rather than cars. With the advent of smart parking and more mobility alternatives to personal vehicles, better use of existing parking will drive decreased demand for the country's parking space surplus and for surface parking. Cities can further accelerate this system by updating building codes and land use policies to reflect reduced need for parking, a move which drives down building costs and encourages more varied development options. At the end, urban spaces can become greener, cleaner, more compact, and more inherently walk-able, bike-able and serviceable by a multimodal transportation system (Science Research Group 2014).

### **Description of Smart Parking System**

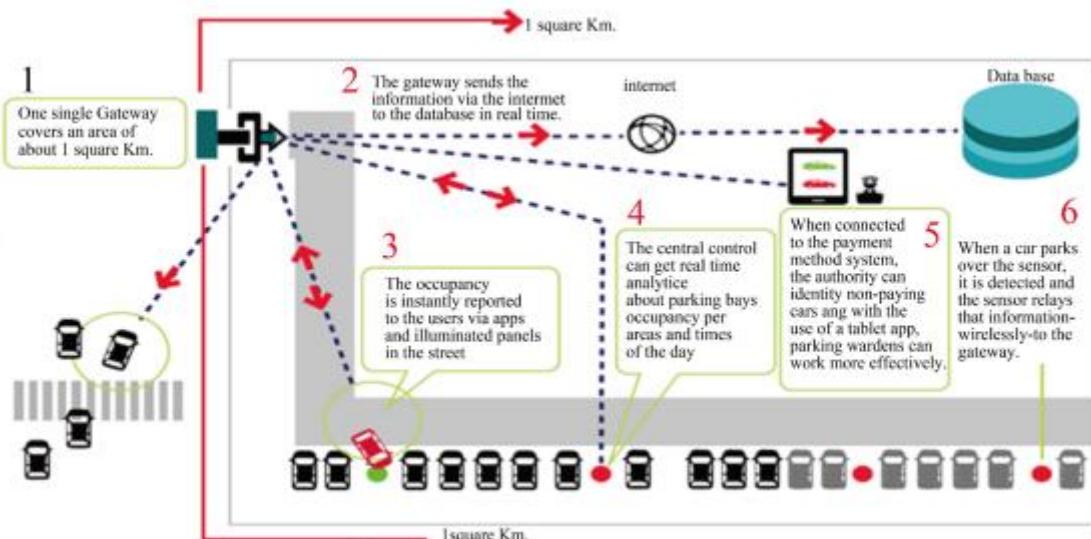
The smart parking system includes many systems which perform simultaneously in one platform for unique task within a time. The description of the smart parking system is clearly given as (Happiest Minds).



**Figure 2.** Using procedure of Park Easy, Android App



**Figure 3.** Flow chart of the process of the intelligent parking system



**Figure 4.** A typical sketch of working process of intelligent Parking System

The Parking System includes three modules-Monitoring module, Control module and a displaying unit. The monitoring module includes ultrasonic sensors which identifies the free parking spaces and transmits the Information to control unit.

Apart from detecting the car, the sensor also provides additional information like the stretch of time the car has been parked and also its health status.

It also provides the possible shortage route to reach the parking lot.

Along with these modules it will also have centralized system for supervisory and maintain a data base of parking space and will have a SMS gateway.

The control units process the information and send the information to the supervisory system.

Centralized system receives information of parking space from the controller. It then sends the information such as slot allotted, time parked, billing information and directional details to the user's mobile phone.

## **Challenges for Implementing the Smart Parking System**

This system is totally based on the internet with a wide range of network usage. It also depends on the automatic analysing system involving the cameras, sensors and display unit. This system is also engaged with the online route providing system such as Google Maps, etc. so it must be using higher speed network. There are some more challenges are given as follows:

The major challenge in implementing the Smart parking systems is of system integration due to wide variety of hardware and software platforms involved and hence possess a great threat or concern to the system scalability.

The technology platform supporting those systems which comprises of a myriad of hardware sensors, dynamic messaging systems and traffic control devices, wireless, computer clients, servers, hardware drivers and application interfaces.

Enabling all these devices from thousands of different vendors to communicate and tying them together into one platform is the greatest challenge in reducing the cost and complexity of smart parking. The varieties of infrastructure hardware and software systems that need to be integrated are enormous and add to it.

Another major point comes from the electronic payment vendors. These payment processors provide permit based electronic payment, typically for a convenience fee. The key too many of these hosted solutions is scalability, the ability of the transaction processor to support over wide geographical, market and service areas, with minimal cost.

## **PROCEDURE**

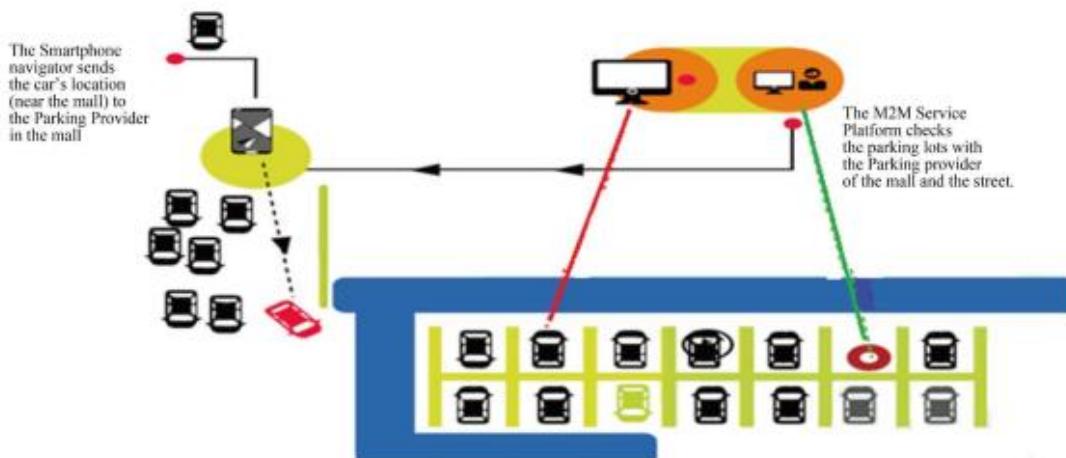
The procedure flow of the entire system through M2M device from the app. Firstly, the user checks the availability of the parking spaces through “Park Easy” App, as shown in Figure 5. When the user enters the data of the desire spot for parking (for mall), it sends the message to the service provider, who checks the availability of the parking space near about the user requirement spot. If the parking is available, it gives automatically feedback to the user. If the user selects the parking space, then the service provider gives the automatic message of the parking charges to the user with the possible shortages route of the parking. And also give the message to the Parking provider after the payment of the parking space through online payment system, as shown in Figure 6. Therefore, when the user reaches the parking lot, the street parking meter will detect the number plate of the car, and send the message to the parking provider (Wootton, J.R., Garcia-Ortiz, A. and Amin). Parking provider recommends the parking space to the navigator through service device. This service procedure is shown in Figure 7. Finally, when the user placed the car in the parking, with the selected time limit, the service provider gives the printed ticket to the user. The meter measures the time of the parking, after the selected time period, the On-Street parking meter intimate to the service provider and send a message to the user to remind about the park car. The leaving time of this car is also shown to the other users by searching in android app, “Park Easy”. The final stage of this system is shown in Figure 8. This shows the using procedure of the entire system with the help of smart phones. Park Easy App mainly helpful in reserve the parking spaces before the time of need. The parking should be cleared vision, including the relaxation of time for the extension of parking need. This relaxation should depend on the situation and site of the parking lots. This relaxation of time should be classified according to the saturation of the parking cars on sites or on locality, as blue zone, yellow zone and green zones.

These zones show the activity of the moment and saturations of cars. According to the sequences:

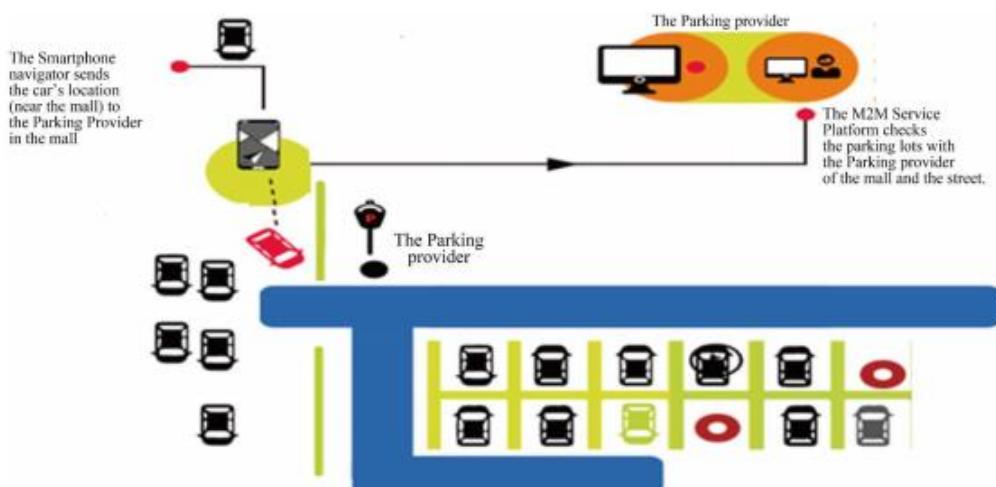
• **Blue Zone:** Those zones which are most saturated like railway stations, airports, etc. In this zone, the extension of time limit is strictly prohibited and the relaxation time is only for two hours.

• **Yellow Zone:** Those zones which are saturated at peak hours. In this zone, the extension of time is limited in only peak hours such as commercial areas, markets, malls, etc. Rest of the day, the relaxation time will increase at certain limit with paying extra amount on extension.

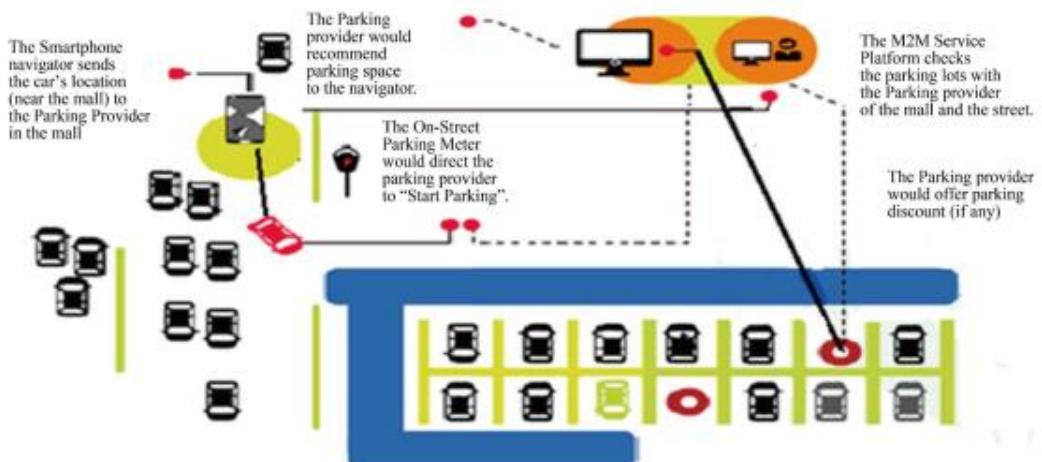
• **Green Zone:** Those zones which are slightly saturated or the areas of college, institutes, parks etc. In this zone, the extension of time limit never prohibited and no extra amount is applied on increasing the time of parking



**Figure 5.** Sketch of the procedure of detecting of parking spaces

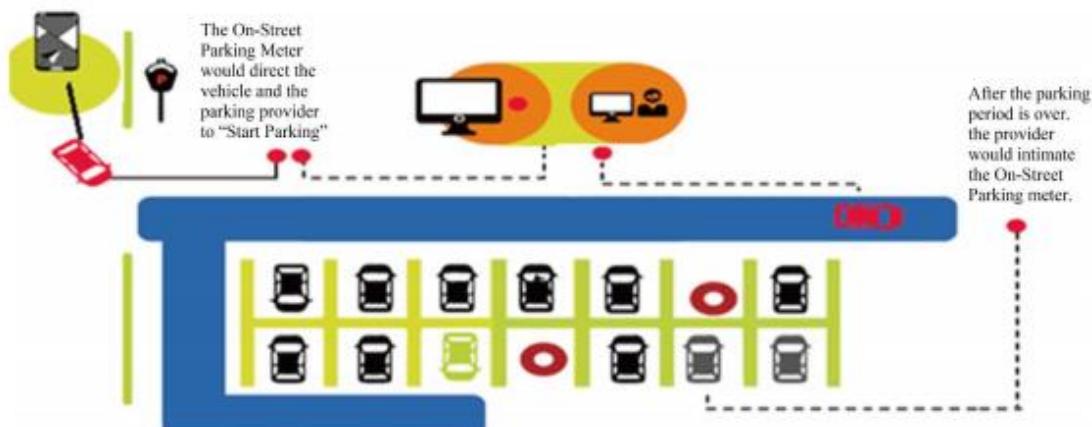


**Figure 6.** Sketch of the response of parking availability and reservation of parking



**Figure 7.** Sketch of service procedure

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**Figure 8.** Final stage of the parking service

## CONCLUSIONS

Today, in the information age, the quest is for global economic efficiency in a world economy governed by environmental concerns, economic alliances, and trade agreements (Faheem, S.A., Mahmud, G.M., Khan, M., Rahman and Zafar, H, 2013).

Due to the worldwide spread of motorization and urbanization raises new issues for city-developers. The industrialization of the world, increase in population, slow paced city development and mismanagement of the available parking space has resulted in parking related problems (Zhang, X. and Wan, D, 2010).

One of the key concerns of urban traffic is the growing size of the space occupied by parking cars which affect the traffic highly. Development of industrial automation has now reached the level where reliable and efficient solutions can be given into the hands of Smart parking designers.

Modern parking has their possibilities, but they can only be exploited by using new architectural, mechanical and control solutions. Only an advanced, state-of-the-art control system can serve the increasing needs of customers.

Parking is difficult and costly system for implementation but Park Easy App gives the suitable way for utilizing the money and techniques and it also gives better revenue to the investors. Primarily smart parking technology is about enhancing the productivity levels and the service levels in operations.

Some of the underlying benefits can be lowering operating costs, while building value for customer to drive occupancy, revenues and facility value. Proposed system will also decrease the traffic congestion as the number of vehicles parked on the street will decrease. These new systems will boost the parking business by the increase in the number of customers, (Wiseman, Y, 2010).

Finally, smart parking can actually transform the very makeup of our urban landscapes, making them more amenable to people rather than cars. The field is constantly changing, and new techniques invent continuously, so software solutions will be expected to be tailored to type designs in the future. This requires continuous development and standardization of software modules.

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**O 45. ASSESSMENT OF TRANSPORTATION-ORIGINATING AIR POLLUTANTS WITH GIS**

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**ABSTRACT:** The key elements considered for assessment of the naturalness of the lakes and rivers relate to the degree of intactness of the natural elements, patterns, processes, and extent of any physical land use changes or presence of different constructions. The natural character is essentially a measure of the naturalness or modifications of the natural elements, patterns and processes that comprise a water body. The current contribution is based on a process to assess the level of natural character that involves an understanding of the current systems and attributes that contribute to Lake Dojran ecosystem including abiotic, biotic and other factors. This assessment considered imputes data, such as river hydrology and morphology, aquatic and terrestrial ecology, water quality and landscape architecture. This approach is based on field visit carried out in end of March 2021 and further on a desktop review of relevant available data. The second component of this study includes the visual aspect of amenity as recreational values of the Lake Dojran in its full services. The effect of dramatic water level change/decrease (based on historical data of the period 1985-2000) on visual amenity values was correlated to offered recreation values. The survey analyses on the North Macedonian side of the lake revealed that <25% of the lake margins remained at the natural level, while the pressure from different sectors of human presence is steadily increasing.

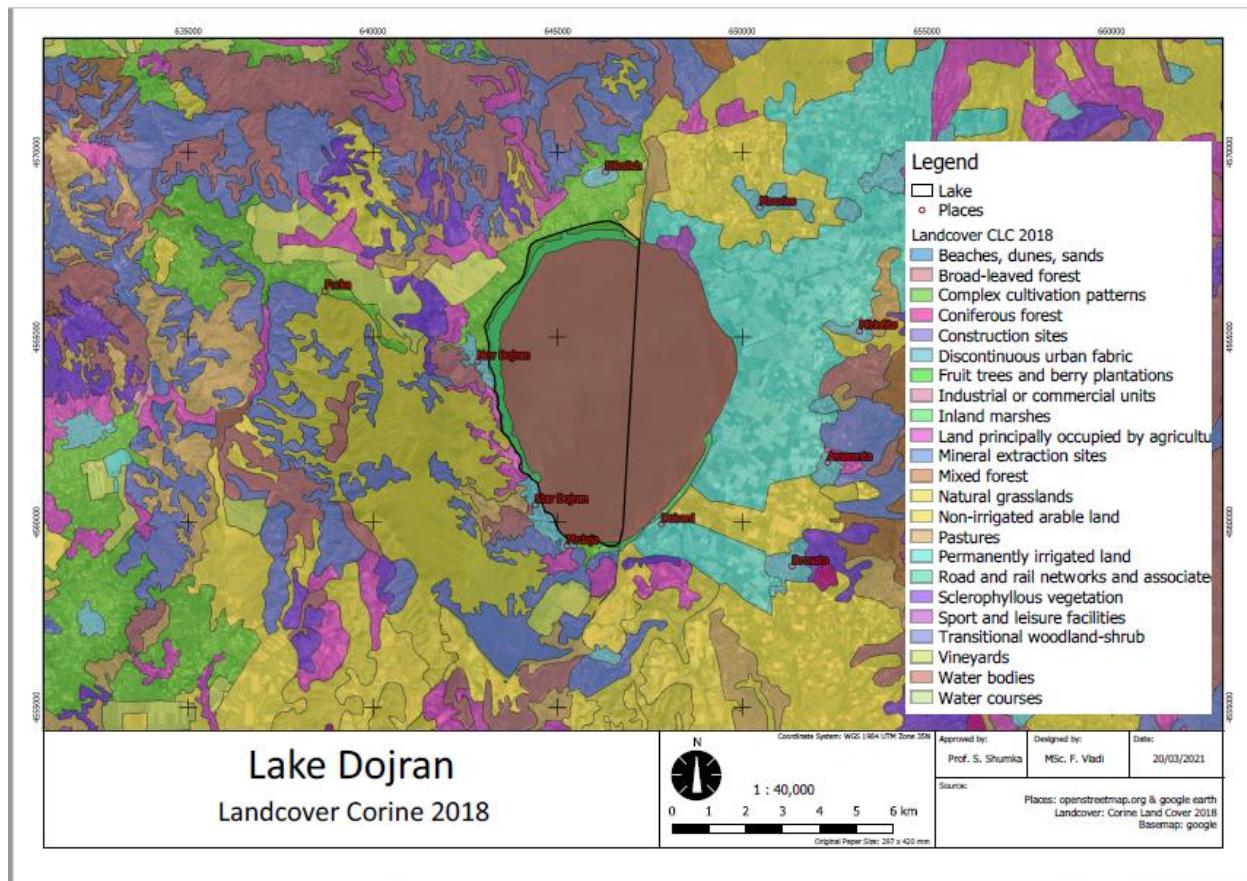
**Keywords:** Air pollution, Heavy metal, Noise pollution, Soil pollution, Transportation

**INTRODUCTION**

Rivers and lakes are dynamic and complex features set within a broader landscape context (Boffa Miskell Limited, 2018). At the state they are, they provide a visual, ecological and recreational focus in a landscape as well as providing physical links throughout their catchments (Shumka, 2018). Rivers, lakes and their margins have natural character, amenity and landscape values that require consideration in water allocation decisions particularly relating to how changing river flows and lake levels can affect those values.

Following Abell *et al.*, (2008), Lake Dojran is part of the Vardar (422) freshwater eco-region at the wider European delineation. The lake is a shallow water body with the bottom laying at an elevation of 138 m a.s.l., while the highest recent absolute altitude above sea level of the water surface was 148 m (Bojovic *et al.*, 2016). The watershed and the lake itself are shared by two countries, Greece and North Macedonia (Figure 1).

The lake was formed in a karstified basin created by a combination of Tertiary and tectonic activity. The sediments of the lake watershed are composed of mineral-rich ancient alluvial and limestone sediments. A minor part of the watershed on Macedonian side is composed of diluvia clay sediments (Popovska *et al.*, 2005; Popovska & Bonacci, 2008; Gesovska *et al.*, 2013). The northern and eastern belts of the watershed are rocky and covered with low forests and weeds (Figure 1). Forest and semi-natural areas, including agricultural land, cover most of the catchment. The lake is recharged from direct runoff, small rivers and groundwater and it does not have surface outflow (Sotiria & Petkovski, 2004).



**Figure8.**Lake Dojran, Corine land cover (state of 2018)

The watershed within the Macedonian territory is characterized with a relatively large annual production of erosive material of about 29.000 m<sup>3</sup>/annually, out of which only 323 m<sup>3</sup>/annually is transported towards the lake.

The main water flows are situated on the Greek side and they include: Odza Suji (Breska River) with a waterbasin of 94.3 km<sup>2</sup>, carrying all the waters from the South slopes of the mountain Belasica, and the river Kavakalaris, with the water basin of 21 km<sup>2</sup>. On the Macedonian side, there are 26 smaller rivers, creeks and springs; the most important ones are: Crn Potok, Pazarli Dere, Suva Reka, and Derven Rama. The water volume is 262 million m<sup>3</sup> which corresponds to the average depth of 6.5 m (maximum depth).

## MATERIAL AND METHODS

Assessment Methodology criteria for natural character: Each component of the lake has been assessed separately using a set of attributes that incorporate the abiotic and biotic factors specific Lake Dojran systems as below. The experiential component of natural character has been considered for the complete lake rather than for each component separately (Table 1; Table 3). The field data collection has been conducted in the period of 25<sup>th</sup> 29<sup>th</sup> March 2021.

In this assessment:

*Active bed:* Includes varying lake shore extents for the typical range of lake levels. The landward extent of the active zone is often delineated where permanent terrestrial vegetation meets the bare gravel/rock substrate.

*Context:* Refers to the wider landscape context of the catchment adjacent to the lake, and considers the land use, landform and vegetation cover that contributes to the overall character of the lake.

*Margin:* Refers to the strip of land between the active bed and the wider landscape context, including the banks. River processes, patterns and influences will be evident in the margin, such as occasional flooding, historic banks and channel patterns. From locations within the lake margin the active bed is the visually dominant feature. The margin is typically narrow and may incorporate terraces, banks,

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abandoned riverbed, floodplains, river and tributary confluences and built infrastructure. Generally topographic features define the extent of the margin as they extend between the top and base of banks or terraces. Vegetation type boundaries can also define the margin extent, such as where riparian scrub or planting meets grazed pasture in the landscape context.

**Table5.** Assessment methodology criteria for natural character

<b>Lake components</b>	<b>Attribute groupings</b>	<b>Lake Natural Character Attributes</b>
Active bed	Abiotic	Flow regime characteristics and levels, managed or natural flows.
		River channel /lakebed substrate morphology including modifications/ structures e.g. boat ramps, dams, diversions
		Water Quality-if available indicator of ecological health
Margin	Biotic	Aquatic ecology, flora/fauna, habitat, pest species
	Abiotic	Modification and structures- buildings, quarries, bridges roads,
Context	Biotic	Terrestrial ecology, (also describe braided riverbeds) e.g. vegetation and bird habitat
	Abiotic and biotic	Land modification/land use / vegetation. Urban, agriculture
All (focus on active bed and margin)	Experimental	Views, sounds, sense of naturalness, wildness remoteness

A Five-Point scale was used to assign an overall level of natural character to each of the river/lake components.

**Table2.** The scale used to determine an overall level of natural characters for each of the river / lake components.

<b>Very High</b>	<b>High</b>	<b>Moderate</b>	<b>Low</b>	<b>Very Low</b>
Very High levels of natural character due to Very Low or no levels of modification	High levels of natural character due to Low levels of modification	Moderate levels of natural character due to moderate levels of modification	Low levels of natural character due to High levels of modification	Very Low levels of natural character due to Very High levels of modification

## **RESULTS AND DISCUSSIONS**

The shape of the lake is rather regular with a maximum length of 8.9 km and maximum width of 7.1 km. The volume of the lake at norm is  $10.4 \text{ m}^3$ . The lake doesn't have surface outflow. The only natural outflow is the lake water surface evaporation. Total watershed area of the lake is  $271.8 \text{ km}^2$  out of which 32% belongs to Macedonia. The water surface area of the lake at normal elevation is  $42.2 \text{ km}^2$  out of which 63.6% belongs to Macedonia (Popovska *et al.*, 2005; Gesovska *et al.*, 2013).

In the period of 1990-2010 the Lake Dojran water level decreased seriously. This water declination together with the simultaneous water quality deterioration resulted in biodiversity diminishing and plankton reduction (Gesovska *et al.*, 2013).

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**Figure2.** Components of the active bed, margins and context

The Lake Region represents one of the important centers of biodiversity for Western Balkan and SE Europe and has been also recognized internationally for its rich biodiversity and abundance of species, and thus has been proclaimed as an important area for the conservation of European species and habitats (Figure 2). Currently the Lake Dojran is part of different international networks and initiatives for the conservation and protection of nature, such as: the Emerald network of areas of special conservation interest (2002; Bern Convention), North Macedonian important plant areas (2004), the Balkan Green Belt (2004; IUCN), Ramsar site – Wetlands of International Importance (2008; Ramsar Convention), Important Bird Area (2010; BirdLife International), candidate Natura 2000 site (EU Birds and Habitat directives). Since 1977 Dojran Lake has been protected with national law and holds a protected status of a Monument of Nature (Official Gazette of SRM N° 45/1977, Official Gazette of NM N° 51/2011). Based on researches conducted so far, there are 16 species registered in Lake Dojran, while other authors reported a number of 24 species that do not have established real populations (Kostov et al, 2010). In the basin of Lake Dojran 8 fish species are Balkan endemics (out of 16 species that already have established populations in the Lake ecosystem. The endemics autochthonous fishes from Lake and its catchment area are: *Alburnus macedonicus* (Karaman, 1928), *Barbus macedonicus* (Karaman, 1928), *Chondrostoma vardarensis* (Karaman, 1928), *Pachychilon macedonicum* (Steindachner, 1892), *Rhodeus meridionalis* (Karaman, 1928), *Cobitis vardarensis* (Karaman, 1928), *Sabanejewia balcanica* (Karaman, 1928), *Gobio bulgaricus* (Drensky, 1926). Other species present in the lake include: *Cyprinus carpio* (Linnaeus, 1758), *Perca fluviatilis* (Linnaeus, 1758), *Rutilus rutilus* (Linnaeus, 1758), *Salaria fluviatilis* (Asso, 1801), *Scardinius erythrophthalmus* (Linnaeus, 1758) and *Tinca tinca* (Linnaeus, 1758).

**Table3.** Assessment of Natural character of the Lake Dojran

Natural Characterl_Lake Dojran		Degree of Natural Character
Active Bed	• The lake formed in a karstified basin created by a combination of Tertiary and tectonic activity.	Low Moderate

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	<ul style="list-style-type: none"> <li>• Heavily influenced by development of the intensive agriculture activities on both sides of the lake (North Macedonia and Greece).</li> <li>• Water quality affected by various types of pollution, accelerated eutrophication.</li> <li>• In the basin of Lake Dojran 8 fish species are Balkan endemics (out of 16 species that already have established populations in the Lake ecosystem).</li> <li>• The lake is used as a feeding ground from the pelicans.</li> <li>• Recent increase of population of alien and invasive fish and other species.</li> <li>• The lake provides ground for recreational fishing activities that at the current circumstances are beyond its capacities.</li> <li>• Modifications to the active bed include different structure constructed for tourism and recreational fishing, and agricultural activities.</li> <li>• Large water quantity is used for the irrigation purposes on both sides of the lake (North Macedonia and Greece).</li> <li>• There is a lack of waste water treatment facilities.</li> <li>• There is a large number of boats, particularly during the fishing days.</li> <li>• <u>Scenic view notable, particular during spring time.</u></li> </ul>	
Margin	<ul style="list-style-type: none"> <li>• The eastern lake margin remains actively uses (see Figure 1) for the agriculture purposes.</li> <li>• Southern margins on both sides of the lake are heavily used for housing and tourism purposes.</li> </ul>	Low Moderate
Context	<ul style="list-style-type: none"> <li>• Forest (both low and high forest stands) and semi-natural areas, including agricultural land, cover most of the catchment.</li> <li>• The main water flows are situated on the Greek side and they include: Odza Suji (Breska River) carrying all the waters from the South slopes of the mountain Belasica, and the river Kavakalaris. On the North Macedonian side, there are 26 smaller rivers, creeks and springs; the most important ones are: Crn Potok, Pazarli Dere, Suva Reka, and Derven Rama.</li> <li>• Grazing and hunting are also practiced within Context.</li> <li>• Modifications are minor in proportion to the overall context of the lake.</li> </ul>	High
Experimental	<ul style="list-style-type: none"> <li>• Highly scenic, relatively large scale open landscape with wide and distant vistas.</li> <li>• Unique combination of water and associated bird species of the lake and sloping gravel beaches.</li> <li>• Presence of winds and waves contribute to a dynamic environment on windy days.</li> <li>• After the dramatic water level drops of two decades ago, there are normal levels of modification</li> <li>• Surrounding landscape is perceived to be of high natural character.</li> </ul>	Very High
<b>VISUAL AMENITY - Lake Dojran</b>		<b>Degree of Visual Amenity</b>
Nature of views, viewing audience	<ul style="list-style-type: none"> <li>• Overall, beyond the urban and rural settlements landscape has a very high level of visual coherence.</li> <li>• The unusual combination of water body (water surface) with surrounding mountains slopes it contains high visual and scenic values.</li> <li>• The lake is intensively used, primarily in the summer, for fishing, boating and recreation. The surrounding mountainous landscape means other potential recreational activities.</li> <li>• When lake levels were low, more of the shoreline was exposed which is considered unsightly by some.</li> </ul>	High

## **CONCLUSIONS**

Lake Dojran is a shared resource and no action can be taken by one country without impacting the resources and conditions in the other country. So, all further steps including monitoring and survey need to be coordinated among relevant authorities of North Macedonia and Greece.

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In this conclusions section we propose 10 steps measures and actions for Lake Dojran conservation with intention improvement of management practices, protection of biodiversity of current and future potential impacts (Table 4). They are connected with building of capacities on both littoral countries in order to: To help conserve globally significant biological diversity and restore important habitat components; To enhance the transboundary cooperation in the Lake Dojran region; To reduce nutrient loads and pollutants to the lake; To increase the overall resilience of the lake ecosystem to the human impacts and climate conditions; To contribute at the local welfare, economic and social prosperity.

**Table4.** Summary proposed measures and actions for the conservation of Dojran Lake

No	Measures	Actions
1.	Joint Body for Lake Management	Establishing Joint Lake Dojran Body (it should be composed by representatives of central and local authorities surrounding Lake Dojran, CSO from North Macedonia and Greece)
2.	Joint Agreement	Joint document/Agreement, signed between North Macedonia and Greece by relevant management authorities, in relation to Lake Dojran
3.	Harmonized monitoring program of water quality base don WFD	The monitoring program/protocols should be harmonized with regards to methods, locations and relevant authorities
4.	Improved Lake Data and Share	The Lake data statistics has to be improved, stored with similar approach and regularly shared/exchanged
5.	Joint Biodiversity Assessment	The Biodiversity assessments, surveys and whatever type of monitoring (including scientific ones) has to be integrated considering the lake itself as a unique ecosystem. This will increase the data reliability and serve as real bases for further actions.
6.	Conservation	<ul style="list-style-type: none"> <li>• Habitat conservation actions;</li> <li>• Action plan for habitat conservation;</li> <li>• Action plan for endemic species conservation;</li> <li>• Conservation action plans per fish species</li> </ul>
7.	Abatement plan for the non-native fish species	The abatement plan and any intervention should be done “science based” and jointly agreed by littoral countries (North Macedonia and Greece).
8.	Recreational fishing actions	Jointly agree on recreational fishing management, control of feeding sites, considering the negative impacts to the water quality in a situation of an accelerated lake eutrophication process.
9.	Joint Educational program	<ul style="list-style-type: none"> <li>• The joint program has to lead reducing environmental impacts of agriculture (pesticides, fertilizers, irrigation water, agricultural waste, support to agricultural associations); Increased awareness of the local communities on fish biodiversity values;</li> <li>• Altering local stakeholder’s reservations towards conservation; minimization of conflicts; establishment of cooperation; involvement of local stakeholders in the management issues of Dojran.</li> <li>• Establishment of Dojran centre for Nature and Human.</li> </ul>
10.	Joint Projects	A GEF Full size project would be one the adequate approaches towards integrated ecosystem management, with participation of both littoral countries.

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**O 46. EVALUATION OF THE GOREME NATURAL PARK IN TURKEY THE  
FRAMEWORK OF ECOLOGICAL PLANNING**

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**ABSTRACT:** Göreme National Park is an detrited plateau located in the formerly active volcanic region of the Central Anatolian Plateau, as part of the Cappadocia region. The geomorphology of a volcanic tuff landscape sculpted with erosion, mountain ridges, valleys and "fairy chimneys" is a rare geographical formation in the world. As a protected World Heritage site, Göreme National Park is now the center of attraction with intense touristic visits, rapid urbanization and urban transformations, facing ecological stress. This article aims to evaluate the relationship between natural ecological values and anthropocentric effect-intensive development projects for the future use of Göreme National Park, which hosts different uses in the historical process and reflects the balance between human and nature. In this context, the current situation of Göreme National Park will be analyzed in the article, and an evaluation regarding ecological planning will be made in order to protect the ecological structure in line with the problems and potentials and existing features.

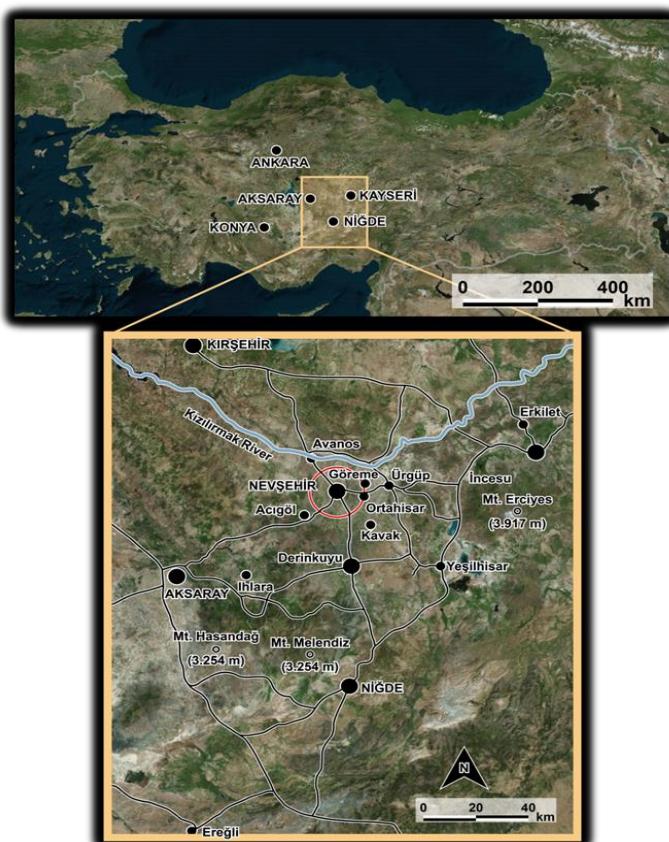
**Keywords:** *Göreme National Park, ecological planning, natural cnservation, land use*

**INTRODUCTION**

Cappadocia, whose borders in ancient times stretched to the Taurus Mountains in the south, Aksaray in the west, Malatya in the east and the Eastern Black Sea in the north, is now within the borders of the provinces of Nevşehir, Aksaray, Niğde, Kaysri and Kırşehir (**Figure 1**) (Mutlu,2015; Bulut,2018). Göreme Historical National Park is a weathered plateau located in the former active volcanic region of the Central Anatolian plateau, as part of the Cappadocia volcanic region. With its unique mountain ridges, valleys and geomorphological structure of fairy chimneys, volcanic tuff landscape sculpted by water and soil erosion, Cappadocia is among the rare landscapes of the world. In the historical geography Cappadocia Region has been one of the preferred settlement centers of Anatolia since ancient times, due to the easy formation of tuff cities by the local communities in the region, the fertile plains of Bagadania and Kataonia, the river networks, the religious center of ancient societies, Argaios Mountain (Mt. Erciyes), and since it is one of the important centers of the history of Christianity with its many historical churches, monasteries and chapels, from prehistoric times to the present day (Bulut,2018; Aydan-Ulusay, 2003). Göreme Historical National Park, located at a central point in the countryside of Nevşehir province, whose settlements date was dated to Prehistoric periods, is 10 kilometers away from the city center and was used as a religious education center from the early Christian period to the Byzantine period, while the necropolis of the people living in Avanos during the Roman Period was still being sed (Ayhan,2020, Bulut 2018, Mutlu,2015). Göreme Open-Air Museum, with its cultural and natural values, was included in the UNESCO Cultural Heritage List on December 6, 1985 as a World Cultural and Natural Heritage (Url 1). Göreme has the status of National Park, Archaeological Protected Site, Naturally Protected Site, Urban Protected Site and Tourism Protection and Development Area within the framework of the National Administrative Legislation of the State of Republic of Turkey. The natural assets of the region are the volcanic structure and geological formation values in the area, and the cultural assets are the historical tuff city heritage and fairy chimney structural values. This extraordinary nature and culture relationship of Cappadocia, which has been shaped by different cultures from early ages (from Hati, Assyrian, Hittite, Persian, Macedonian (Alexander the Great), Roman, Middle Byzantine, Seljuk, Principalities and Ottoman periods) to the present, is reflected in the physical space as; cave

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houses, churches, monasteries, underground cities, fairy chimneys. Göreme Historical National Park is believed to have been an important center for religious and secular life during the Middle Byzantine period (Kalas, 2004). Today, Tokalı Church carved into several rocks decorated with rich frescoes, Nuns and Priests Monastery, the architectural style and frescoes of St. Basil's Chapel, Elmalı Church, Yılaklı Church, Dark Church and Çarıklı Church are some of the prominent cultural and historical values of the region. Göreme National Park, which is under multiple site protections with its geomorphological natural values and unique cultural values, is exposed to the risk of losing its ecological balance due to intense mass tourism, rapid urbanization and widespread technical infrastructure development projects and anthropocentric arrangements organized for globalizing service needs. In this study, these ecological pressures on the natural and cultural values created through planning will be evaluated by describing the examples of the plan decisions of the Göreme Uzun Erimli Plan reflecting on the current land use, and the ecological problems and potentials determined regarding the Göreme National Park will be entered into the proactive ecological planning database as a scientific and rational framework (Kozlowsky, 1968-1985; Frey, 1999).



**Figure9.**Cappadoccia , Goreme Historical National Park (Map produced from the Map General Command Web Page and BingMaps)

## **MATERIALS AND METHODS**

The effects of the Göreme Historical National Park Long Term Development Plan on the natural environment will be evaluated with the reflections of the existing landscape land use. The ecological effects of these plan decisions on the geomorphological features, historical and cultural features and recreational values, which are the National Park selection criteria of Göreme Historical National Park, will be evaluated in comparison with the data sets based on the literature.

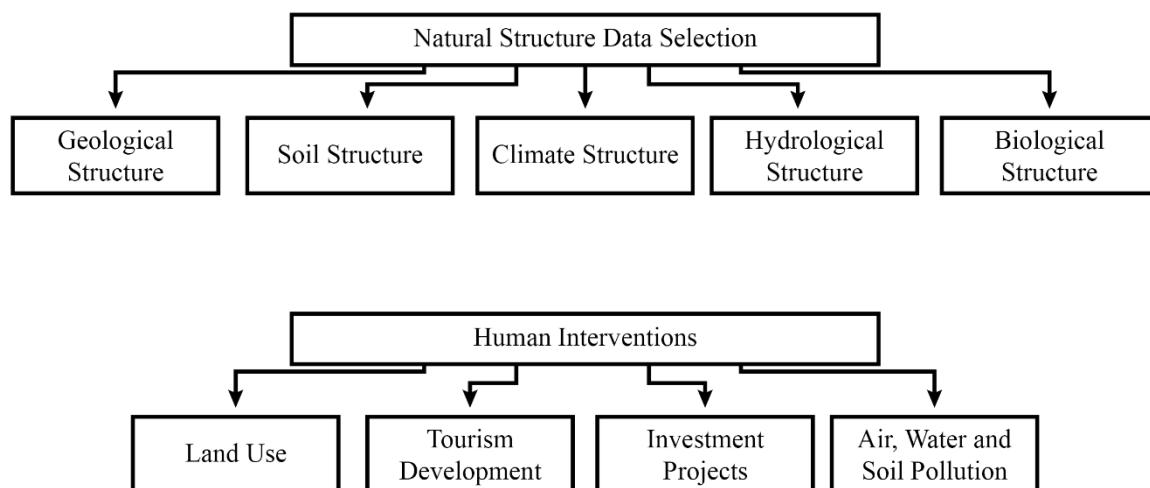
In order to determine the ecological effects of natural and human-induced interventions on Göreme Historical National Park, the climatic change, seismicity, soil structure, geomorphological structure, flora-fauna structure of the research area, land use decisions, tourism development decisions and

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environmental pollution values evaluation criteria composes the methodological flow framework of the research.

Each assessment component of the research area was evaluated separately using a set of attributes including ecological planning principles specific to the Natural and Cultural Heritage area as follows. Each component of the natural and cultural character of the world heritage site is not considered pointwise, but spatially, for the entire protection area (**Table 1**). Field data was obtained using Göreme Historical National Park Long Term Development Plan decisions, literature-based areal data and official government statistics. Another output of the study is the production of policies for the sustainability of Göreme's regional and local natural resources with rational ecological planning in a balance between protection and use.

**Table 1.** Methodology flow chart



The ecological sensitivity of the Long-term Development Plan of 2001 will be evaluated by comparing the data obtained from **Table 1** with the data obtained by Yıldırım and Çorakbaş (2020) in the GIS based risk mapping study for the Göreme Historical National Park area and the rocky areas of Cappadocia. In **Table 2**, GHNP Ecological Structure Evaluation Criteria are defined in 4 scales.

## **SURVEY AREA, RESULTS AND DISCUSSIONS**

Göreme Historical National Park administratively covers an area of 9572 ha within the borders of Nevşehir Province, Nevşehir Center, Avanos and Ürgüp Districts (T.R. Ministry of Forestry, National Parks Department, 2001), (**Figure 2**). In Göreme National Park, there are urban development areas of Göreme, Uçhisar and Avanos districts and areas belonging to Çavuşin, Zelve, Ürgüp district centers and Ortahisar settlement.

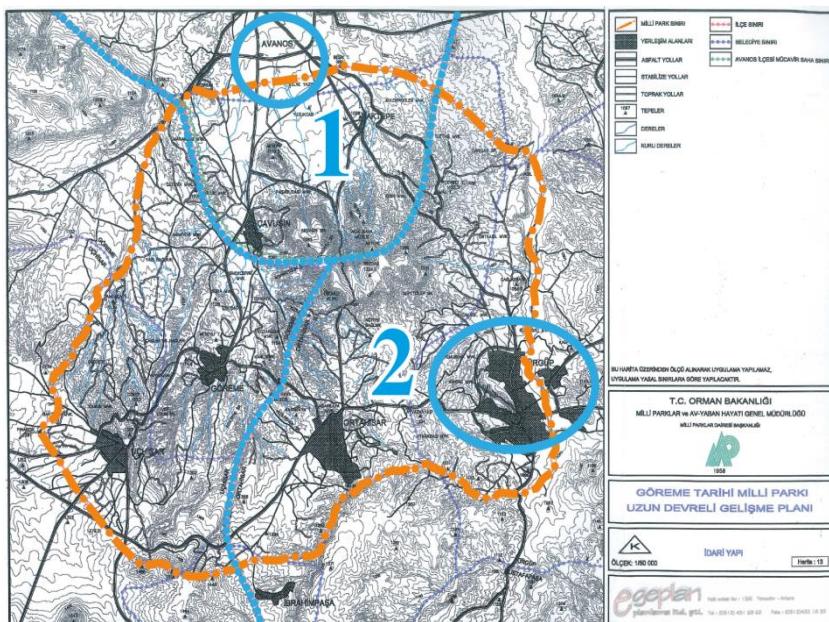
**Table 2.** GHNP Ecological structure evaluation criteria

Göreme National Park Components	Components Associated with Ecological Structure	Ecological Impact Factors	Ecological Pressure Degree				<u>Experimental Comparison: GIS Based Risk Maps for GHNP and Rocky Areas of Cappadocia by Yıldırım and Corakbaş (2020)</u>	<u>Experimental Comparison: GHNP Long Term Development Plan (2001)</u>
			Very High	High	Moderate	Low		

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Settlements Within the National Park	Urban Areas	Population Development					
		Economic Structure-Tourism-Industry-Social Infrastructure					
		Technical Infrastructure, Air Quality, Water Quality -if Available Indicator of Ecological Health					
		Population Development					
		Farming Areas					
	Rural Areas	Natural Monuments-Fairy Chimneys					
		Climate, Flora/Fauna, Habitat, Pest Species					
	Natural Structure Landscape Examples	Terrestrial Ecology (Volcanic Tuff Landscape) e.g. Fairy Chimneys, Rocky places Vegetation and Fauna Habitat					
	Cultural Structure Landscape Examples	Urban texture Samples From Urban and Rural areas, Cut Rocks Shelters, Vernacular Architectural Structure Samples, Monumental Structures, Road and Street Textures					

Open-Air Museum	Göreme and Zelve Open-Air Museums	Visitor Density and Ecological Limits						
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**Figure 2.** Goreme Historical National Park's Administrative Borders (T.R. Ministry of Forestry, Department of National Parks, 2001)

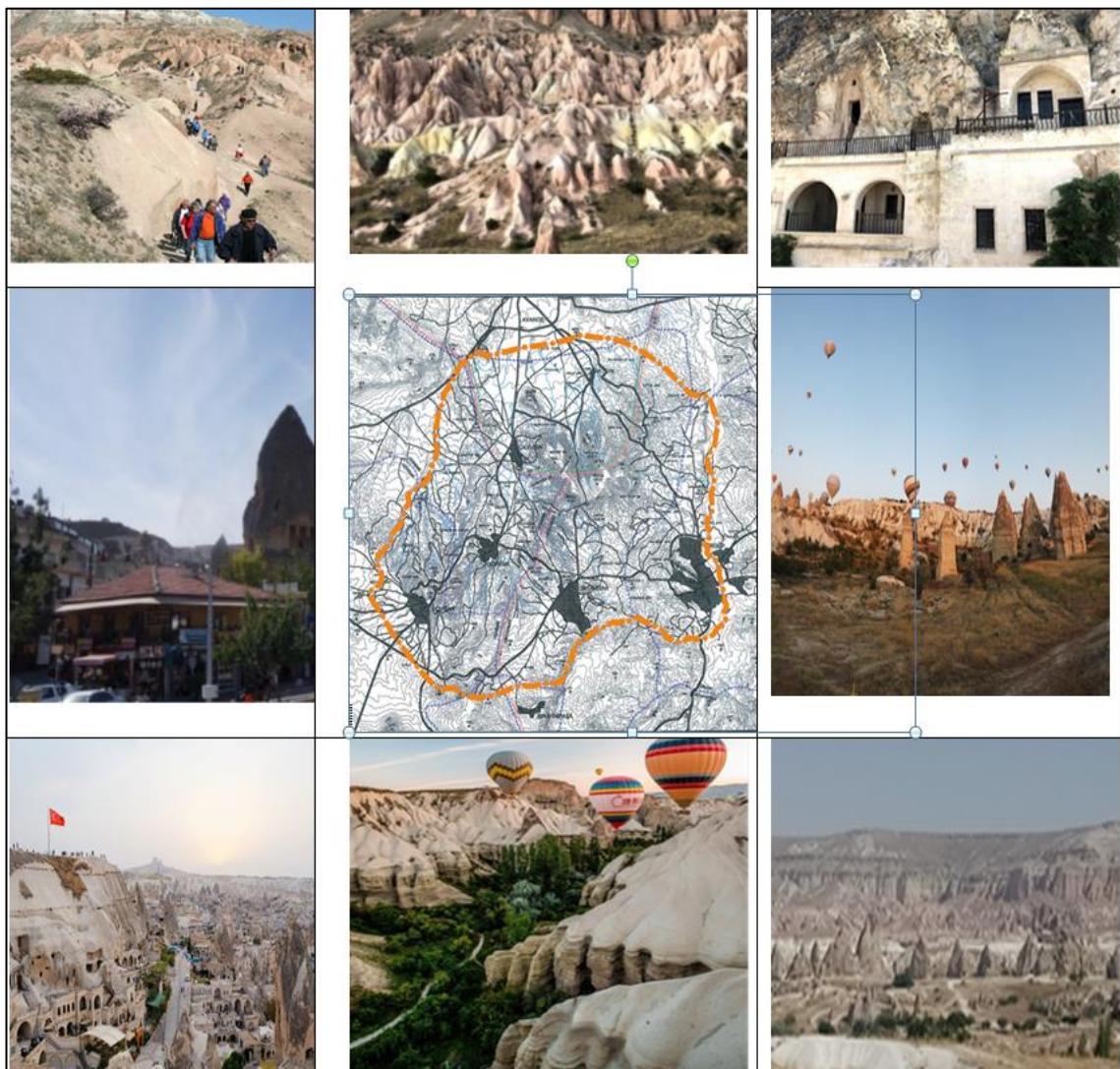
#### **Ecological Effects of the Settlements in the National Park in terms of Population-Economic Structure-Technical Infrastructure**

Population development and administrative structures of the settlements in Göreme Historical National Park are presented in Table 3 (Url 2). As can be seen from the table, Ürgüp and Avanos Municipalities have shown a rapid growth of approximately 2.25 in the last 30 years. On the other hand, although the population growth rate is suggested at a high rate in the National Park Protection plan, it does not meet the real population growth. This means that the rate of urban growth for the National Park is much higher than expected in the plan and that urban settlements develop contrary to ecological planning criteria, creating ecological pressure. **However, compared to Ürgüp, Avanos settlement, which entered the borders of the National Park in terms of development area, creates high/moderate ecological pressure.**

In Nevşehir, the labor force participation rate was 50.5%, the employment rate was 47.5% and the unemployment rate was 6% in 2012 (Ministry of Culture and Tourism, 2012). In the distribution of the population according to the main economic activity branches in Nevşehir province, the most important share belongs to the agriculture sector with 70%. In the relevant year, the service sector comes in second with 20%, followed by industry with 10%. Among the settlements within the National Park, Ürgüp and Avanos stand out in local wine production, and viticulture is common on slopes and hillsides. These settlements also contribute to the tourism sector with storage opportunities in rock-carved cool cellars in urban and rural building parcels. As a commercial sector, there were approximately 2000 storage businesses in the National Park area in 2010. In particular, storage activity is concentrated numerically in Uçhisar, Göreme and Ortahisar. The places with the highest visitor and vehicle density in the national park are the Göreme Open Air Museum and the area of fairy chimneys called Three Beauties. **The Göreme Open Air Museum in the center of the National Park and the tourism and industrial areas within the municipal boundaries of Ürgüp and Avanos place a very high ecological pressure on the National Park in the spatial sense (Figure 3).**

**Table 3.** Population Development of the National Park Area and Its Surroundings (Url2, TÜİK Statistical Data Portal)

Affiliated Location			National Park Borders		1990	2000	2010	2020	GHNP Long Term Development Plan Projection Population
	Province	District	Within	Partially					
<b>Uçhisar</b>	Nevşehir	Province Center	+	+	3159	3856	3717	3838	<b>5740</b>
<b>Göreme</b>	Nevşehir	Province Center	+		2425	2587	2200	2133	<b>3680</b>
<b>Ortahisar</b>	Nevşehir	Ürgüp Town Center	+	+	3543	3936	3564	2998	<b>4790</b>
<b>Ürgüp</b>	Nevşehir	Town Center	+		11040	14538	34372	35697	<b>22080</b>
<b>Avanos</b>	Nevşehir	Town Center		+	10010	11921	35145	32932	<b>16050</b>
<b>Çavuşin</b>	Nevşehir	Avanos Town Center	+		830	821	693	520	<b>940</b>
<b>Aktepe/Zelv e</b>	Nevşehir	Avanos Town Center	+		135	115	73	51	<b>90</b>
<b>Toplam GHNP Population</b>					31142	37774	79764	<b>78169</b>	<b>53370</b>



**Figure 3.** Cultural Landscape in Goreme Historical National Park (T.R. Ministry of Forestry, Department of National Parks, 2001)

The most common tourism activities in GHNP are nature and cultural tourism, faith tourism, balloon tourism, horse tourism, convention tourism, wineries, discovery of authentic traditional handicrafts, gastronomic tourism, etc. As of 2016, there are 230 accommodation facilities with tourism operation certificates in the national park area, and 71 thousand 856 domestic and foreign tourists visited Göreme Open Air Museum. However, the lack of a holistic effective visitor impact management plan regarding the protection-use balance of each recreational activity for tourism purposes and the deficiencies highlighted in the UNESCO 2014 periodic report, such as the density of ATV vehicles, the dense distribution of base stations, the exceeding the visitor carrying capacity in the area at peak hours, the density of balloons used in balloon tourism, Tourism **has a very high ecological pressure on the National Park** due to visual and environmental pollution due to the lack of direction signs in the park and the poor accessibility in the area (Evcı, A , Kuş Şahin, C, 2017).

In GTMP According to Technical infrastructure 2018 TUİK data, 93% of the population including Uçhisar, Ortahisar, Ürgüp, Göreme, Avanos, Çavuşını and Zelve have sewage facilities and 80% of the annual discharged wastewater is treated ([Url:3](#) TÜİK Belediye atıksu İstatistikleri, 2018). Solid waste landfill facility is located in Sulusaray İçmece, 15 km from the national park. The drinking and tap water used from Nevşehir surface water is insufficient, and 33 wells throughout the province meet the water need as reinforcement (Nevşehir Valiliği, 2019). 15 industrial facilities in the region have individual treatment facilities. Renewable energy resources are predominantly used in the region, and SPP,

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Geothermal, HEPP facilities (7 units), and Natural Gas are dominant. The technical infrastructure has a high ecological pressure on the National Park.

In 1965, 75% of the population lived in rural areas and 25% lived in cities. Nearly half of the population living in cities is in Nevşehir. Other district centers were towns. In 1990, the rural population decreased to 61%, and the urban population started to increase in all districts. In 2015, while the rural population decreased to 25%, the urban population in the districts increased by 514 due to the tourism-related increase in the urban indicators (**Table 4**), (Karabacak, 2016). **With the increase in the rate of urbanization in the urban sedentary population, a high degree of ecological pressure has emerged on the anthropogenic origin National Park.**

**Table 4.** Rural-Urban Population Distribution in the National Park Area and Its Surroundings (1990-2015) (Karabacak, 2016).

	1990-Rural	%	1990-City	%	2015-Rural	%	2015-City	%
Center	34081	39	52719	61	32285	25	98713	75
Acıgöl	19559	75	6489	25	13455	70	5748	30
Avanos	29651	75	10010	25	19823	59	13505	41
Ürgüp	24648	69	11040	31	14262	41	20629	59
Derinkuyu	11463	57	8580	43	10294	49	10814	51
Gülşehir	26027	75	8499	25	9896	45	12222	55
Hacıbektaş	12749	61	8062	39	6007	54	5077	46
Kozaklı	18376	71	7556	29	6550	47	7487	53
TOTAL	176554	61	11955	39	112572	39	174195	61

Agricultural Areas are 83% of the total area throughout the province, and cereal production is in the first place (**Table 5**). In the second place, vegetable growing and viticulture are carried out. An important part of the National Park, Göreme Open Air Museum is surrounded by extensive vineyards. Vineyards are indispensable elements of the landscape, and without these vineyards the “soul of the place” would disappear in the museum space. Therefore, it is of great importance to encourage local people to continue this type of agriculture in rural areas of Cappadocia. 71% of agricultural lands are cultivated using pesticides. **The effect of agricultural activities on soil pollution also creates a high degree of ecological pressure on the anthropogenic origin National Park.**

**Table 5.** Land Use Distribution Rate in the National Park Area and Its Surroundings (1990-2015) (Karabacak, 2016).

Land Use Types	Field Size			
	2000	2000	2018	2018
	Size in ha.	%	ha.	%
Residential area	11142,89	2,03	13562,43	2,47
Agricultural fields	451123,12	82,22	454578,83	82,85
Forest areas and semi-natural areas	83967,3	15,3	76962,04	14,03
Wetlands	441,32	0,08	639,34	0,12
Water nature	1782,93	0,32	2905,34	0,53
Total	548647,99	100	548647,98	100

## **Cultural and Natural Heritage Properties in the National Park**

In the study of Bixio, Calio, and De Pascale (2011) on rock-cut settlements and rock structures on GTMP settlement typology, Site-specific typologies were proposed considering topographic features, spatial organizations and functional differences1) Settlements in fairy chimneys (Göreme), 2) Settlements on the slopes (Zelve, Tatlarin), 3) Settlements on large rock blocks and foothills (Ortahisar- Uçhisar castle settlements), 4) Settlement with a rock courtyard (Aynalı Church, Hallaç Monastery), 5) Rock-carved

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monasteries (Kaymaklı, Derinkuyu), 6) Rock carved churches, 7) rock tombs, 8) Dovecote (Guvercinlik Valley in Uçhisar) are approached in 8 different types. (Yıldırım, 2019'dan). A hotel in Uçhisar, which was put into operation with 27 rooms in 1997, has a restoration project of a unique church/bezirhane space (estimated to be 1500 years old), which reveals the historical uses and texture, as well as the intense construction in the area, with 52 rooms completed in 2010 and renovations (**Figure 4**). A wine cellar with thousands of bottles hidden inside the original rock-carved spaces, a part of the historical underground water tunnel that supplies water to the village, many terrace gardens where organic gardening activities are revived and other unique areas have been modernized and brought to daily life. The hotel still continues its construction activities with new room and common area restoration annexes. **There has been a high degree of ecological pressure on the anthropogenic origin National Park with the increase in the urban sedentary population and the rate of urban settlement.**



**Figure 4. Uçhisar settlement on large rock blocks and their foothills Example of "içinden köy geçen otel / the village with a reception desk"(Url: 4)**

In the central plateaus of the GHNp area, there is a terrestrial-semi-desert climate zone effect with an annual average temperature of 10.7°C, the average precipitation amount is 422.9 mm, and the wettest month is May (59.3 mm) according to the precipitation measurements between 1960 and 2016. It is observed that the highest temperature value is 28.5°C in August, and the average lowest temperature value is -3.8°C in January.

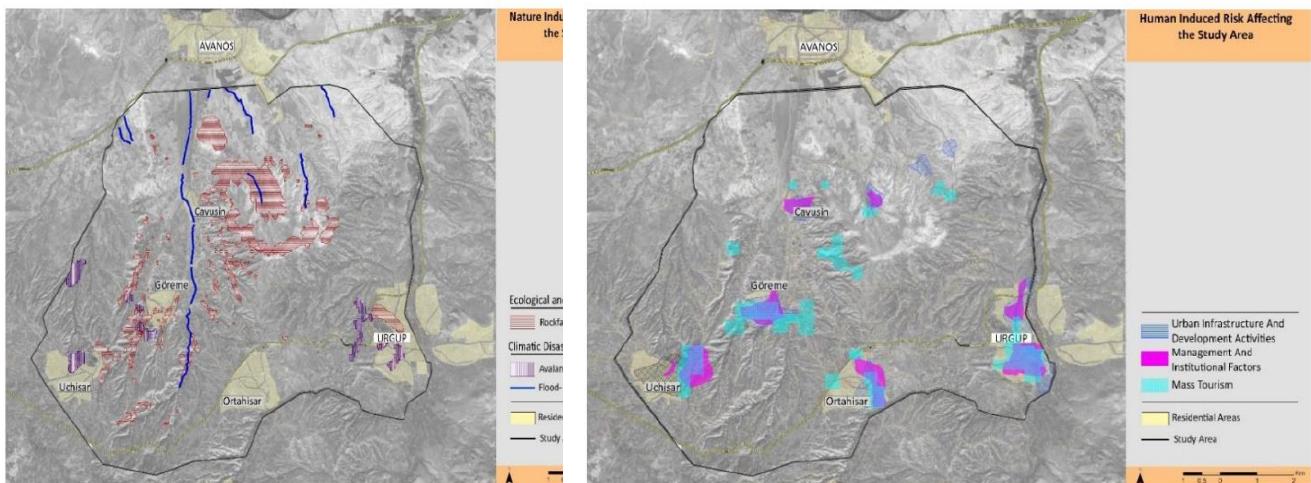
Göreme Hills has been designated as an “Important Plant Area (IPA)” by the World Wildlife Fund (WWF-Turkey). This area, where human settlements have been maintained since prehistoric times, has preserved important steppe plant communities that have survived to the present day, and the presence of approximately 650 taxon has been detected within the national park borders. Of these, 118 are endemic to Turkey. There are 23 rare plants nationwide in Göreme Hills IPA. In addition, this area is covered by the Iranian-Anatolian steppes among the “Endangered Habitats” under the Bern Convention. On the other hand, Göreme Hills IPA, which has been included in the World Heritage List, is also under protection as a National Park (Nevşehir Governorship, 2020). **However, habitat loss has occurred due to domestic, agricultural and industrial pollution and changes in the water regime, therefore, a high degree of anthropogenic ecological pressure has occurred on the National Park (Çiçek, E., et al. 2016).**

### **Experimental Comparison of Research Findings: Yıldırım and Çorakbaş's (2020) GIS-based risk maps for GTMP and rocky areas of Cappadocia**

In his work on the GTMP, Yıldırım (2020) proves that all natural and cultural protection areas are **at risk of deterioration or destruction due to natural threats such as floods, fires, earthquakes or interventions to nature for human-oriented development** and **that risk maps** are a useful tool in

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establishing an effective disaster management process against the risks in these heritage areas (**Figure 5**).



1.GHNP risk map focused on natural threats

2. GHNP human-induced development based risk map

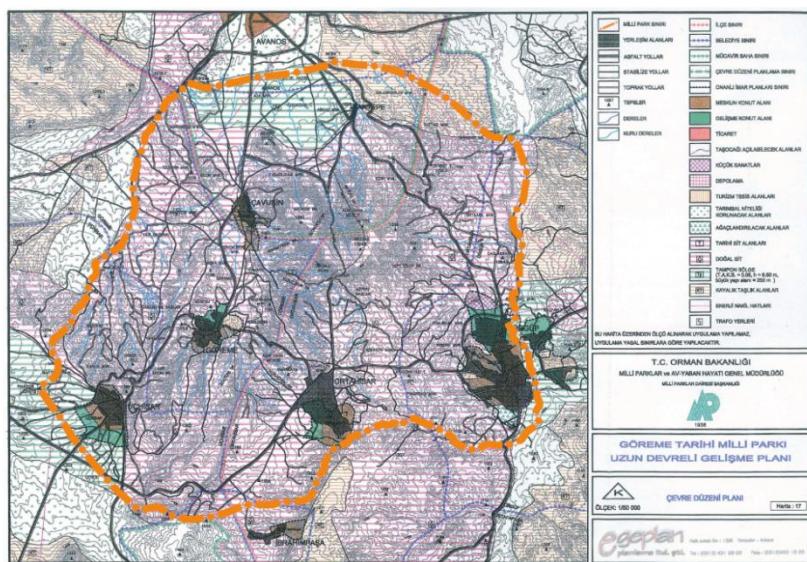
**Figure 5.** Yıldırım (2020) risk maps for the GHNP.

## Experimental Comparison of Research Findings: GHNP Long Term Development Plan Decisions

In the GNHP Long Term Development Plan(2001), measures were introduced to restrict land use decisions for the purpose of protecting natural resources. Plan decisions, some of which are natural and anthropogenic, are summarized in **Table 6** (Figure 6).

**Table 6.** GHNP Long Term Development Plan Decisions (GHNP Long Term Development Plan 2001)

Ecological planning in relation to geomorphology and geological structure	In areas where fairy chimneys are dense, not allowing agricultural activities in order to allow a protective shell to form and reduce crumbling.
	Preparation of a tourist visitor management plan that will minimize the risk of tuff material crumbling on the structure and sightseeing routes caused by 600,000 tourist visits in 1999
	Controlling the risks of flooding, slipping of the rock blocks, rain water leakage on exterior and interior surfaces, traffic vibration, static weakness of the tuff floor, the use of abrasive structure and technical installation materials incompatible with the tuff material.
	GHNP plateau, which was shaped by lava flows of Erciyes (3.917m), Melendiz (2.935m) and Hasandağ (3.254m) volcanic mountains in prehistoric times, should be subject to construction control and protective measures against earthquake risk due to Derinkuyu (20km), Erciyes(20km) and Saltlake(80km) active fault lines.
Natural and cultural landscape protection-ecological planning	In the restoration of rock-cut areas, effective management should be ensured in architectural project acceptance and building inspection processes, since space expansion and excessive use density are incompatible with original, natural and cultural values.
	Taking measures to strengthen the ground statics as well as the natural and cultural landscape, primarily for the areas where the natural wonder Fairy Chimneys are located.
	Touristic facilities and social and technical structures in the national park area should be subject to intense building inspection with geomorphological and geological protection measures.
	Since air, water and soil source pollution, which deteriorates environmental quality and public health, will adversely affect the survival of the ecological system, it should be subject to intensive protection and inspection studies by official institutions.



**Figure 6.** GHNP Long Term Development Plan (GHNP T. R. Ministry of Forestry, Department of National Parks, 2001)

## CONCLUSIONS

Cappadocia and Goreme Historical National Park within Cappadocia, located in the former active volcanic region of the Central Anatolian plateau, have been subject to many planning studies, accompanied by national and international conservation laws, after being included in the UNECSO World Natural and Cultural Heritage list in 1985. The globalization-oriented transformations in urban and regional planning on an international scale have also affected our given wonderful area, which has sensitive vulnerabilities. The findings of this study, focused on ecological planning principles regarding land use, were compared with the evaluated scientific study in which risk maps related to the use of natural and cultural values specific to the area, and the plan decisions of the holistic GHNP Long Term Development Plan for the area. (Table 7). Our research findings, with previous scientific study data, confirm that study consistently, making the sensitivity of ecological planning integrated with today's economy-oriented approaches to the use of natural and cultural resources of GHNP risky. Since the plan projections of the GHNP Long Term Development Plan made in 2001 were exceeded and the plan period has ended, it is essential to carry out a new holistic conservation planning work that takes into account the balance of ecological protection and use of the natural and cultural landscape. Preparation of the Natural and Cultural Heritage Conservation Management Plan integrated with this plan during the planning, projecting and implementation process for the control of the construction in the area is also essential for the ecological sustainability of the area.

**Table 7.** Assessment of Ecological Planning Principles of the GHNP

Göreme National Park Components	Components Associated with Ecological Structure	Ecological Impact Factors	Pressure				<u>Experimental Comparison: GIS Based Risk Maps for GHNP and Rocky Areas of Cappadocia by Yıldırım and Corakbaş (2020)</u>	<u>Experimental Comparison: GHNP Long Term Development Plan Decisions (2001)</u>
			Ecological Degree					
Settlements Within the	Urban Areas	Population Development	Very	High	Moderate	Low	Very High Risk Pressure	

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National Park			Hig h					Moderate Ecological Pressure
			X					
		Economic Structure-Tourism-Industry-Social Infrastructure	X				Very High Risk Pressure	Moderate Ecological Pressure
		Technical Infrastructure, Air Quality, Water Quality -if Available Indicator of Ecological Health	X				Very High Risk Pressure	Moderate Ecological Pressure
Rural Areas		Population Development	X				Very High Risk Pressure	Moderate Ecological Pressure
		Farming Areas	X				Very High Risk Pressure	Moderate Ecological Pressure
		Natural Monuments-Fairy Chimneys	X				Very High Risk Pressure	Moderate Ecological Pressure
		Climate, Flora/Fauna, Habitat, Pest Species	X				Very High Risk Pressure	Moderate Ecological Pressure
Cultural and Natural Heritage Assets	Natural Structure Landscape Examples	Terrestrial Ecology (Volcanic Tuff Landscape) e.g. Fairy Chimneys, Rocky places Vegetation and Fauna Habitat	X				Very High Risk Pressure	Moderate Ecological Pressure
	Cultural Structure Landscape Examples	Urban texture Samples From Urban and Rural areas, Cut Rocks Shelters, Vernacular Architectural Structure Samples, Monumental Structures, Road and Street Textures	X				Very High Risk Pressure	Moderate Ecological Pressure

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Open-Air Museum	Göreme and Zelve Open-Air Museums	Visitor Density and Ecological Limits	X				Very High Risk Pressure	Moderate Ecological Pressure
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**O 47. COMPOST PRODUCTION FROM CHICKEN MANURE AND ENRICHED WITH DIFFERENT MATERIALS OBTAINED FROM AGRICULTURAL WASTES FOR THE IMPROVEMENT OF DEGENERATED AGRICULTURAL LANDS**

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**ABSTRACT:** The most important problem of agricultural lands in recent years is the increasing sensitivity to erosion. In agricultural production techniques; Applications that improve soil quality, provide soil with organic matter and increase soil aggregate stability should be supported. The movement and balance of water, air and plant nutrients in the soil should be sustainable. The main reason for the reduction of soil organic matter in agricultural ecosystems is the release of carbon dioxide into the atmosphere through carbon oxidation. When the carbon lost from the soil cannot be replaced, erosion increases even more. The addition of organic matter increases the aggregation in the soil and increases the resistance of the soil against water and wind erosion, increases the soil quality and increases the plant yield. In Konya Closed Basin (KCB), it is known that the stubble of corn, sunflower wastes from agricultural wastes are burned after harvesting in areas where intensive agriculture is carried out. The organic carbon amount of these agricultural wastes must be recycled to the soil by composting. In addition, it should be aimed to reduce the loss of nitrogen in its content by enriching chicken manure with different materials with composting techniques and to ensure its recycling to the soil and to improve and increase the soil quality. Within the scope of the TAGEM project named "Determining the Effects of Chicken Manure Enriched with Different Materials and Compost Obtained from Agricultural Wastes on Soil Quality and Growth of Corn (*Zea mays L.*)", organic materials obtained from chicken manure and agricultural wastes, Composting operations were carried out in an open heap environment. Providing carbon and nitrogen mineralization in soils by composting chicken manure with agricultural wastes with different materials such as leonardite, clinoptilolite, biochar in problematic, marginal semi-arid areas that are devoid of organic matter, and which have suffered wind erosion in the sustainable land management (SAY) planning in the basin. It is aimed to increase the organic matter content, increase the microorganism activity and aggregate stability, increase plant growth and productivity, and ultimately reduce erosion. The composting process of the project has been evaluated in this study.

**Keywords:** *Chicken manure, Agricultural waste, Organic matter, Compost, Aggregate, Erosion, Karapınar*

**INTRODUCTORY**

Desertification refers to land degradation/land deformation caused by various factors, including climate changes and human activities, especially in arid, semi-arid, and low rainfall areas. Desertification/land deformation and drought directly affect 4 billion hectares which is 25% of the world's land area 168 countries, and 1.5 billion people. While 250 million of this population is at serious risk, about 10 million of them have had to migrate due to desertification/land destruction and drought. 12 million hectares of agricultural land is degraded and 5.6 million ha of forest land is decreasing every year in the world due to desertification/land destruction and drought. Although there is no natural desert in Turkey; its geographical location, climate, topography, and soil conditions increase the sensitivity of the country to land degradation and drought, which cause it to be among the countries most affected by desertification and drought. In general, 65% of our country's land has arid, semi-arid, and semi-humid climate characteristics. In these ecologically sensitive areas, the destruction of vegetation and the deterioration of the natural balance led to erosion of the soil and subsequently the parent material (ÇEM, report 2018). The areas, which is generally arid and semi-arid, where wind erosion is effective are the southern half

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of Central Anatolia (especially Konya, Aksaray, Niğde, Kayseri) and the eastern part (within the borders of Kars, İğdır province) in Turkey, there is a problem of wind erosion from mild to very severe in an area of 465.913 hectares as a dune. Approximately 70% of this area (322.474 ha) is located within the provincial borders of Konya. 103.000 ha of this area is located in Konya Karapınar district and this area constitutes 22.1% of the country-level wind erosion area (TOPRAKSU 1975; Şimşekli, 2012).

In order to prevent these negative effects of the wind, the most used method in agricultural areas to correct the unsuitable physical properties of the soil is the addition of various organic materials to the soil. The increase in a small amount of organic matter in the soil has a significant positive effect on the physical, chemical and biological properties of the soil. Physical properties such as a good structure of the soil, increased aggregation in the soil, increased water holding capacity of the soil, reduction of soil compaction, formation of coarse pores filled with air and formation of ideal seed bed depend on the organic matter content of the soil (Mücevher et al., 2018). The most important problem of our soils is the lack of organic matter. Within the scope of the TOVEP project between 1982-1991, the organic matter content of the soils of Turkey was 21.47% (< 1% very little); 43.78% (1-2%, few); 22.62% (2-3%, moderate); 7.57% (3-4% good); It has been reported as 4.55% (>4% high) (Eyüpoglu, 1999). According to this report, 65.25% of the organic matter content of our country's soils is lower than 2%. Provinces in the Konya Closed Basin (KCB) Region are the cluster of Provinces with the lowest organic matter in our country.

It is technically possible to transform environmental wastes, plant and animal production outputs of organic origin into processes that increase organic matter in the fastest process. In this process, it is enough for human beings to imitate nature as in the ecosystem. The aim of this project is to enable the population living in rural areas to be able to produce applicable organic matter in the countryside.

In the same (KCB), it is known that the stubble of corn, sunflower wastes from are burned after harvesting in areas where intensive agriculture is carried out. The organic carbon amount of these agricultural wastes must be recycled to the soil by composting. In our country's crop production, corn planting area is 638.829 ha, sunflower planting area is 752.632 ha; In the TR52 (Konya, Karaman provinces) Region of the KCB, there is an agricultural land area of 1.323.669 da of corn cultivation area and 794.352 da of sunflower plant cultivation area (TUİK, 2020). The proportion of TR 52 Region in the corn planted area in Turkey is 20.72%; the rate of the cultivated area of sunflower is 10.55%. In the amount of agricultural residue formed on an areal basis, 0.391 tons/da in corn plant; based on the sunflower plant as 0.153 tons/da (Başçetinçelik ve ark. 2005). Therefore, the annual agricultural residue potential in our country is 2.497.821 tons of corn residue and 1.151.527 tons of sunflower residue; In TR 52 Region, the annual agricultural residual potential was calculated as 517.555 tons for corn residue and 121.536 tons for sunflower crop residue. Therefore, in this compost study, corn and sunflower plants, which are plant varieties that are intensively cultivated in KCB and form agricultural residues, were preferred.

The number of brood hen in our country is 258.046.340 and the number of laying hens is 121.302.869 (TUIK, 2020). It was estimated by Turkish statistical institute that the amount of wet chicken manure in Turkey would be approximately 10 million tons in total, which was 7.848.910 tons/year in brood hen and 2.031.823 tons/year in laying hens. In addition, in laying hens, TR 52 Region has 9.99% of Turkey's laying hen assets (2020 TUIK). The number of laying hens in the TR 52 Region is 12.114.651 and the number of broiler chickens is 318.250. It is estimated that there are approximately 210.000 tons of wet chicken manure in the region. Therefore, it is important to bring this organic material to the economy by composting with an environmentally friendly application. In addition, by enriching the chicken manure with different materials with composting techniques, it should be aimed to reduce the loss of nitrogen in its content and, in this way, to ensure its recycling to the soil and to improve and increase the soil quality.

Agricultural plant wastes also have C-rich content. Moist chicken manure contains approximately 5-6% N (Aydeniz and Brohi 1991), nitrogen-rich content and composting of chicken manure with vegetable (park-garden, agricultural, etc.) wastes is the most appropriate solution to balance the C/N ratio. The first high moisture content in chicken manure affects N loss through NH<sub>3</sub> evaporation (Cabrera and Chiang 1994). N mineralization and NH<sub>3</sub> evaporation occur during standing, and the low NH<sub>4</sub>-N values indicate that mineralization is rapid. Therefore, it is considered to add different materials such as biochar, leonardite, clinoptilolite due to their adsorbing properties in order to prevent the reduction of nitrogen loss in moist chicken manure in the composting technique.

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Within the scope of the TAGEM project, "Determination of the Effects of Compost Obtained from Chicken Manure Enriched with Different Materials and from Agricultural Residues on Soil Quality and Corn (*Zea mays L.*) Plant Development", carried out and concluded in Konya-Karapınar in 2019, composting processes of the organic materials obtained from chicken manure and the agricultural wastes were carried out in open stack environment. Providing carbon and nitrogen mineralization is aimed in soils by composting chicken manure with agricultural wastes with different materials such as biochar, leonardite, clinoptilolite in problematic, marginal semi-arid areas that are devoid of organic matter, and which have suffered wind erosion in the sustainable land management (SLM) planning in the basin. Also, with this study, it is aimed to increase the organic matter content, increase the microorganism activity and aggregate stability, increase plant growth and productivity, and ultimately reduce erosion. The composting process of the project has been evaluated in this study.

### **Ecology of Konya Karapınar region, where wind erosion is most common**

Karapınar is on the Konya-Adana highway and is 95 km from Konya. Its population is around 49.000 and its surface area is 4315 km<sup>2</sup>. It is the continuation of the Konya Plain in the north and west and is surrounded by Karacadağ from the east and Andıklı, Küçük and Büyük Tartan hills from the south. The climate of the region is described as semi-arid continental, with hot and dry summers and cold and rainy winters. Most of the snowfall falls in January and February. The average annual precipitation is 275 mm, 40% of which falls during the winter months. The average precipitation from July to September is 15 mm (Şimşekli, 2012). In the Karapınar area, the high temperature in the summer months and the low humidity in the soil profile throughout the year negatively affect the decrease in the amount of organic matter in the soil and ultimately the physical and chemical quality of the soil (Bot and Benites, 2005). These reductions in vegetation due to the temperature difference play an increasing role in degradation, desertification, and ultimately wind erosion due to the decrease in the organic matter cycle to the soil. The physical, chemical properties, and biological productivity of sandy textured soils that are exposed to wind erosion in semi-arid areas are low. The only thing that needs to be done in the improvement of such areas is to increase the organic matter content in the soil. Ozdemir et al. (2005), it was determined that organic and inorganic soil conditioner applications increase the resistance to erosion by increasing aggregation in the soil, decreasing the dispersion rate and wear factor values. Since organic matter contributes significantly to aggregate formation, the increase in organic matter prevents soil erosion by water and wind (Jones, 1991).

## **MATERIAL AND METHOD**

### **Pre-compost preparation processes**

Chicken manure and corn and sunflower wastes from agricultural residues as compost materials were used in the trial within the scope of the project in the Karapınar Desertification and Erosion Research Center affiliated to Konya Soil Water and Combating Desertification Research Institute of the General Directorate of Agricultural Research and Policies of the Ministry of Agriculture and Forestry.

In addition, as an absorbent feature that reduces nitrogen loss in chicken manure, three different materials, biochar, leonardite, clinoptilolite were also used. Biochar material was obtained from the spindle pruning residue obtained from the study land (Mücevher et al., 2018). In the project, clinoptilolite, leonardite, biochar, sunflower and corn residues, and chicken manure materials required for composting were procured. In composting, since the small size of the particle reduces the compost time and allows the compost to mature in a shorter time, Sunflower and corn residues were passed through a crusher grinder (<6mm size) before composting. For the compost pile, 540 kg sunflower residue (1/3 ratio) and 1620 kg corn residue material were prepared. On 13.06.2019, these materials for the compost test, C and N analyzes were performed at the Leco device in the Soil Section at the S.Ü. Faculty of Agriculture. Based on the C and N analysis results, the composting process was started (Table 1).

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**Table 1.** C and N contents of the materials used

Materials	Moisture avg.	% C avg.	%N avg.	% C/N
Corn residue	9,00	91,30	0,67	137,29
Sunflower residue	11,00	76,90	0,76	100,66
Biochar	11,00	78,90	2,70	29,22
Clinoptilolite	16,04	1,40	0,19	7,37
Leonardite	25,70	23,24	0,64	36,31
Chicken manure	50,59	43,50	6,08	7,15

### **Composting process**

The stages of the composting process carried out on the land of the same Research Center can be explained as follows. On 02.07.2019-03.07.2019, mixing (1/3 ratio) and moistening (approximately 70% moisture) of sunflower and corn residues as agricultural waste plant pile was carried out before composting. The mixing and moistening process was repeated 3 times to assimilate the moisture better into the plant piles. On 08.07-09.07.2019, after 4 equal amounts of plant piles were made for 4 different compost subjects, wet chicken manure was added equally to each plant pile. Therefore, 4 equal 876 kg compost piles (531 kg of agricultural residues, 345 kg of animal residues) were prepared for 4 different compost subjects. These 4 equal compost heaps are adjusted so that the C/N mix ratio=25/1. Mixtures were calculated on dry matter (DM).

The compost formula is given by the researchers as follows (Demir, 2012).

$$R = [Q1*C1*(100- M1) + Q2*C2*(100- M2) + Q3*C3*(100- M3)] / [Q1*N1*(100- M1) + Q2*N2*(100- M2) + Q3*N3*(100- M3)]$$

R: C/N ratio of the mix				
Q1: Amount of base material of sunflower residue (g)		Q3: Amount of base material of chicken manure (g)		
C1: Organic carbon content of sunflower residue (%)		C3: Organic carbon content of chicken manure (%)		
M1: Moisture content of sunflower residue (%)		M3: Moisture content of chicken manure (%)		
Q2: Amount of base material of corn residue (g)		N1: Nitrogen content of sunflower residue (%)		
C2: Organic carbon content of corn residue (%)		N2: Nitrogen content of corn residue (%)		
M2: Moisture content of corn residue (%)		N3: Nitrogen content of chicken manure (%)		

After obtaining the C/N ratio as 25/1, compost mixtures were added 10% additional enriched materials (biochar, leonardite, clinoptilolite according to their subjects) over DM according to the subjects of 4 different composts. On 09.07.2019, in the open pile, the composting process of the project was started on 4 different compost subjects and only chicken manure was added, as stated in the project, in 5 different subjects (Table 2).

The initial compost piles were adjusted to be h=1,30 m high, a= 2,40 m wide, and L= 4 m long. Compost piles were covered for about 1 week. Moisture and temperature data of the composts were recorded every 2 days. The compost is covered at night and left open during the day. Mixing and aeration of compost piles were carried out at certain date intervals (average 4 days). A total of 27 mixing processes were carried out in compost formation. Maximum effort was made to keep the conditions equal in the mixing and moistening processes of the composts. Composting processes were terminated when the internal temperature of the composts was close to the outdoor air temperature. Composting became the final product on 25.10.2019 after 109 days (Figure 1 and 2).

**Table 2.** Compost trial topics

Compost Matters	Agricultural waste (sunflower/corn; 1/3) /	Animal waste (chicken manure)	Enriched Material by weight (dry matter)
Compost 1 (K1)- compost+biochar	C/N =25/1 compost	% 10 biochar	
Compost 2 (K2)-kompost+leonardite	C/N =25/1 compost	% 10 leonardite	
Compost 3 (K3) kompost+clinoptilolite	C/N =25/1 compost	% 10 clinoptilolite	
Compost 4 (K4) compost	C/N =25/1 compost		

Compost 5 (K5)-chicken manure compost



**Figure 1.** at the beginning view of composts-09.07.2019; **Figure 2.** the end view of composts-21.10.2019

### **Analysis measured in compost piles**

The following parameters from the compost piles were measured. Temperature, moisture, pH, EC, C/N change, N loss, organic matter loss (OML), color change, bulk density, specific weight, porosity, and micro and macro elemental analysis processes were followed in compost piles.

Compost temperature measurements were made from 6 different points of the heap with a Teslo 925 brand temperature measuring device. Moisture values of the compost were also analyzed in 3 replications after taking samples from 6 different points of the pile until they reached a constant weight in the oven (TMECC, 2001). In the moisture analysis of the compost samples in the oven, it was seen that the process took 5 to 6 days to reach a constant weight at 70 °C.

pH and EC ( $dS\ m^{-1}$ ) analyzes were carried out in the laboratory of Konya Soil Water and Combating Desertification Research Institute once a week on compost issues (TMECC, 2001).

C/N analyzes of the composting head and middle and final compost products were carried out in the LECO device in Selçuk University Soil Department laboratory. Changes in C (%), N (%), and reductions in % N loss were calculated at the beginning and end of compost subjects.

In the composting process, organic matter loss (OML) due to decomposition as a result of microorganism activities was also calculated. Organic matter loss in the final compost obtained in the muffle furnace in the laboratory of our institution was revealed (Table 9). Changes in the organic matter ratio (OM) of the material during the composting process were used to calculate the organic matter loss (Haug 1993).

The moisture values of the material were calculated by drying the samples in an oven at 70 °C until they reach their constant weight. As a result of the drying process, the following equation was used to calculate the moisture content over the weight loss, for example (TMECC, 2001).

$$\text{Moisture (\%)} = (\text{wet sample weight} - \text{dry sample weight}) / \text{wet sample weight} * 100$$

Organic Matter in Dry Matter (OM) (%); The weight loss of the samples burned at 550 °C in the muffle furnace is equal to the amount of volatile matter. Volatile matter is considered as total organic matter (Kocasoy 1994).

$$\text{Ash (\%)} = 100 - (\text{OM (\%)}) ; \text{Organic Matter Loss (OML) (\%)} = [\text{OM}_{\text{initially}} (\%) - \text{OM}_{\text{end}} (\%)] * 100 / [\text{OM}_{\text{initially}} (\%) * (100 - \text{OM}_{\text{end}} (\%))]$$

Bulk density (BD) ( $\text{g/cm}^3$ ), specific weight (SW) ( $\text{g/cm}^3$ ), and porosity in other words free air ratio (%) values of compost subjects were measured once a week in the laboratory of the same Research Institute (TMECC, 2001). In the calculation of porosity in compost, % Porosity or (Free Air Ratio) =  $(\text{SW} - \text{BD}) / \text{SW} * 100$  is excluded from the formula.

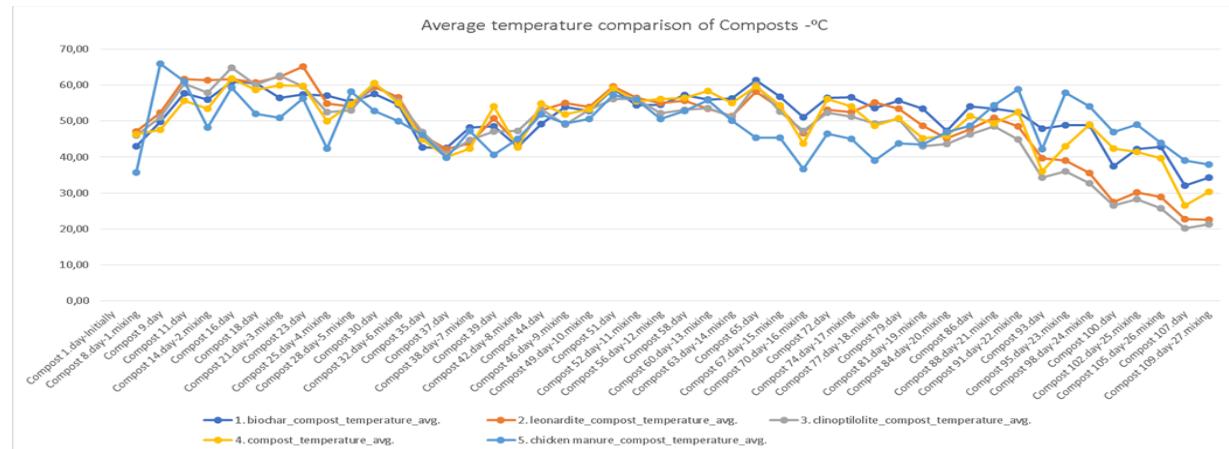
In the laboratory of our institution, the initial and final compost products were burned in the wet burning process according to the Mars 6 wet burning device (EPA 3051a) method, and after the extraction processes were completed on the Whatman 42 filter papers, elemental analysis readings were made in the ICP OES 5100 SVDV device.

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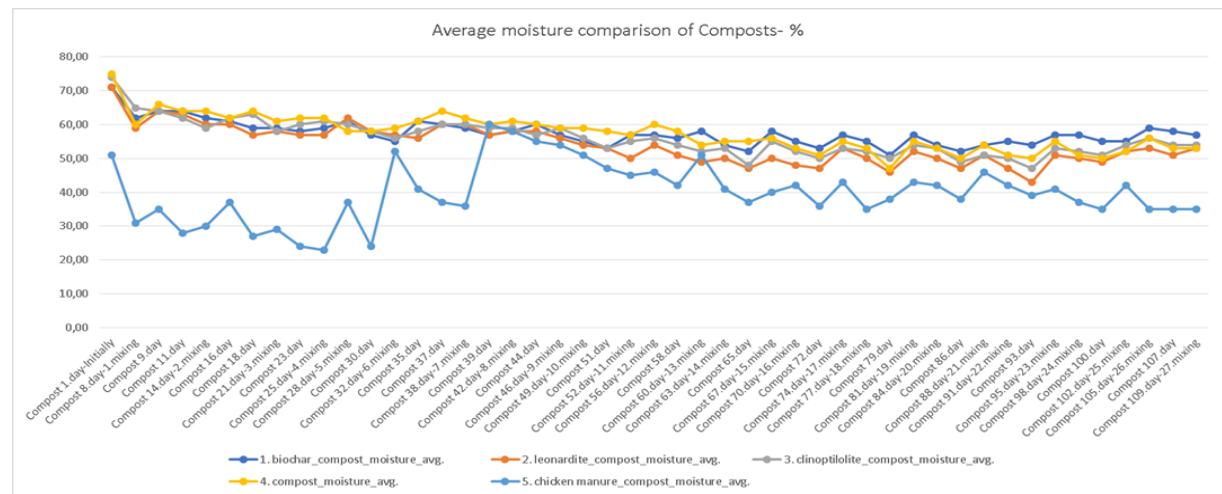
### FINDINGS AND DISCUSSIONS

#### Composting temperature and moisture values analysis results

The graphical representation of compost temperature measurements and compost moisture values of 5 different composting processes carried out in the same Research Center are given in Figures 3 and 4.



**Figure 3.** Temperature changes according to days in composts- °C



**Figure 4.** Moisture changes according to days in composts-%

According to the “Compost Quality Communiqué” published in the Official Gazette dated 05.03.2015 and numbered 29286 by the Republic of Turkey Ministry of Environment and Urbanization, the hygiene value is uninterrupted for 2 weeks at 55 °C, 1 week at 60 °C, 5 days at 65 °C. will be processed at 70 °C for 1 hour. According to Canadian composting criteria, the compost pile must be subjected to aerobic decomposition for 3 days above 55 °C (Epstein, 1997). Although mesophilic temperatures provide appropriate composting, many experts recommend that the compost temperature should be between 43-65 °C (Camci Çetin et al., 2004). In thermophilic phases, pathogens, weed seeds, and fly larvae are killed, and legal practices state that the temperature should be 55 °C to kill human pathogens (RYNK, 1992; Keener et al., 2000).

In the study, if we look at the temperature parameters in the compost pile, we see a sinus fluctuation curve in the temperature curve. In general, we see that there is an initial increase in the temperature curve, followed by a decrease, and a further increase in temperature with re-humidification. The change in this temperature fluctuation is equivalent to the loss of organic matter in the compost, and the temperature decreases over time. To ensure better combustion throughout the compost, it has been taken care of keeping the temperature values constant, generally between 50-60 °C. It was observed that there was a decrease in temperature values towards the maturation stage of the compost. The composting

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process was terminated when the outdoor air temperature was closed the indoor temperature of the compost. The composting process started and ended equally in 5 different compost piles.

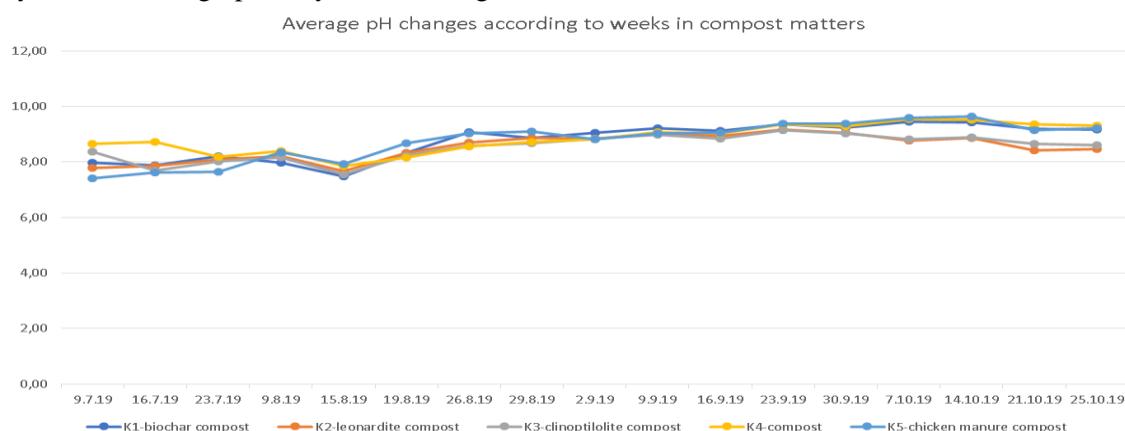
In compost subjects, the temperature values are respectively, K1 (biochar compost) at an average of 55.58 °C for 16 days, for K2 (leonardite compost) at an average of 54.18 °C for 16 days, for K3 (clinoptilolite compost) at an average of 52.79 °C for 14 days, K4 (compost) at an average of 54.27 °C for 16 days and K5 (chicken manure compost) was at an average of 54.32 °C for 11 days. It has been observed that the temperature of the compost piles is at an average of 62.21 °C for 6 days for K2 (leonardite compost) and at an average of 60.98 °C for 6 days for K3 (clinoptilolite compost). The highest temperatures occurred for K4 (compost) at 70 °C and for K2 (leonardite compost) at 69.2 °C. When evaluated in terms of temperature among compost subjects, it is seen that K3 (Clinoptilolite compost) and K2 (leonardite compost) subjects complete the composting process the fastest and show early compost maturation. K5 (chicken manure compost) shows that it matures at the latest and does not lose its temperature.

One of the desired parameters in compost conditions is ventilation conditions which is humidity and mixing. The oxygen required for aerobic composting is usually supplied with air. The water vapor formed by the ventilation process is also removed from the process. Since oxygen ( $O_2$ ) is used by microorganisms and  $CO_2$  is released during the process, the amounts of  $O_2$  and  $CO_2$  in the compost pile can be used to control aeration (Suess 1985).

In this study, moistening and mixing processes of compost piles were generally carried out together. The moisture content of compost affects microorganism activities, temperature, and decomposition rate (Bernal et al., 2009). The moisture content should be between 50-60% in order to continue the composting process effectively (Epstein, 2011). Therefore, care was taken to keep the humidity between 50-60% stably in the experiment. In compost moisture adjustment, the liquid part should be in a consistency that will not flow when we squeeze the compost pile in our hands. If there is excessive moistening, the desired burning and temperature increase will not be achieved, since porosity will not form in the compost piles. Therefore, when the mixing is increased and humidity values are kept between 50-60%, it will be seen that the temperature values are between 50-60 °C by themselves. Aeration and mixing were occurred 27 times in compost piles. Each time, the mixing process was done by turning the side of the heap over and over. In the next stage, better combustion was achieved by doing the opposite. If we look at the humidity values, it is seen that the humidity is best kept and the humidity is the highest in K1 (biochar compost). It is seen that the humidity is at the lowest level in the case of K5 (only chicken manure compost). Although the humidification and mixing processes were carried out equally in all compost matters, it was observed that K5 did not absorb moisture at the beginning. After the 38th day, the humidity was kept in the stable range (50% humidity). The order of moisture in the compost was K1 > K4 > K3 > K2 > K5.

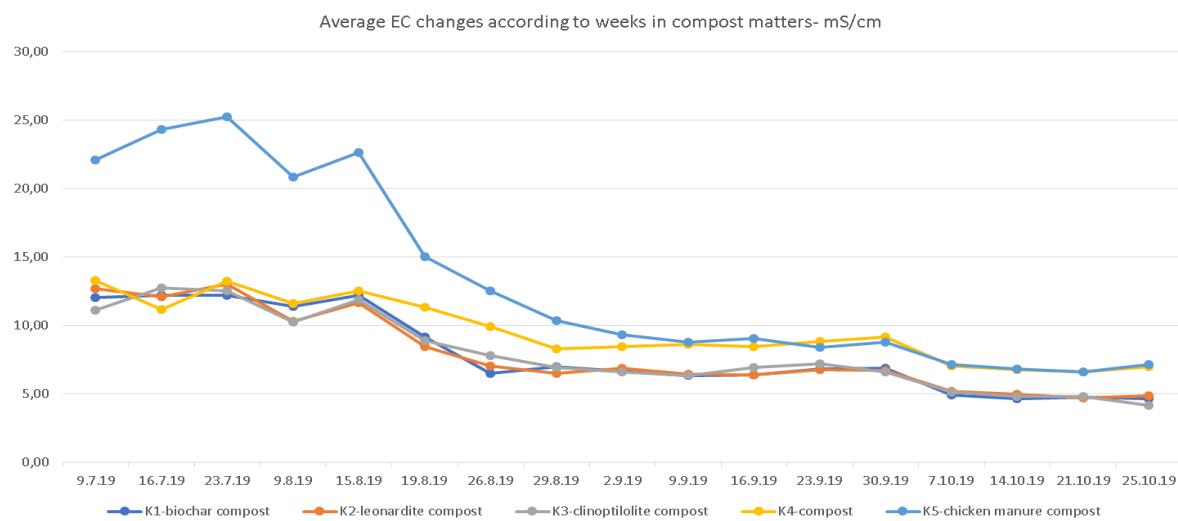
### **Composting pH and EC values analysis results**

During composting, pH and EC parameters were monitored weekly on composts (TMECC, 2001). The analysis results are graphically shown in Figures 5-6 below.



**Figure 5.** Average pH changes according to weeks in composts

According to the same "Compost Quality Communiqué", it has been reported that the pH value should be between 5.5 and 8.5 for compost to be applied. As a result of composting, it is seen that the pH value in the final compost heaps is generally between 8 and 9. A slight increase in pH was observed over time with the composting process. The reason for this may be the possibility of lime in the content of the chicken manure material used in the compost. At the beginning of the compost, pH of composts were K1-7.98, K2-7.78, K3-8.38, K4-8.65, K5-7.40, respectively, while at the end of the compost, pHs were K1-9.16, K2-8.47, K3-8.60, K4-9.30, K5-9.21. The pH value was lower for K2 (leonardite compost) and K3 (clinoptilolite compost) compared to other subjects and the pH was close to 8.5.



**Figure 6.** Average EC changes according to weeks in composts-( $\text{mScm}^{-1}$ )

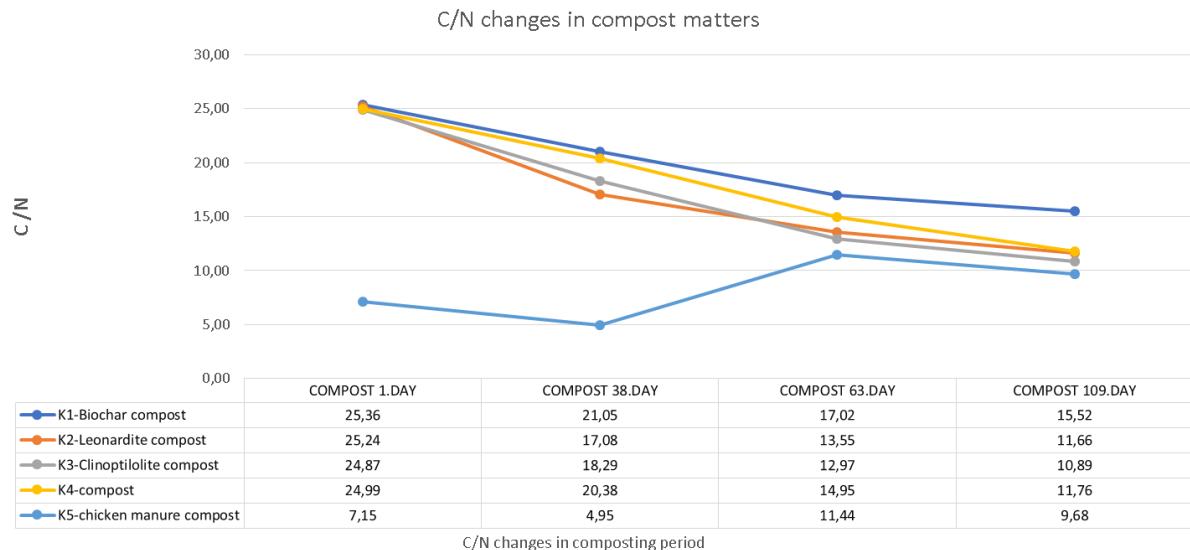
With the composting process in compost piles, decreases and improvements in EC value have been observed over time. At the beginning of the compost, EC of K1, K2, K3, K4, and K5 ( $\text{mScm}^{-1}$ ) were 12.04, 12.67, 11.10, 13.29, 22.06, while at the end of compost, they were 4.66, 4.90, 4.15, 6.99, 7.16 respectively. EC values are ordered from lowest to highest as K3>K2>K1>K4>K5 in EC values. According to soil quality standards, soil salinity in terms of EC ( $\text{dSm}^{-1}$ ) is 0-4 unsalted and 4-8 slightly salty (Richards, 1954). It is seen that especially the subject of K3 (clinoptilolite compost) is suitable for soils close to the salt-free class.

#### Composting end %C, %N, C/N analysis results

One of the most important factors for successful composting in the composting process is considered to be the C:N ratio (Poincelot, 1977). While the preferred limits for rapid composting are 25:1-30:1 in the C:N ratio, 20:1-40:1 is predicted as acceptable limits (RYNK, 1992). In this study, C/N analysis results of the final compost formed as a result of compost were made on the LECO device on 25.12.2019 (Table 3). The C/N change over the composting period in composts is graphically indicated in Figure 7.

According to the same "Compost Quality Communiqué", C/N 10-30 is required. If we look at the C/N changes in compost subjects, it is seen that the K1, K2, K3 and K4 compost subjects decreased from approximately C/N 25/1s initially over time.

It has been observed that K3 (clinoptilolite compost) is C/N-10.89 and K2 (leonardite compost) is C/N-11.66 and that more mature composting is provided in these compost subjects and is also suitable for the same Compost Quality Communiqué. In the project, an evaluation was made in terms of nitrogen loss (%N) in composting (Table 3).



**Figure 7.** C / N changes in composts

**Table 3.** Reduction in N loss (%) and C, N (%) changes at the beginning and end of compost in composts

Compost matters	C, N (%) changes in compost subjects at the beginning and end of compost						Reduction in N loss-%
	At the beginning			Finally,			
	C	N	C/N	C	N	C/N	
K1	71,08	2,80	25,36	37,96	2,44	15,56	12,96
K2	66,02	2,62	25,24	29,16	2,50	11,66	4,43
K3	64,03	2,58	24,87	21,33	1,96	10,88	23,88
K4	69,62	2,79	24,99	28,34	2,41	11,76	13,51
K5	43,50	6,08	7,15	22,37	2,31	9,68	62,01

When the nitrogen (%N) loss in compost matters is ordered from the highest loss to the least, they are listed as K5 > K3 > K4 > K1 > K2. The most N loss was in K5 (chicken manure compost). Nitrogen loss was found to be less in other compost subjects than in K5 subjects. The least nitrogen (%) N loss was in K2 (leonardite compost) and K1 (biochar compost).

#### Organic matter loss (OML) analysis results in composting

In the muffle furnace, organic matter loss was revealed in the final compost issues (Table 4).

**Table 4.** OM and OML calculation at the beginning, middle, and end of composts

Date	9.07.2019	15.08.2019	9.09.2019	25.10.2019	15.08.2019	9.09.2019	25.10.2019
Matter	OM %	OM %	OM %	OM %	OML-%	OML-%	OML-%
K1	73,52	70,20	60,87	56,18	15	44	54
K2	67,10	59,04	50,68	37,21	29	50	71
K3	59,24	50,86	42,19	37,08	29	50	59
K4	66,82	64,89	56,25	47,95	8	36	54
K5	67,13	55,54	47,41	37,07	39	56	71

According to the same "Compost Quality Communiqué", Organic Matter (in dry matter) should be > 35%. OM (%), in terms of evaluation, respectively; the subject of K1>K4>K2>K3>K5 comes up. In all compost matters, organic matter (DM) is more than 35% and is considered appropriate.

OML (%), Organic matter loss, were highest in K5 and K2. The least happened in K1. The reason for the low loss of organic matter in K1 (biochar compost) here may be due to the resistance of biochar to decomposition by microorganisms. OML (%), Organic matter loss respectively; It comes as K5=K2>K3>K1=K4. In addition, weighings (DM) were made at the beginning and end of the compost in the project. Organic matter loss (OML) was determined and is indicated in Table 5 below.

**Table 5.** Organic matter loss (OML) between at the beginning and end of the composts

Compost matters	At the beginning compost 1.day-kg	At the end compost 109.day-kg	Organic matter loss-%
K1	964,13	440,62	54,30
K2	964,13	431,94	55,20
K3	964,13	428,44	55,56
K4	876,48	338,82	61,34
K5	1.531,38	572,15	62,34

About 2 times of organic matter loss (OML) occurred in the all compost matters. In OML, they are ordered from most to least as K5> K4> K3> K2> K1.

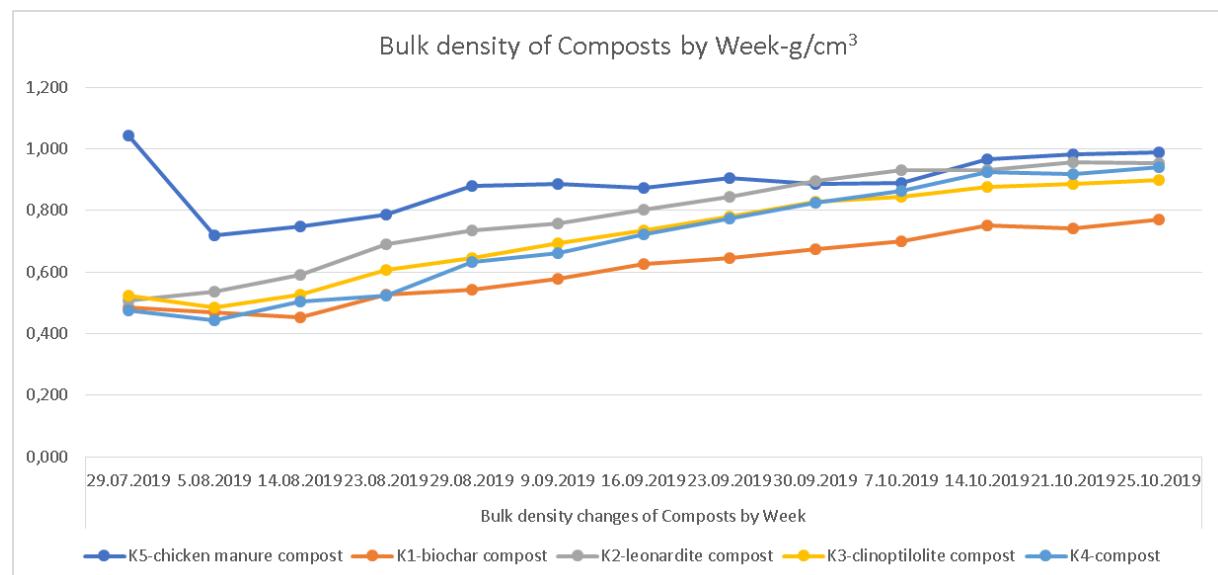
### Colour change in composting

During the composting process, while the yellowish color was dominant in the compost heaps at the beginning, it was observed that with the burning event, it turned light brown over time and then dark brown. It was observed that the color changed to black in the final compost piles. It was observed that the fastest blackening in color change was K2 (leonardite compost) and K1 (biochar compost).

### Analysis results of bulk density, specific weight, and free air ratio (porosity) values in composting

In the project, on composts, Bulk density (BD), Specific Weight (SW), and free air ratio (porosity) analyzes were followed once a week. Graphical representation of BD, SW, and porosity changes during the composting period is shown in Figures 8-10. Karapınar sandy soil was used as well as compost subjects in the evaluation of the comparison of composts in porosity change.

#### Bulk density (BD) in Composts-(g/cm<sup>3</sup>)



**Figure 8.** Bulk density (BD) changes in composts by week

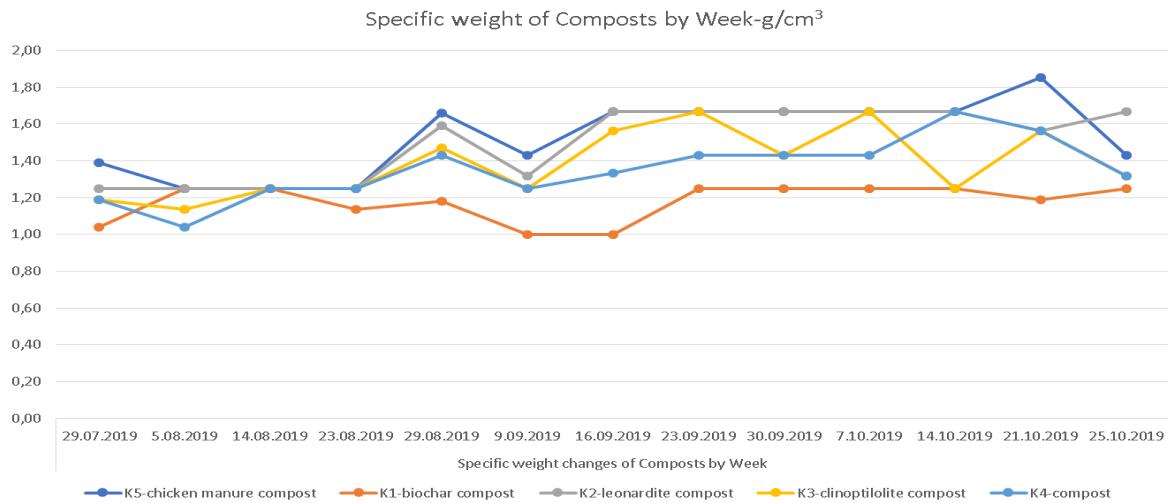
K1 (biochar compost) is lower in BD. The BD value of K5 (chicken manure compost) is higher than other composts. In compost matters, there is an increase in BD values over time. In terms of bulk density, a change is observed in the form of K1<K3<K4<K2<K5< Karapınar Sandy Soil.

#### Specific Weight (SW) in Composts-(g/cm<sup>3</sup>)

The highest SW value occurred in K5 (chicken manure compost). K5 (chicken manure compost) SW value is greater than other compost subjects. K1 (biochar compost) is lower in SW. In compost matters,

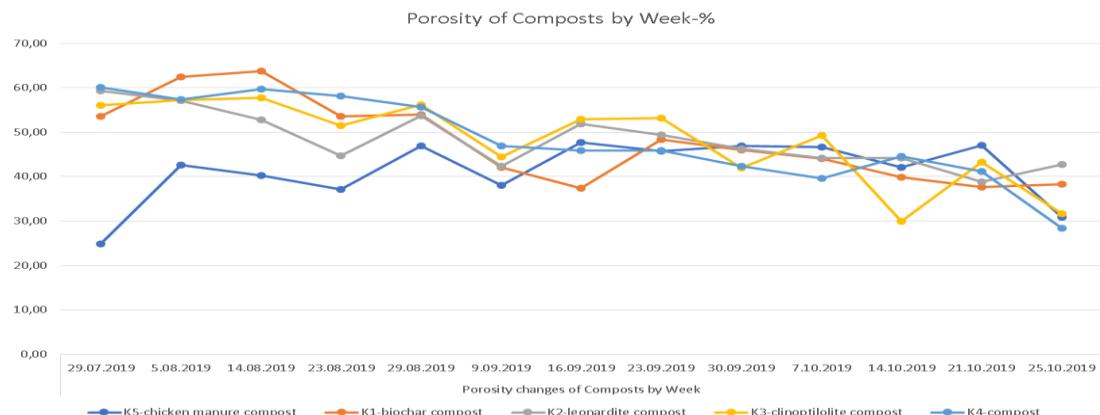
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there is an increase in SW values over time, as in BD. The results were summarized as K1<K4<K3<K2<K5< Karapınar Sandy Soil.



**Figure 9.** Specific weight (SW) changes in composts by week

## **Free air ratio or (Porosity) in Composts -(%)**



**Figure 10.** Porosity changes in composts by week

In the composting environment, there should be enough porosity to allow the necessary air to spread to the microorganisms. Free air ratio in the range of 20-35% as an indicator of the amount of free air in the material is suitable for composting (Jeris and Regan 1973, Külcü and Yaldız 2003). When the porosity (free air ratio) of the compost subjects during the composting period is examined, it is seen that the % porosity decreases in the other composts except for K5 (chicken manure compost). The porosity decreases as the compost matures. This is because, in the compost matters during the composting period, as BD increased higher than SW over time, the porosity decreased in the final composts compared to the initial state in the porosity values. In the final compost dated 25.10.2019, Porosity status was formed as K4<K5<K3<K1<K2.

## **Elemental analysis results of wet burning in initial and final composts in composting**

The composts formed as a result of the 109-day process in the composting process were read on the ICP OES SVDV 5100 device for elemental analysis after the wet burning process. Analysis results are given in Table 6 below. In the results of the analysis, for example, when examining the initial and final K5 (chicken manure compost), there was an approximately 2-fold increase in plant nutrient concentration

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inversely proportional to the organic matter loss. Similarly, increases in plant nutrient element concentration are observed in all compost subjects. According to the same "Compost Quality Communiqué", it is seen that those trace elements are well below the limit values in all final composts.

**Table 6.** Elemental analysis results in initial and final compost products

Compost matters	Elemental analysis results in final and initial compost products-ppm														
	Al	B	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Na	Ni	P	Pb
K1_09Temmuz19_compo st	22,9 203,6	47695, 5	0,1 7	0,5 1	2,9 4	16,3 7	229,9 6	14211, 7	3681, 3	163,4 9	5,9 805,4	6,9 7	3486,0 0	0 0	102,6 5
K2_09Temmuz19_compo st	21,9 917,5	53472, 2	0,1 6	1,0 4	7,8 5	20,3 4	1408, 0	14794, 7	3686, 1	174,7 5	7,1 909,8	2,1 6	3399,0 3399,0	5 5	114,6 5
K3_09Temmuz19_compo st	2260, 2	57757, 5	0,0 3	0,8 9	3,9 9	20,0 2	19014, 7	4149, 6	236,1 8	1033, 0	6,4 2	5,6 4020,1	134,6 6	2	140,9 2
K4_09Temmuz19_compo st	24,2 249,8	60971, 0	0,1 5	0,6 1	3,5 7	20,2 6	272,6 6	17788, 3	4227, 0	211,7 997,9	4,8 9	5062,8 5062,8	1,4 0	0 0	213,7 8
K5_09Temmuz19_compo st	30,4 145,1	70853, 3	0,1 5	0,6 2	3,9 4	33,8 6	18136, 7	3065, 6	292,3 9	1737, 8	6,1 5	9213,4 3	0,4 5	1,6 184,8	184,8 8
K1_25Ekim19_compost	304,5 1248,	80836, 33,1	0,1 0,1	0,8 1,2	4,5 7,9	27,2 33,2	156,0 1899,	23035, 23138,	5139, 4876,	268,8 295,8	1624, 1674,	6,9 8,5	7670,7 2,3	7 198,8	198,8 1
K2_25Ekim19_compost	5 3318,	86920, 84170,	0,1 0,1	1,2 1,2	7,9 5,5	33,2 28,9	1029, 27522,	27522, 5227,	359,8 359,8	1849, 1849,	8,1 8,1	7810,2 8,9	4 198,8	4 8,9	247,3 198,8
K3_25Ekim19_compost	4 42,7	98453, 98453,	0,1 0,1	1,0 1,0	5,9 37,5	37,5 384,4	3 1	29845, 5361,	5361, 5061,	360,1 562,8	2232, 3326,	7,5 7,9	10572, 17317,	1,7 1,0	9 386,4
K4_25Ekim19_compost	375,8 51,2	1 1	3 2	1 1	2 6,8	61,3 322,0	384,4 1	29683, 5061,	5061, 562,8	3326, 3326,	9 8	7249,0 17317,	1 1	9 0	9 386,4
K5_25Ekim19_compost	296,3 9	124817 5	5 8	4 1	1 1	322,0 322,0	7 1	1 5	1 9	8 8	1 1	0 0	6 6		

## **CONCLUSION AND EVALUATIONS**

When the compost analysis data is evaluated, according to the temperature values, it is seen that K3 (clinoptilolite compost) and K2 (leonardite compost) complete the process and mature the fastest. K5 (chicken manure compost) shows that it matures at the latest and does not lose its temperature. If we look at the humidity values, it is seen that the humidity is best kept and the humidity is the highest in K1 (biochar compost).

If we look at the humidity values, it is seen that the humidity is best kept and the humidity is the highest in K1 (biochar compost). It is seen that the humidity is at the lowest level in the case of K5 (only chicken manure compost).

The pH value was lower for K2 (leonardite compost) and K3 (clinoptilolite compost) compared to other subjects and the pH was close to 8.5. With the composting process in all compost piles, decreases and improvements in EC value have been observed over time. It was observed that it was close to 4 ( $\mu\text{S cm}^{-1}$ ) especially in K3.

Considering the C/N changes in compost subjects, it was seen that K3 (clinoptilolite compost) C/N-10.89 and K2 (leonardite compost) C/N-11.66 were found to be more mature composting in these compost subjects. In terms of nitrogen (% N) loss in compost subjects, the most N loss was in K5 (chicken manure compost). Nitrogen loss was found to be less in other compost subjects than in K5 subjects. The least loss of N was in K2 (leonardite compost) and K1 (biochar compost). OML (%), Organic matter loss was highest in K5 and K2 and least in K1. The reason for the low loss of organic matter in K1 (biochar compost) here may be due to the resistance of biochar to decomposition by microorganisms.

As for the colour change, it was observed that the fastest blackenings were K2 (leonardite compost) and K1 (biochar compost). Similarly, in all composts, increases in BD and SW; a decrease in porosity values were observed. When looking at the porosity of composts during the composting period, it is seen that the % porosity decreases in other composts except for K5 (chicken manure compost). Similarly, increases in plant nutrient element concentration are observed in all compost subjects.

In the light of all the evaluations, we can briefly say that during the composting period, we see that the composting process of K2 (leonardite compost) and K3 (clinoptilolite compost) compost subjects among all composts, in temperature parameters, completes the composting process more quickly and matures. In the C/N evaluation, it was seen that K2 (leonardite compost) and K3 (clinoptilolite compost) are better and lower C/N ratio in compost formation due to their high absorbency and nitrogen retention, high porosity in the compost, thus keeping air and water well, increasing ventilation and providing better combustion. In addition, it has been observed that K1 (biochar compost) retains well moisture, nitrogen loss is low, and organic matter loss is also low due to its resistance to decomposition by microorganisms.

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**O 48. EVALUATION OF GEOLOGICAL PROPERTIES OF SOLID WASTE LANDFILL**

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**ABSTRACT:** It is known that consumption and wastes increase in parallel with the increasing population, rapid urbanization, and industrialization. For this reason, the determination of solid waste landfills has become very significant. The geological characteristics of the region, which are included in the location criteria, have a significant impact. In this study, some of the geological and geotechnical parameters in Konya and the results from other studies were compared. A clay unit with low plasticity was observed and its properties were evaluated after the drilling results.

**Keywords:** *Konya, Solid Waste, landfill Area, Settlement, Geology*

**INTRODUCTION**

Urbanization, rapid population growth, industrialization, and rapid technological developments have brought many environmental problems with them. The amount and type of solid wastes produced by humans are increasing day by day along with the increase in population and needs (Karaca, 2008; Ozturk and Arici 2021). The problem of disposal and storage of solid wastes in a healthy and economical way has gained more importance compared to previous years (Yesilnacar et al. 2005). When determining the landfill areas, it is very important to know the geological-hydrogeological characteristics of the region in the process of storing wastes and making them harmless to the environment. (Karaguzel and Mutlутürk, 2005; Yılmaz, 2008). Landfill area selection is a multidisciplinary study subject, primarily geological factors should be carefully examined in landfill area selection. There is no single method in selecting a location for any engineering structure, and the methods may vary due to the different geological features and units of each region. Therefore, different geological models may arise in different regions (Yılmaz, 2008). It will be more appropriate in terms of design and planning to prepare the geological model engineering structure by considering the geology of the region. In this study, some of the geological and geotechnical properties (engineering properties of the ground) of the Konya and Kırıkkale solid waste landfills were evaluated by comparing them because they have similar geological properties.

**MATERIAL AND METHOD**

For this study, two 20 meters deep foundation drillings were made in Konya solid waste landfill. By using the dry system (Auger), 3.00 meters deep tube sample (UD) was drilled and Standard Penetration Test (SPT) was performed every 1.5 meters. Natural water content, Atterberg limits, and particle size distribution tests were carried out on the sample taken in accordance with TS 1900-1 and TS 1900-2 (2006) standards. The obtained results were evaluated by comparing them with the results of different studies published in Turkey and the world.

**GEOLOGICAL SETTINGS**

**Konya Solid Waste Landfill Area**

In the study area, the units on the surface are divided into three main groups: basement, ophiolitic and cover units (Figure 1). The basic units representing the first group are mostly delimited by the dip-slip Konya Fault Zone in the western part of the city and they morphologically form mountainous areas. The basic units consist of Sızma and Ardıçlı groups belonging to the Bozdağlar Massif. The ophiolitic units representing the second group are also seen in the western part of the city and in the Yükselen region

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and Altınekin regions. The ophiolitic units consist of the Hatip ophiolite complex and Çayırbağı ophiolites. The third group of cover units is mostly concentrated in the settlement area and the surrounding plains. It consists of volcanic products and young clastics developed in the same period with the terrestrial and lacustrine clastics belonging to the Dilekçi Group, which extends on the basic units with an angle unconformity. During the Pleistocene and Holocene periods, different types of clastics occurred due to streams that have Lake-terrestrial transitions and carry materials into the lake (Arıcı, 2019; Arık and Ozturk, 2011; Ozturk and Baykal 2012; Ozturk and Baykal 2020). Konya Group, which is generally alluvial, consists of mainly yellowish brown, slightly cemented siltstone, sandstone, and conglomerate, which covers a significant part of the Konya province settlement area. Siltstones are the dominant rock type and contain sandstone interlayers. Konya Group has a large number of meshed stream facies representing the Pliocene Pleistocene transition, some of which can be separated lithologically and show the distribution in a size that can be mapped. These units consist of Beşyüzevler, Konya, Aslimyayla, Sakyatan and Göçü formations from west to east (Arıcı 2019). The landfill area is built on the Konya formation. Konya Formation is composed of yellowish, brown slightly attached siltstone, sandstone, and pebble stones. This unit covers the entire study area and includes densely residential areas and clayey and silty soils where agricultural activities are carried out (Arıcı 2019).

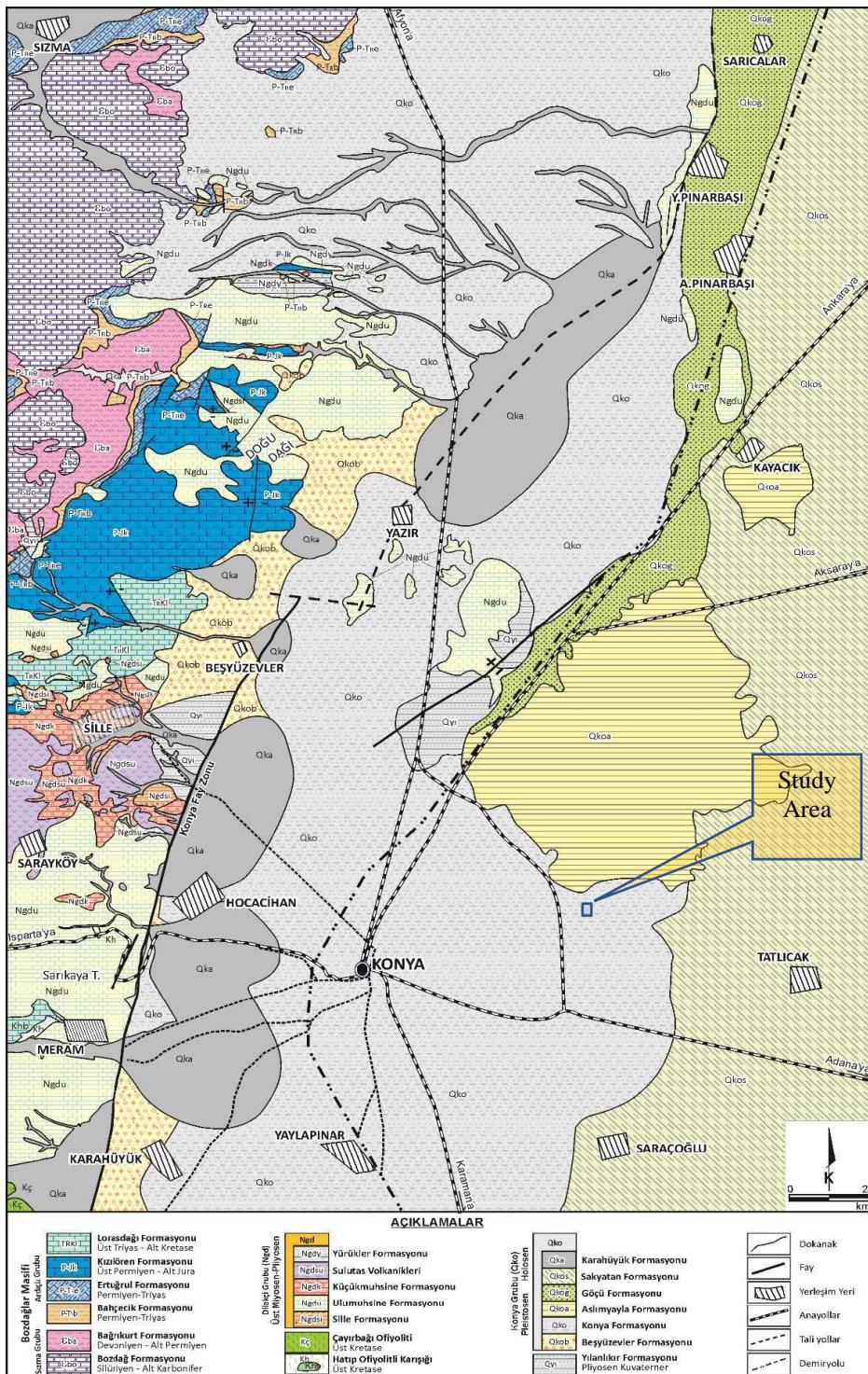
According to the geological geotechnical research report conducted in the landfill site, when SPT - N30 values are taken into account, it was found as Medium - Solid, according to Consistency Index it was found as Hard, and according to the liquidity index, it was found as plastic - solid or semi-solid. The natural unit volume weight is 18.2 kN / m<sup>3</sup> and ML class is a fine-grained ground composed of inorganic silt up to 2.50 meters in the study area, rock flour, very fine sand, silty or clayey fine sand, CL-class inorganic clay with low plasticity, silt with low plasticity, pebbly clay, sandy clay, silty clay, weak clay (Horasan, 2006).

### **Kırıkkale Solid Waste Landfill Area**

The geology of the Kırıkkale solid landfill is the unit called the Kasımağa formation, in which limestones and andesite blocks are observed occasionally with alternation of pebble stone, sandstone, claystone. There are units belonging to İncik and Kızılırmak formations in the area considered as a landfill (Savaş and Korkanç, 2010). İncik formation, consisting of regressive character, evaporitic, red-brown, gray-colored, parallel cross-bedded, low-angular / non-angular grained, medium-good-loosely attached terrestrial conglomerate, sandstone, mudstone alternation, was named by Birgili et al. (1975). The lower parts of the İncik formation consist of gypsum-anhydrite and mudstones alternating with medium-well-bonded, thin-medium-thick parallel-bedded sandstones, while the middle-upper levels are alternating with mudstones and increasingly cross-layered conglomerate and sandstones. Kızılırmak formation is alternated with sandstone, mudstone, and gypsum intermediate levels in places.

Kızılırmak formation constitutes the youngest unit formed in terrestrial conditions in the study area. The formation has deposited in fluvial and lacustrine environments. It covers materials from pebbles to sand size in lots of mud on the slopes. Since the color of the mud is red, the unit is generally colored red. Pebbles are derived from the old units on which they are located, depending on the region. In the middle of the basin, lacustrine facies are passed. Here, loose sandstone, generally mudstone and gypsum intercalated with them, and tuff and limestone levels in some places are observed. Layer structures become prominent in lacustrine facies while sorting, and grading can be observed. In addition, caliche formations can be observed in some places in the unit. Slope debris, fluvial and lacustrine facies within the unit are laterally transitive among themselves (Birgili et al., 1975). The Kızılırmak formation is gradationally transitive from the bottom to İncik formation. In the higher parts of the topography, especially acidic magmatic rocks and other older units are incompatible. At the top, they are covered with disharmony by current formations (alluviums) (Savaş and Korkanç 2010).

In the natural unit weight tests performed on samples taken from the boreholes in the landfill area, results between 18.05-18.64 kN / m<sup>3</sup> were obtained. It has been determined that the units forming the floor of the solid waste landfill are predominantly composed of clay and silt, while the remaining part consists of sand and gravel. In addition, according to the Atterberg (Consistency) Limits experiments, it was determined that the majority of the samples consisted of CL group low plasticity clays. Considering the SPT-N30 values obtained from SPT tests performed at different depth levels in drillings, it has been determined that the foundation ground is "Very solid - hard" (Savaş and Korkanç 2010).



**Figure 1.** Study area geology map (Taken from Horasan 2014, edited)

## DISCUSSION

Transportation and location of the settlement area, Meteorological, Geomorphological, Geological-Hydrogeological, Geotechnical investigations should be the first criteria that come to mind. The factors that play an important role in the selection of the relevant landfill sites for the disposal of solid wastes are mainly geological, hydrogeological, and geotechnical. Regional geology may not provide sufficient information in the development of a geological model for an engineering structure. In such a case, local geology should be studied in detail. Geological units that are seen in the study area, especially young

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sediments (soil types) and rock types (their depositional environment and age), stratigraphic and tectonic structures should be investigated (Yılmaz, 2008). In this study, the researches made for Konya and Kırıkkale and the parameters used in different studies are evaluated in Table 1.

**Table 1.** Comparison of the Geological Geotechnical features of Konya Landfill Site

<b>Factors</b>	<b>Parameter</b>	<b>For Konya</b>	<b>*For Kırıkkale</b>	<b>Source</b>
<b>Geology</b>	Unconsolidated units	Low plasticity clay	Low plasticity clay	Langer (1995)
<b>Distance to fault zones</b>	>60 m	None	None	Langer (1995), EPA (1998)
<b>Land Slope</b>	$\alpha < 10^\circ$	0-10°	0-10°	Leao et al., (2004)
<b>Groundwater depth</b>	>3 m	> 6.5 m	>20 m	Bagchi (1994)
<b>Impermeable Base</b>	>3	~100	~100	Bagchi, 1994
<b>Thickness</b>				
<b>Liquid Limit</b>	20-40	32	41-53.6	Bagchi, 1994
<b>Plastic Limit</b>	10-20	18	20-27.3	Bagchi, 1994
<b>Water Content</b>	15-20	19.34	16.3-24.3	Bagchi, 1994

\*Savaş and Korkanç, 2010

## **CONCLUSIONS**

The basic parameters of environmental problems are urbanization, rapid population growth, and industrialization. It is known that the amount of waste increases day by day due to the rapid population growth and the increasing need for buildings. In this case, determining the location of the landfill has become very important. The geological geotechnical evaluation of the storage area is very important in preventing problems such as leachate mixing with groundwater. The area studied in this study largely meets the criteria required for a solid waste landfill according to the geotechnical properties, thickness, groundwater level, and permeability characteristics of the foundation ground. A clay unit was observed in the 20-meter drillings made in the region, and it is thought to be especially important in the protection of groundwater.

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**O 49. EXAMINING RELATIVE VARIABLE IMPORTANCE (RIV) AND ESTIMATION THE STRENGTH OF INTERACTION EFFECTS (SIE) OF PARTICULATE MATTER (PM<sub>10</sub>) CONCENTRATION AT CITY OF KONYA, TURKEY**

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**ABSTRACT:** One of the most important climatic elements in a certain area is snow. The amount and depth of this paper investigated the use of stochastic boosted regression trees (BRTs) to draw an inference about particulate matter (PM<sub>10</sub>) concentrations at Konya city in Turkey. A total one calendar year 2020 data of 8784 hourly PM<sub>10</sub> concentrations, gases (Nitrogen Dioxide (NO<sub>2</sub>), Sulphur Dioxide (SO<sub>2</sub>) and Carbon Monoxide (CO)) data were gathered from the Konya City air quality monitoring station and the meteorological data wind speed (ws), wind directions (wd), temperature (temp), pressure and relative humidity (rh)) data were captured from Konya Airport meteorological station. Data were analysed statistically by using a comprehensive package, R Software and its packages to understand the variability and trends. An artificial intelligent approach named the Stochastic Boosted Regression Trees technique were used as a response variable and time systems and meteorological parameters were analysed in advance stage. The BRT model development process with algorithm development were done to achieved the lowest root mean squared error (RMSE) with high coefficient of determinant ( $R^2$ ) value for the linear relationship between the number of samples and number of trees ( $nt$ ) of 4485 for OOB, 9999 for CV and 8103 for test were found. The performance of the boosting model was assessed, by comparing the fraction of predictions within two factor (FAC2), coefficient of determination ( $R^2$ ) and the index of agreement (IOA) of the model. It was found that the FAC2 was 0.82, the  $R^2$  values were above 0.50 ( $R = 0.74$ ), and Index of Agreements (IOA) was 0.70 which fall range are within an acceptable for model performance. It was found that **Relative Variable Importance (RIV)** that influenced PM<sub>10</sub> was SO<sub>2</sub> (27 %), O<sub>3</sub> (23.5 %), NO<sub>2</sub> (20.6 %) and temperature (10.36). This can be link to the location of these chosen station is co-inside closed to an arterial road that link these cities to the other, whereby a lot of motor vehicles the source emission strength due to city development in Konya City. The Estimation of the strength of interaction effects (SIE H-Index) can assess the relative strength of interactions variables were found up to 0.27 for CO and O<sub>3</sub> interactions, followed by 0.23 for Temperature and Humidity, and 0.124 for NO<sub>2</sub> and SO<sub>2</sub>. Results showed that the model developed was within the acceptable range and could be used to understand particles formation and identify important parameters that influence for estimating particle concentrations for the year 2020 in Konya city and this can be applied to other datasets.

**Keywords:** Boosted regression trees, Air pollution, Relative Variable Importance (RIV), strength of interaction effects (SIE)

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**O 50. CHEMICAL CHARACTERISATION OF OREGANO VULGARE ESSENTIAL OIL  
FROM SOUTH-EAST ALBANIA**

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**ABSTRACT:** In this paper were present chromatographic data of *Oregano vulgare* essential oil from Kolonja area located in South-East Albania. *Oregano vulgare* is a flowering plant of mint family (Lamiaceae). It is native to the Mediterranean region. *Oregano vulgare* can find almost in all Albania areas. Since ancient times it has been used in culinary and traditional medicine. Aerial parts of *Oregano vulgare* were sampled in the end of the June for a five years period (2015-2019) in Kolonja area. The air-dried leaves samples were subjected to European Pharmacopoeia apparatus (Clevenger type) for 4 hours to obtain *Oregano vulgare* essential oil. The leaves contain 1.43 - 1.74% essential oil. The chemical composition of the essential oils was analyzed using GC/FID technique. *Oregano vulgare* essential oil samples were injected in a Varian 450 GC. VF-1ms capillary column (30 m x 0.33 mm x 0.25 um) were used for separation of terpene compounds. Monoterpene were in higher percentage in all studied *Oregano vulgare* essential oil samples between 87.5% to 89.4%. Aromatic monoterpene (p-Cymene, Thymol and Carvacrol) were found as the main constituents (74.4 - 81.2%) because of fenolic type for this essential oil. Profile of *Oregano vulgare* was the same for all years despite the differences in atmospheric conditions and harvesting time. Profile and leveles of *Oregano vulgare* samples from Kolonja, South-East Albania was similar with other reported studies from Balkan and Mediterrean area. plants.

**Keywords:** *Oregano vulgare L.*, Essential oils, Terpene, Thymol, Carvacrol, Gas chromatography

**INTRODUCTION**

*Origanum vulgare* is a flowering plant in the mint family (Lamiaceae). It was native in the Mediterranean region and almost in all Albanian territory. It has purple flowers and spade-shaped, olive-green leaves. It is a perennial, although it is grown as an annual in colder climates. It does not survive the winter. Oregano is planted in early spring, the plants being spaced 30 cm apart in fairly dry soil. It will grow in a pH preferred range between 6.0 and 8.0. It prefers a hot, relatively dry climate, but does well in other environments.

Oregano is a culinary herb, used for the flavor of its leaves, which can be more flavorful when dried than fresh. It has an aromatic, warm, and slightly bitter taste, which can vary in intensity. Good-quality oregano may be strong enough almost to numb the tongue, but cultivars adapted to colder climates may have a lesser flavor. Factors such as climate, season, and soil composition may affect the aromatic oils present, and this effect may be greater than the differences between the various species of plants. Among the chemical compounds contributing to the flavour are carvacrol, thymol, limonene, pinene, ocimene, and caryophyllene.

Oregano contains polyphenols, including numerous flavones. The essential oil of oregano is composed primarily of monoterpenoids and monoterpenes, with the relative concentration of each compound varying widely across geographic origin and other factors. Over 60 different compounds have been identified, with the primary ones being carvacrol and thymol ranging to over 80%, while lesser abundant compounds include p-cymene,  $\gamma$ -terpinene, caryophyllene and  $\delta$ -terpineol.

*Organo vulgare* is an herb with a wide range of pharmacological properties such as antimicrobial, gastrointestinal, and nervous system effects. Studies carried out on the chemical composition of the plant

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have shown that the main chemical compounds present in *M. longifolia* essential oil are monoterpenes, particularly oxygenated ones. Essential oils derived from Organo have valuable pharmacological properties that have been investigated by many scientists around the world. Due to their antimicrobial, insecticidal, antifungal, and antibacterial activities, essential oils have been intensely screened and applied in the fields of pharmacology, medical and clinical micro-biology, phytopathology and food preservation (Daferera et al., 2000).

## **MATERIALS AND METHODS**

### **Reactive and standards**

Toluene of chromatographic grade and anhydrous Na<sub>2</sub>SO<sub>4</sub> were purchased from Sigma Aldrich. A mixture of n-alkanes (Sigma Aldrich) from n-octane (C8) to eicosanes (C20) was used for calculation of Kovats indices (KI).

### **Sampling of *Oregano vulgare L.* from South-East Albania**

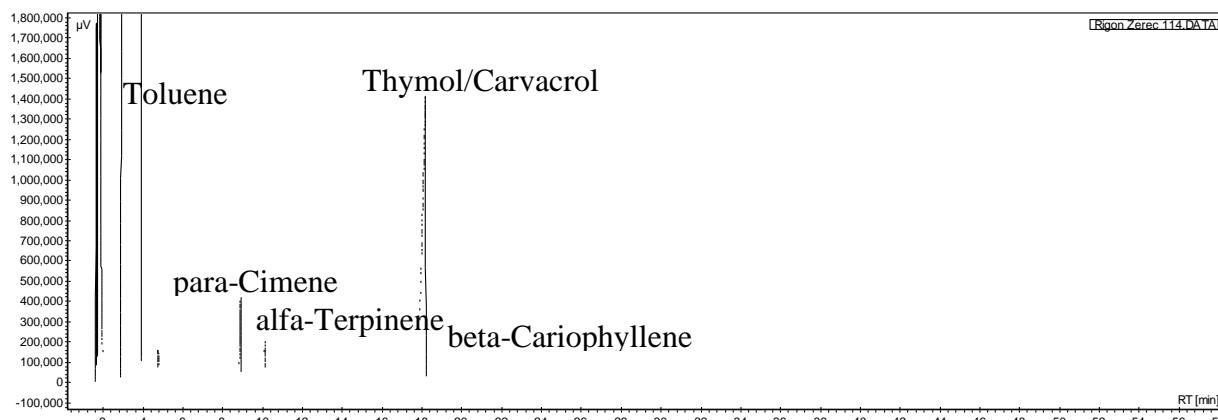
*Oregano vulgare* samples were taken from population of Kolonja area, located in South-East Albania. Areal parts (branches, leaves and flowers) of *Oregano vulgare* plants were sampled in the second week of the June for a five years period from 2015 to 2019 in four station of Kolonja area (Shtika, Starja, Borova, Barmashi and Leskoviku). Material plants were air dried in shadow for saving their morphological characteristics.

### **Isolation of *Oregano vulgare* esential oil**

Dried plant material of *Oregano vulgare L.* were cut in small pieces (0.5 to 2 cm) before analyze. 50 g of plant material was subjected to hydrodistillation for 4 h, using a modified Clevenger-type apparatus to produce essential oil. 1 ml Toluene was added to the extracting balloon for isolation of *Oregano* essential oils. The oil was dried by anhydrous sodium sulfate (Na<sub>2</sub>SO<sub>4</sub>) and kept sealed in dark glass vial at +4 °C until use. Diluted essential oil in Toluene was used for GC/FID analyse.

### **Apparatus and chromatography**

Gas chromatographic analyses of *Oregano vulgare* essential oil were realized with a Varian 450 GC instrument equipped with a flame ionization detector and PTV detector. The temperature of PTV injector was 260°C. 1 ul of oregano essential oil diluted in Toluene was injected in splitless mode. A temperature for FID was held at 280°C. Nitrogen was used as carrier (1 ml/min) and make-up gas (25 ml/min). Hydrogen and air were flame detector gases with 30 ml/min and 300 ml/min, respectively. VF-1ms capillary column (30 m x 0.33 mm x 0.25 µm) was used to isolate compounds of *Oregano vulgare L.* essential oil. The oven temperature was programmed as follows: 40°C (held for 2 minutes) to 150°C (with 4°C/min), after that to 280 °C with 10°C/min and held for 2 minutes. The identification of the compounds was based on comparison of their Kovats indices (KI), their retention times (RT) and literature (Adams, 1995; David et al., 2010; Konig et al., 1999; Bozin et al, 2006). Chromatogram of the *Oregano vulgare* essential oil for Leskoviku 2018 sample was shown in Figure 1.



**Figure 1.** Chromatogram of *Oregano vulgare* essential oil from Kolonja, South-East Albania

## RESULTS AND DISCUSSION

Essential oil samples of *Organo vulgare L.* from Kolonja area, located in South-East Albania were analyzed using GC/FID technique. All oregano samples were taken at Gramozi and Melesini mountains at an altitude of more than 1000 m above sea level. Average results of samples for one year were presented in this study. The data shown percentage for the total of peaks except for the peak of Toluene that was the solvent used for extraction. For individual *Organo vulgare* essential oil were found from 40 to 50 compounds. The peaks lower than 0.1% was not present in this study. The data present the total of 22 main compounds that were found for all analyzed organo essential oil. Their total (average value) were found from 92.6.0% (2015) to 97.4% (2018). Terpenes that were found in higher percentage were: Carvacrol, para-Cymene, gamma-Terpinene and beta-Caryophyllene.

Table 6 shows the average percentages of main components analyzed for *Oregano vulgaris* from the Kolonja area (2015 – 2019). Note that distribution of terpenes in *Oreganum vulgare* samples for a five years period it was almost the same for all analyzed samples. Small differences were noted between the stations (analyzed samples in a year) and between data collected for one year. These differences could be because of geographic and geologic factors for studied areas. Latitude and the position of the plants in the places where they are growing could affect in their composition. Also, humidity, air temperature, harvesting time and soil composition could affect in their composition as well as in their differences. Based in these data and chemical structure of terpenes were calculated the total of terpene groups. Figure 2 shows the distribution of the main compounds analyzed in oregano plants from South-East Albania. The main compounds found in *Oreganum vulgare* were: Carvacrol (57.3 - 76.2%) > Thymol (0.8 - 4.5%) > para-Cimene (5.2 - 14.2%) > gamma-Terpinene (2.4 - 3.9%) > beta-Caryophyllene (2.4 - 4.9), etc. Other compounds are from 0.5 - 3%. This profile was similar with oregano essences from other areas of Albania. In essential oil of Kolonja area was noted a high percentage of Carvacrol and a very low percentage of Thymol.

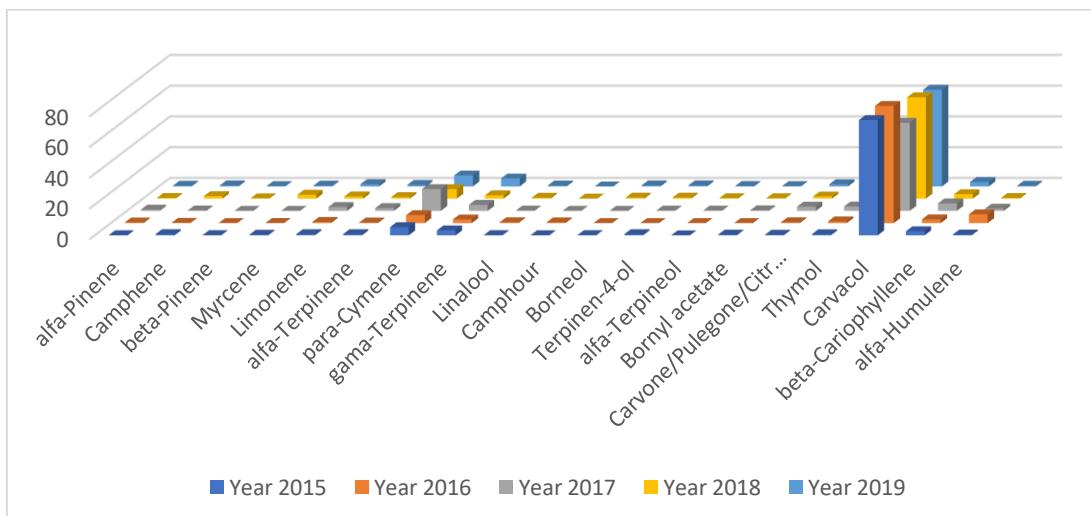
**Table 1.** Averages of main compounds in analyzed Organo essential oil samples from South-East Albania, 2015 - 2019

	Rt	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019
alfa-Pinene	4.32	0.09 ± 0.02	N.D.	0.81 ± 0.17	0.47 ± 0.19	0.53 ± 0.15
Campheine	4.41	0.78 ± 0.17	0.21 ± 0.05	0.30 ± 0.06	1.6 ± 0.52	0.67 ± 0.04
beta-Pinene	5.22	0.14 ± 0.04	N.D.	0.04 ± 0.01	0.25 ± 0.04	N.D.
Myrcene	5.34	0.42 ± 0.07	0.09 ± 0.02	0.07 ± 0.02	2.55 ± 0.52	0.52 ± 0.13
Limonene	6.41	0.78 ± 0.43	0.77 ± 0.17	2.56 ± 0.71	1.48 ± 0.35	1.55 ± 0.51
alfa-Terpinene	6.47	0.83 ± 0.11	0.38 ± 0.09	1.83 ± 0.48	0.99 ± 0.17	0.76 ± 0.15
para-Cymene	6.91	5.34 ± 2.01	5.15 ± 1.72	14.20 ± 4.82	6.13 ± 1.16	7.17 ± 2.16
gama-Terpinene	7.33	3.20 ± 1.38	2.37 ± 0.58	3.92 ± 1.16	2.18 ± 0.73	5.18 ± 1.18

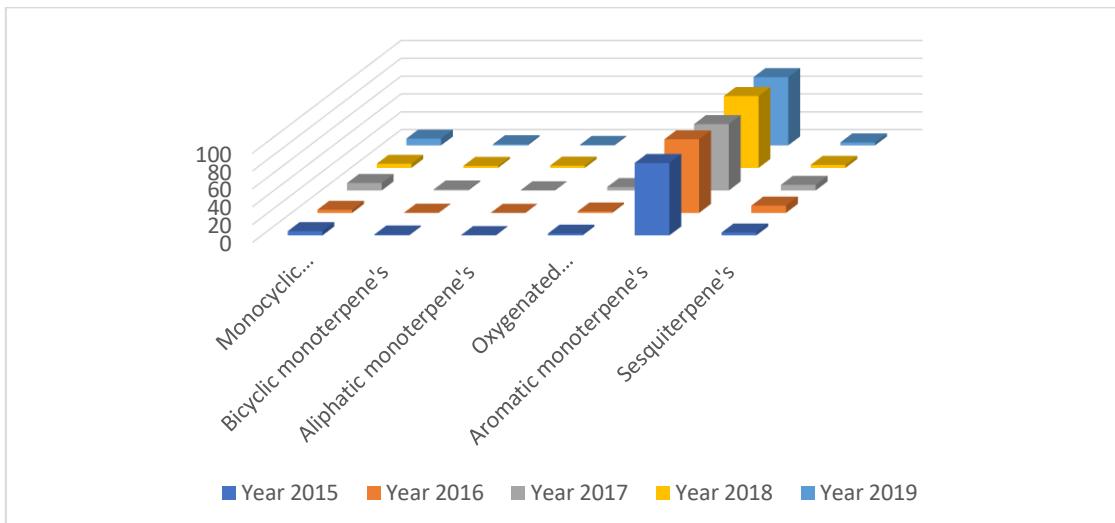
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Linalool	7.98	0.15 ± 0.02	0.57 ± 0.08	0.20 ± 0.05	0.62 ± 0.07	0.64 ± 0.14
Camphour	8.13	0.08 ± 0.01	0.50 ± 0.07	0.04 ± 0.01	N.D.	N.D.
Borneol	8.44	0.15 ± 0.03	N.D.	0.02 ± 0.01	0.68 ± 0.07	0.47 ± 0.09
Terpinen-4-ol	9.12	0.79 ± 0.21	N.D.	0.19 ± 0.04	0.69 ± 0.11	0.58 ± 0.09
alfa-Terpineol	9.21	N.D.	N.D.	0.23 ± 0.06	0.32 ± 0.10	0.61 ± 0.10
Bornyl acetate	10.52	0.45± 0.05	N.D.	0.34 ± 0.08	0.27 ± 0.07	N.D.
Carvone/Pulegone /Citreneol	11.82	0.42 ± 0.07	0.57 ± 0.08	2.77 ± 0.83	1.41 ± 0.53	1.47 ± 0.27
Thymol	12.01	0.74 ± 0.49	1.09 ± 0.27	2.87 ± 0.71	8.49 ± 1.83	6.49 ± 0.93
Carvacol	13.23	75.04 ± 7.25	76.23 ± 7.88	57.30 ± 11.42	65.9 ± 7.52	62.91 ± 8.63
beta-Carioiphylle	16.95	2.64 ± 0.82	2.42 ± 0.63	4.85 ± 1.13	2.91 ± 0.63	2.93 ± 0.53
alfa-Humulene	23.14	0.55 ± 0.08	5.73 ± 1.32	1.42 ± 0.43	0.44 ± 0.08	0.46 ± 0.07
Total	92.57	96.09	93.93	97.4	93.47	
Total Monoterpene's	89.39	87.93	87.61	94.06	90.13	
Monocyclic monoterpene's	4.81	3.53	8.31	4.64	7.64	
Bicyclic monoterpene's	1.01	0.21	1.12	2.33	1.4	
Aliphatic monoterpene's	0.42	0.09	0.07	2.55	0.55	
Oxygenated monoterpene's	2.03	1.64	3.79	4.02	4.02	
Aromatic monoterpene's	81.13	82.47	74.37	80.52	76.52	
Sesquiterpene's	3.19	8.15	6.27	3.34	3.34	

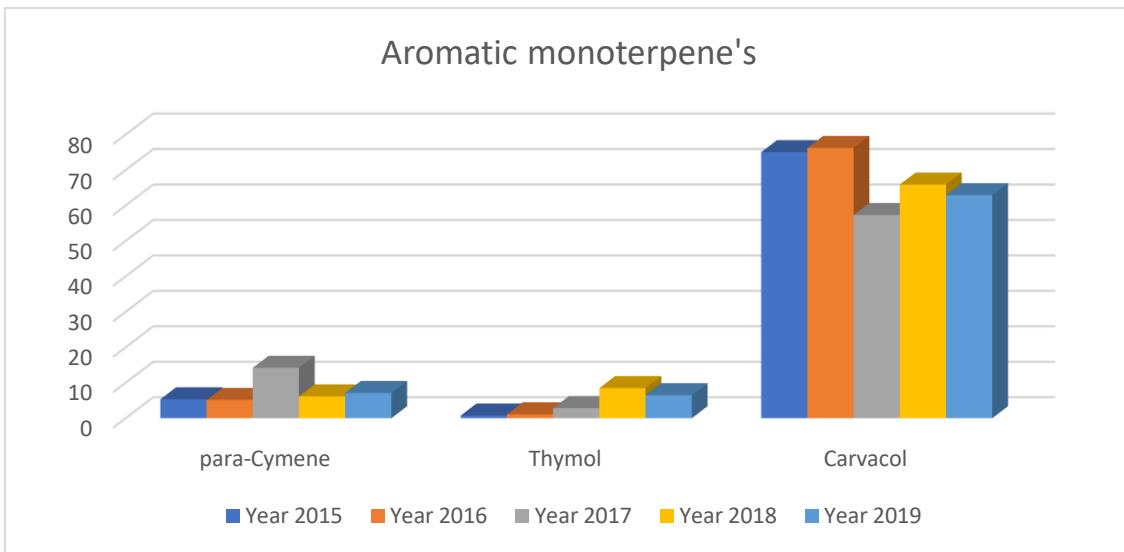
The terpenoic groups found in *Oreganum vulgare* samples were: aromatic monoterpenes, oxygenated monoterpenes, monocyclic monoterpenes, bicyclic monoterpenes, aliphatic monoterpenes and sesquiterpenes (Figure 3). Monoterpenes were found in higher level for all oregano samples ranged from 87.6% to 89.4%. The main monoterpene group found in all analyzed oregano samples was aromatic monoterpenes (Figure 4). Aromatic monoterpenes (para-Cimene, Thymol and Carvacrol) were found from 74.4 to 82.5%. These essential oils belong to phenolic types due to the high percentages of Carvacrol in them. Percentage of Carvacrol was found between 57.7% (2017) to 76.2% (2016). Its percentages are connected with humidity, air temperature, harvesting time in respective years. Oxygenated monoterpenes (Linalool, Kamfur, Borneol, Terpilen-4-ol, alfa-Terpineol, Pulegon, Carvon, Citreneol and Acetat bornili) were found in range from 1.6% to 4.1% (Figure 5). Even in lower percentage oxygenated monoterpenes are important for oregano taste and aroma. Note that *Oreganum vulgare* from Kolonja area is one of the most wanted in Albanian market. Monocyclic monoterpenes (alpha-Terpinene, Limonene and gamma-Terpinene) were the second group in oregano essential oil with 3.5 - 8.3% (Figure 6). Their profile for all samples was: gamma-Terpinene > alfa-Terpinene > Limonene. Figure 7 shows bicyclic monoterpenes in *Organo vulgare* essential oil samples of South-East Albania. Alfa-Pinene, Kamfene and beta-Pinene were found from 0.2 to 1.8%. Myrcene was representative of alicyclic monoterpenes (Figure 8). Its percentage was found from 0.1 - 0.5%. Figure 9 shows sesquiterpenes in analyzed *Organo vulgare* essential oil samples from Kolonja area (2015 – 2019). Beta-Carioiphylle and alfa-Humulene were found from 3.2% to 8.2%. Beta-Carioiphylle was found in higher percentage for all oregano samples except the sample of year 2016. The data obtained from analyzed samples of *Oreganum vulgare* of Kolonja area for a five years period showed that chemical composition of them was the same at the time because of their origin. Geographical position of oregano plants especially altitude, air temperatures, humidity and geological composition of the soil are important factors that affect directly in their chemical composition. These results were similar to other reported data of *Oreganum vulgare* essential oils from the Balkans and the Mediterranean area.



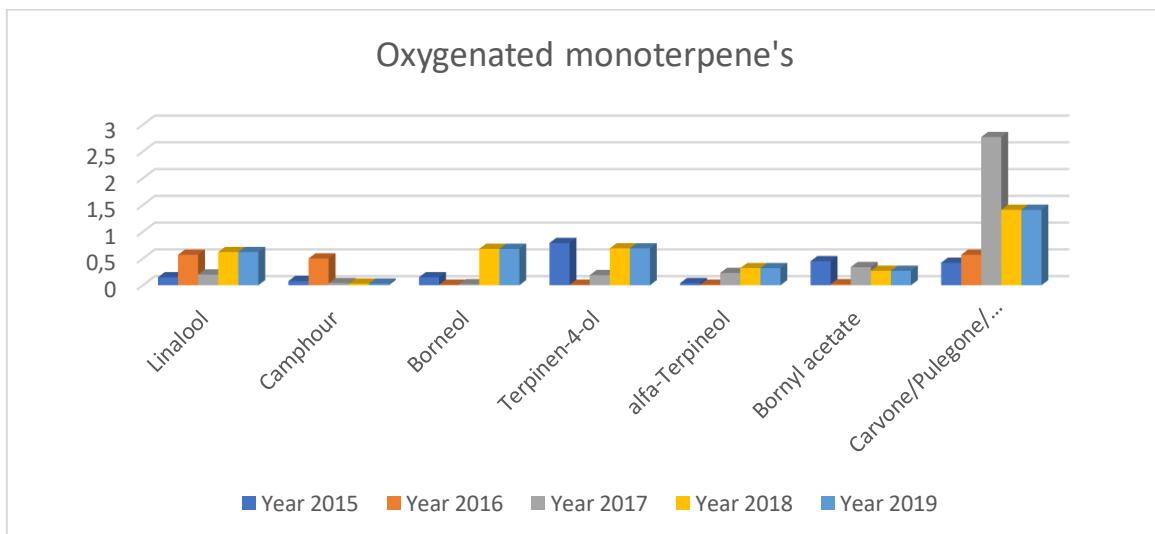
**Figure 2.** Distribution of terpenes in *Organo vulgare* essential oil samples from Kolonja area



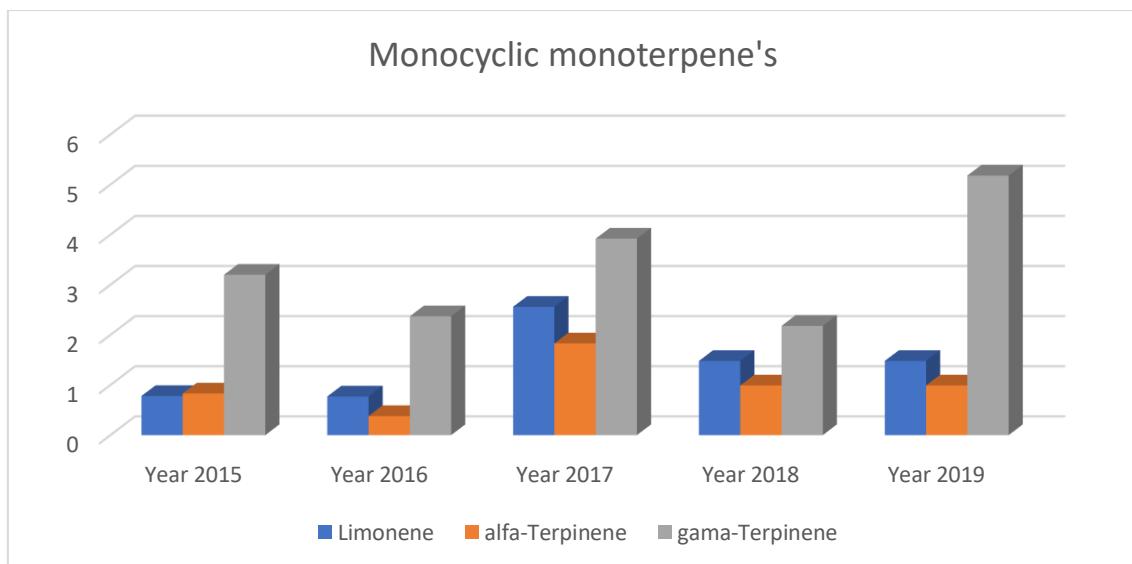
**Figure 3.** Main groups of terpenes in analyzed *Organo vulgare* essential oil samples



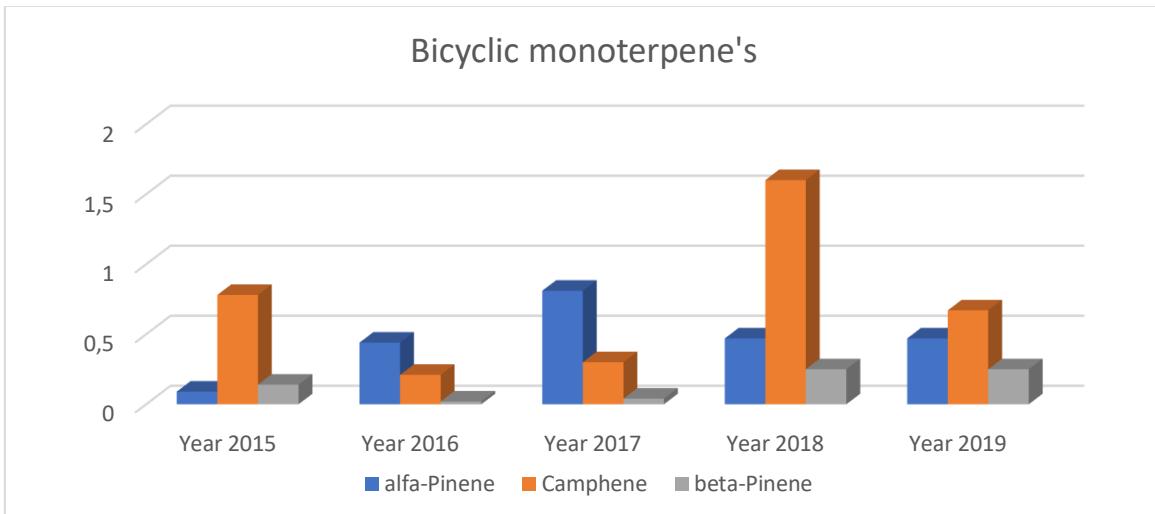
**Figure 4.** Aromatic monoterpenes in analyzed *Organo vulgare* essential oil samples



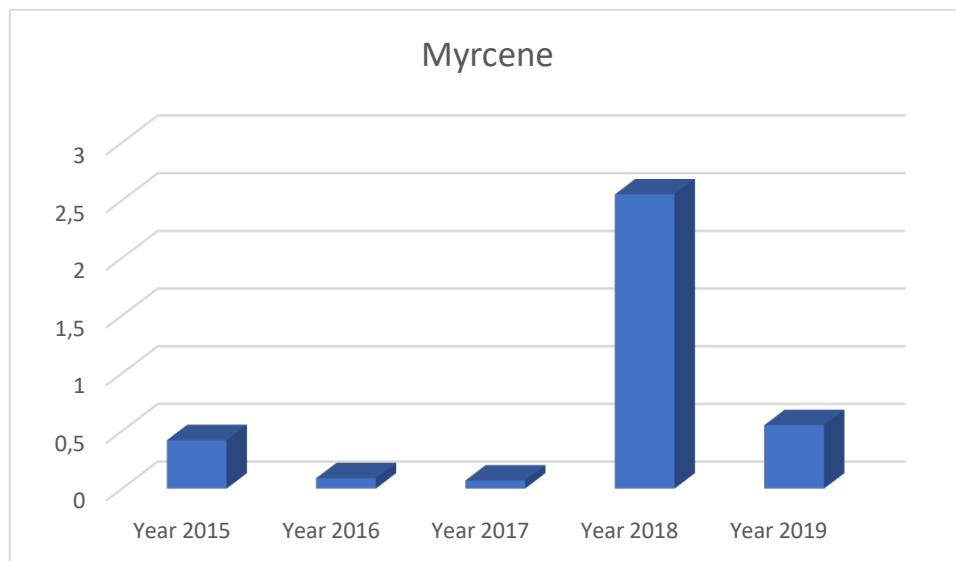
**Figure 5.** Oxygenated monoterpenes in *Organo vulgare* essential oil samples from Kolonja area (2015 – 2019)



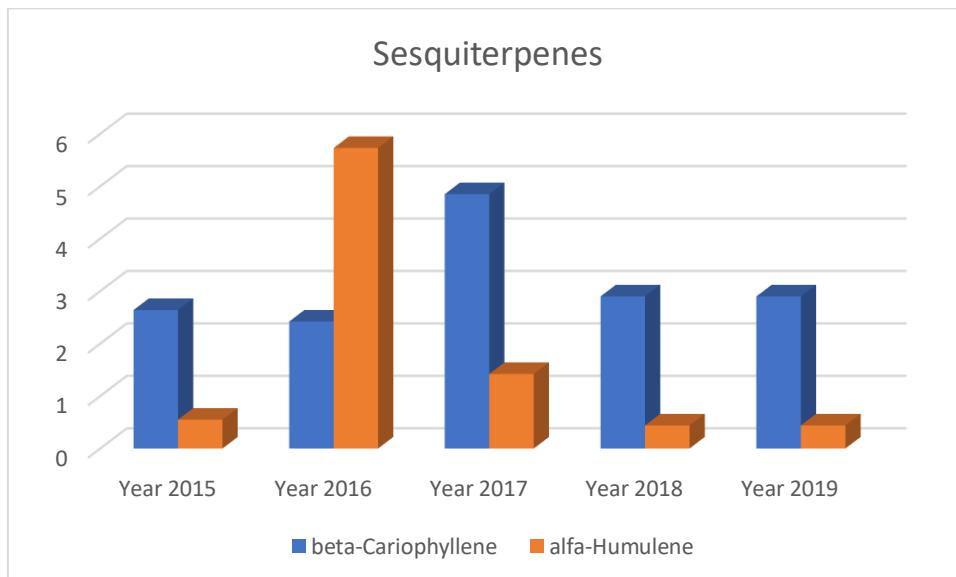
**Figure 6.** Monocyclic monoterpenes in analyzed *Organo vulgare* essential oil samples



**Figure 7.** Bicyclic monoterpenes in *Organo vulgare* essential oil samples of South-East Albania



**Figure 8.** Aliphatic monoterpenes (Myrcene) in essential oil of organo samples



**Figure 9.** Sesquiterpenes in analyzed *Organo vulgare* essential oil samples from Kolonja area (2015 – 2019)

## CONCLUSIONS

Essential oil of *Organo vulgare L.* samples from Kolonja area (South-East Albania) were analyzed using GC/FID technique. Oregano samples were taken at Gramozi and Melesini mountains at an altitude of more than 1000 m above sea level. Average results of samples (five stations) for one year were presented in this study. Chromatograms of *Organo vulgare* essential oil shows 40 to 50 compounds in total. The data present 22 main compounds found for all analyzed samples with a total of 92.6.0% to 97.4%. Carvacrol, para-Cymene, gamma-Terpinene and beta-Caryophyllene were identify in higher percentage for all analyzed samples. Monoterpenes were found in higher level for all oregano samples. The main monoterpene group found in all analyzed oregano samples was aromatic monoterpenes. In essential oil of Kolonja area was noted a high percentage of Carvacrol and a very low percentage of Thymol. These essential oils belong to phenolic types due to the high percentages of Carvacrol in them. Distribution of terpenes in *Oregano vulgare* samples for five years period it was almost the same for all analyzed samples. Samll differences were noted between the stations (between analyzed samples in a year) and between data collected for one year. These differences could be due to geographic position, geologic factors, humidity, air temeperature, and harvesting time. Profile and leveles of *Organo vulgare L.*

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samples from South-East Albania was the comparable with other reported studies from Balkan and Mediterrean area.

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**O 51. A COMPARISON OF PESTICIDE AND PCB LEVELS BETWEEN SOIL AND FRUIT/VEGETABLE SAMPLES FROM MYZEQEJA AREA, ALBANIA**

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**ABSTRACT:** In this paper are presented concentrations of organochlorinated pesticides and polychlorinated biphenyls (PCB) in soil, fruit and vegetable samples from Myzeqeja area. Previous application of pesticides for agricultural purposes or/and atmospheric deposition of PCBs and other volatile/semivolatile compounds, irrigation waters, agromechanics and different accidents are the main ways of organic pollutants presence in soil samples. Myzeqeja field is the main agricultural area in Albania. Soil and plant (fruit/vegetable) samples (in the same area) were selected in 15 different stations of Myzeqeja field. Samples were taken in May 2020. Ultrasonic extraction used for extracting organochlorinated pesticides, their residues and PCBs from soil and fruit/vegetable samples. Clean-up procedure was performed using firstly silicagel with sulfuric acid and a second clean-up procedure in an “open” florilis column. Qualitative and quantitative analysis was realized in Varian 450 gas chromatograph equipped with ECD detector. For simultaneous separation of organochlorinated pesticides and PCB markers was used Rtx-5 capillary column (30m x 0.32mm x 0.25µm). In all studied samples were found organochlorinated pollutants. These facts reflect the presence of these pollutants because their previous use, bioaccumulation processes, slope, soil geology, fruit/vegetable type, irrigation water used, atmospheric deposition, etc. The main origin of organochlorine pesticides could be as result of their previous uses for agricultural purposes because the higher concentrations for their metabolites. Profile PCB marker were as following: PCB 28 > PCB 138 > PCB 153. This fact confirms atmospheric origin of these compounds in Myzeqeja area.

**Keywords:** *Organochlorined pesticides, PCB, Soil samples, Fruit and Vegetable samples, Gas chromatography*

## INTRODUCTION

In this study was determined concentrations of organochlorine pesticides (OCPs) and PCBs in the main and the most important agricultural areas of Albania. Myzeqeja field lies in the South-West Albania between Shkumbini and Vjosa rivers. This area is used and continue to be used for agricultural purposes because is very fertile, especially for corns, fruits and vegetables. Before, Second World War the main parts of Myzeqeja field have been a wetland. Organochlorine pesticides (DDT, Lindane, HCB, etc) were used intensively form 1946 to 1990s in this area firstly for against mosquitos (malaria vector) and after that for agricultural purposes. Polychlorinated biphenyls (PCB) were not in use in Albania but they were reported in many ecosystems because of atmospheric depositions.

Organochlorine pollutants have high stability, high bioaccumulation capacity and the ability to spread out far away from the application site. OCPs and PCBs are very stable compounds in enviroment. Depending of matrices their degradation process need many years. Their degradation speed in soil or sediments is slower. Soil contamination is one of most important factors influencing the quality of agricultural products. Usage of heavy farm equipment, the land drainage, an excessive application of agrochemicals, emissions, etc, generate a number of undesired substances, which after deposition in soil may influence crop quality (Como et al, 2013; Stancheva et al 2011). Runoff affects the movement of pollutants in water over a sloping surface. The amount of pollutants runoff depends on: the slope, the texture of the soil, the soil moisture content, rainfall, and the type of pesticide used (Gashi et al 2013). The fate of a pesticides to soil depends largely on two of its properties: persistence and adsorption. Once applied to cropland, a pesticide may be taken up by plants, adsorbed to plant surfaces, broken down by sunlight (photdegradation), or ingested by animals, insects, worms or microorganisms in the soil. Factors controlling pesticide adsorption include pesticide charge; soil pH, temperature and water content; the presence of previously adsorbed chemicals that have a stronger bond to soil particles; and the amount

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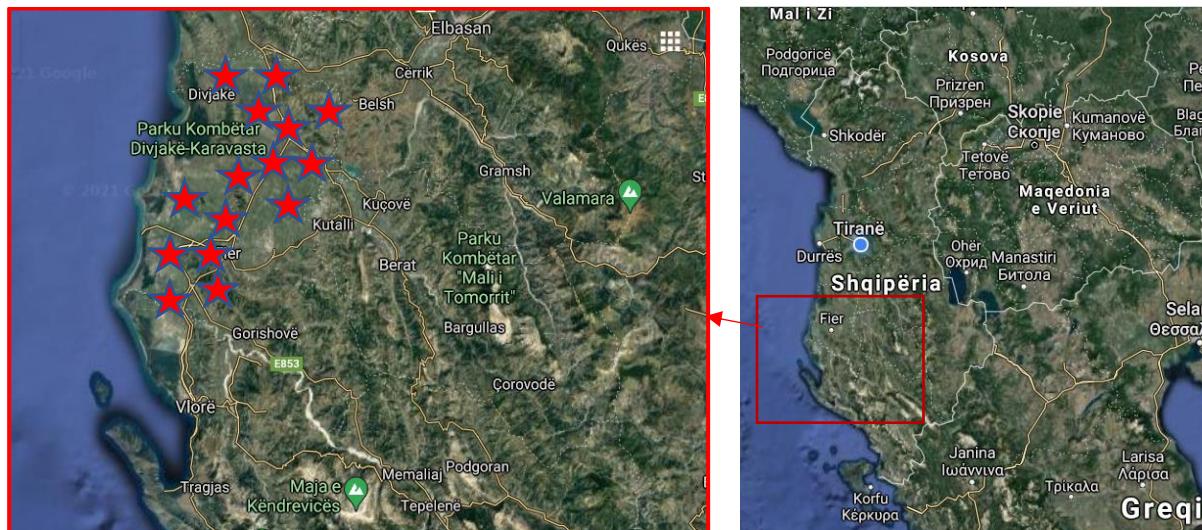
and type of organic matter present. In general, pesticide adsorption relates inversely to pesticide solubility in water. Highly soluble pesticides are weakly adsorbed and pose a greater threat of groundwater contamination (Penttila and Siivinen, 1996).

Organochlorine pesticides and PCBs are classified as Persistent Organic Pollutants (POP) because they are persistent for many years after their application (Shayler et al, 2009). Human exposure to chlorinated organic pollutants primarily occurs through food contamination. Fish, meat, fruit, vegetables and other dairy products are the most important dietary sources of pesticides and their metabolites for humans (Lazaro et al, 1996). Great concern was caused by chlorinated compounds, which proved to be extremely persistent in the environment and accumulative in the food chain (Penttila & Siivinen, 1996; WHO & FAO 1983; Wilhelm et al, 2002).

## MATERIAL AND METHODS

### Sampling of vegetable, fruits and soil samples

For this study were sampled in the same stations (14 station in total) soil and fruit/vegetable samples. Stations were selected in agricultural areas that are used and continuos to be in use as well as to be more representative of Myzeqeja field. Soil samples were taken until 30 cm depth and transported in plastic bags (+4°C). In the laborator they were dried in open air. Onion (S1 – North of Myzeqeja field), potato (S2 and S5), lettuce (S3 and S12), spinach (S4), carrot (S6 and S11), tomato (S7, S10 and S13), peper (S8), cucumber (S9), strawberry (S14 – South of Myzeqeja field). Fruit/vegetable samples were transported in plastic bags in +4°C prior to their analyze. Soil and fruit/vegetable samples were taken in May 2020.



**Figure 1.** Sampling station in Myzeqeja field, May 2020

### Treatment of fruit and vegetable samples for GC analyze

The vegetable and fruit samples were homogenized with anhydrous sodium sulphate (1:10) and were extracted by ultrasonic bath (10g fresh weight of biota) assisted by 50 ml hexane:dichloromethane 3:1, (v:v). The extract was purified firstly by shaking with 15g silica gel, impregnated previously with 45% sulfuric acid for the macromolecules hydrolize. A further clean-up was performed in an open glass column with Florisil, deactivated with 5% water. The organochlorine compounds were eluted with 7 ml of hexane:dichloromethane 4:1(v:v). The extract was concentrated to 2 ml and analyzed by GC-ECD (Nuro et al, 2014).

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### **Treatment of soil samples for GC analyze**

Soil samples were dry firstly in open air and after that were sived for selecting 63 micron fraction. A sub-sample from 10 g of soil samples were extracted by ultrasonic bath assisted by 50 ml hexane/dichloromethane 3:1, (v:v). The extract was purified by shaking with 5 gr sodium sulphate and 5g silica gel, impregnated previously with 45% sulfuric acid. A further clean-up of this extract was performed in a open glass column packed with Florisil, deactivated with 5% water. The organochlorine compounds were eluted with 7 ml of hexane:dichloromethane 4:1(v:v). The extract was concentrated to 2 ml and after that analyzed by GC-ECD (Nuro et al, 2014).

### **Gas chromatography analyzes of pesticides and PCBs**

Organochlorine pesticides and PCBs were analyzed simultaneously using HP 6890 Series Plus with  $\mu$ ECD detector and a capillary column Rtx-5, 30m long x 0.25mm i.d. x 0.25  $\mu$ m film thicknesses. Helium was used as carrier gas and nitrogen as make-up gas. Manual injection was done in split mode (1:50) in 280°C. The organochlorine pesticides detected were according EPA 8081 standard: HCHs (a-, b-,  $\gamma$ - and d-isomers), DDT's-related chemicals (p,p-DDE, p,p-DDD, p,p-DDT), Heptachlors (Heptachlor and Heptachlor epoxide), Aldrine's (Aldrine, Dieldrin, Endrin and related compounds), Endosulfane's (I, II and Endosulfane sulphate isomer's), Methoxychlor and Mirex. Analysis of PCBs was based on the determination of the seven PCB markers (IUPAC Nr. 28, 52, 101, 118, 138, 153 and 180). Quality assurance procedures included determination of LOD, LOQ, precision, reproducibility and accuracy of the method. Five calibration points with concentrations of 5, 10, 25, 50, 100 ng/ $\mu$ l were selected for both, pesticides and PCB's. Qualitative analyze was based on external standard method (Vryzas et al, 2009; Lekkas et al, 2004; Nuro et al, 2014).

## **RESULTS AND DISCUSSION**

Analyze of organochlorine pesticides, their residues and PCB was realized in soil and fruit/vegetable samples from Myzeqeja field. Pesticides were used intensively in this area from 1946 to 1992 for against malaria vectors (mosquitos) and for agricultural purposes. Organochlorine pollutants are very stable compounds while they can be found in environment for many years after their application. Soil and fruit/vegetable samples were taken in the same stations in order to evaluate their accumulation process from soil to plants.

Figure 2 shows the total of OCPs in soil and fruit/vegetable samples from Myzeqeja field. Organochlorine pesticides were found in all soil and fruit/vegetable samples. OCPs concentrations were found 20 – 50 times higher in soil samples. Their range was in soil samples 70.5 – 345.7 ng/g (155.3 ng/g mean value) and in fruit/vegetable samples were 0.1 – 13.5 ng/g (4.7 ng/g mean value). S8 soil sample and potato sample were the most polluted samples. The found level could be mostly because of previous use of pesticides in this area. The distribution of organochlorine pesticides in all analyzed samples (soil and fruit/vegetable) was almost the same for all stations because the origin of pollution is the same. It was noted that some pesticides were in higher levels for some stations. This could be because of punctual sources or new arrivals from different effluents and drainage channels of agricultural areas. Profile of organochlorine pesticides (Figure 3) in soil samples were: Endosulfan sulfat > Endosulfan alfa > Endrin keton > Dieldrin > Metoxychlor. Almost the same profile was found in fruit/vegetable samples where Endosulfanes and Adlrins were found in higher concentrations compare to other groups of pesticides. Their presence in fruit/vegetable could be because of bioaccumulation process not because of their recent use. Note that profile of pesticides could be connected with the period in which these pesticides were applied in different sampling stations. Also, individual properties (physico-chemical properties) of each pesticide and their residues could be affect their profile.

Figure 4 shows the profile of Lindane and its isomers in soil and fruit/vegetable samples from Myzeqeja field. Lindane and its isomers were found in all soil samples and in 76% of fruit/vegetable samples. Their mean concentration was 1.3 ng/g in soil samples while in fruit/vegetable were 0.72 ng/g. Their total were 2-5 times higher in soil samples. Alfa-HCH was found in higher level in soil samples while beta-HCH was identify as main HCHs in fruit/vegetable samples. This profile could be because of HCHs

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stability and their bio-affinity to pass from soil to plants. Total of HCHs were lower than permitted level for soil and fruit/vegetable samples conform Albanian and EU legislation.

Heptachlores in soil and fruit/vegetable samples from Myzeqeja field was shown in Figure 5. Heptachlor and Heptachlor epoxide were found in all soil samples and in 83% of fruit/vegetable samples. Their mean concentration was 2.9 ng/g in soil samples while in fruit/vegetable were 0.4 ng/g. Their total was found 2-12 times higher in soil samples. Heptachlor epoxide (degradation product of Heptachlor) was identified in higher concentrations in all samples because of Heptachlor previous use. Total of Heptachlors were lower than permitted level for soil and fruit/vegetable samples conform Albanian and EU legislation.

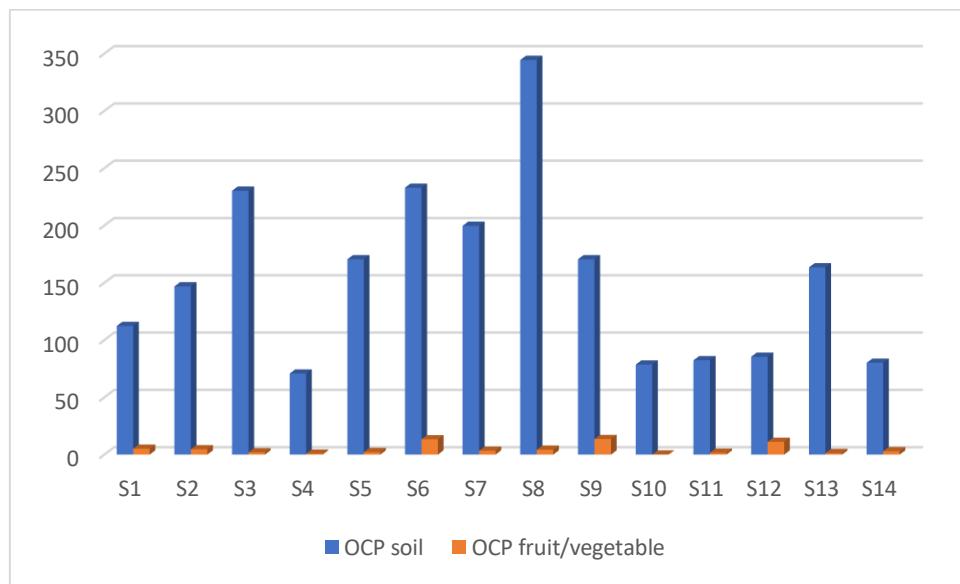
Figure 6 shows profile of Aldrines in soil and fruit/vegetable samples from Myzeqeja field. Aldrines were found in all soil and fruit/vegetable samples. Their mean concentration was 31.8 ng/g in soil samples and 1.4 ng/g in fruit/vegetable. Their total was found 2-100 times higher in soil samples. Degradation products of Aldrine was identify in higher concentrations in all analyzed samples because of its previous use. Profile of Aldrines in soil samples was: Endrin keton > Dieldrin > Endrin > Aldrin. Dieldrin was found in higher concentration in fruit/vegetable samples. Total of Aldrins were lower than permitted level for soil and fruit/vegetable samples conform Albanian and EU legislation.

Figure 7 shows profile of DDT and its degradation products (DDD and DDE) in soil and fruit/vegetable samples from Myzeqeja field. DDTs were found in 87% soil samples and in 66% of fruit/vegetable samples. Their mean concentration was 7.2 ng/g in soil samples and 0.6 ng/g in fruit/vegetable. Their total was found 2-10 times higher in soil samples. DDD and DDE were found in higher concentrations in all samples because of DDT previous use. Higher levels of DDTs were found in three soil samples (S6, S8, S11) of Myzeqeja field. Profile of DDTs in soil samples was: DDD > DDE > DDT. DDE was found in higher concentration in fruit/vegetable samples. This difference between soil and fruit/vegetable samples could be connected mostly with the higher bioaffinity of DDE. Total of DDTs were lower than permitted level for soil and fruit/vegetable samples conform Albanian and EU legislation.

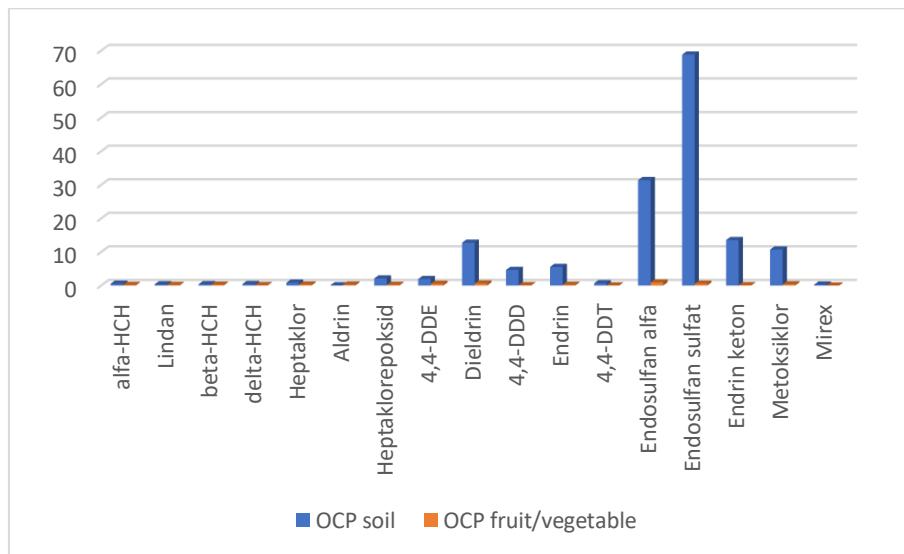
Figure 8 shows profile of Endosulfanes in soil and fruit/vegetable samples from Myzeqeja field. Endosulfane's were found as primary pollutants in all soil samples and fruit/vegetable samples. Their mean concentration was 102.6 ng/g in soil samples while in fruit/vegetable were 4.4 ng/g. Their total was found 2-50 times higher in soil samples. Endosulfan sulphate was identify in higher concentrations in all soil and fruit/vegetable samples. Endosulfanes could have been used in this area recent years under a false trademark. Total of Endosulfanes were lower than permitted level for soil and fruit/vegetable samples conform Albanian and EU legislation. except S3, S6, S8, and S13 samples.

Mirex was found only in 2 soil samples in low level (0.3 ng/g). It was not found in fruit/vegetable samples. Mirex is not used in Albania but their presence could be because of atmospheric deposition or water irrigation.

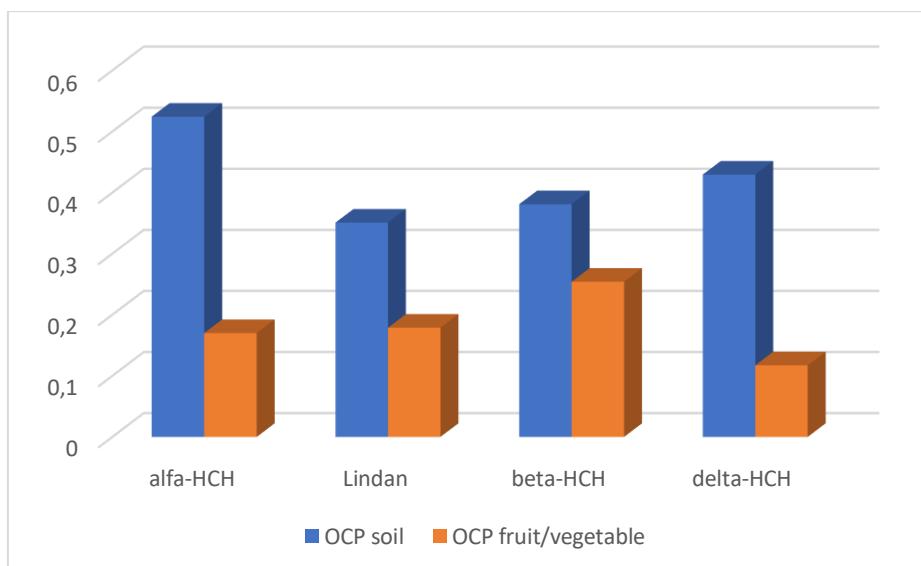
Methoxychlor was found in 71% soil samples and in 29% of fruit/vegetable samples. Mean concentration of Methoxychlor in soil samples was 10.7 ng/g while in fruit/vegetable was 0.4 ng/g. Its total was found 5-50 times higher in soil samples. Its presence could be because of its previous use. Methoxychlor concentration was lower than permitted level for soil and fruit/vegetable samples conform Albanian and EU legislation.



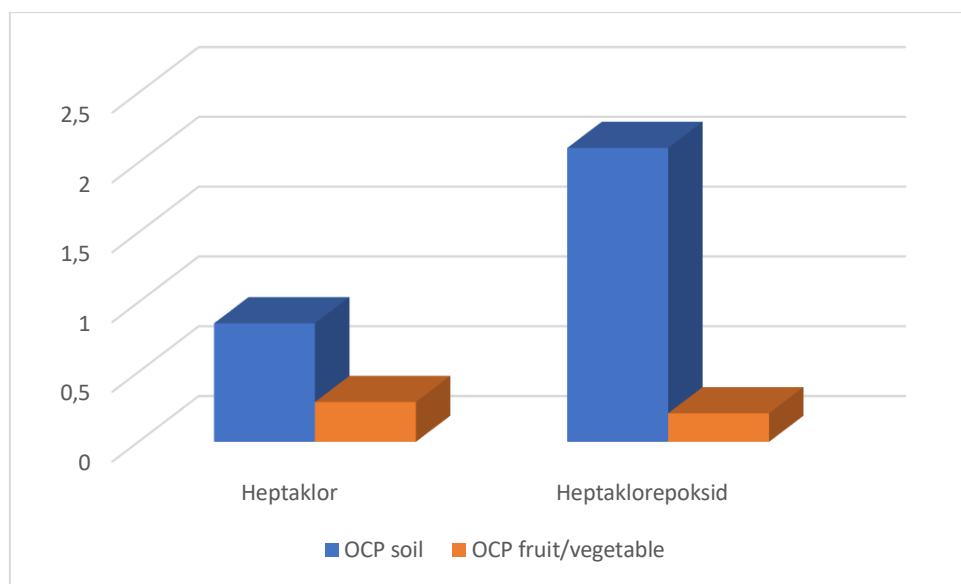
**Figure 2.** Total of OCPs in soil and fruit/vegetable samples from Myzeqeja field



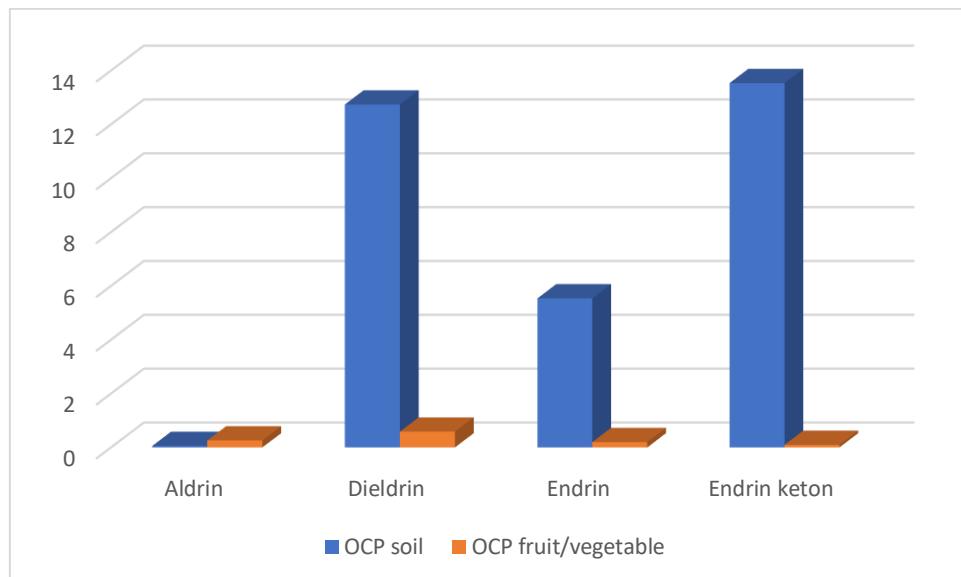
**Figure 3.** Profile of OCPs in soil and fruit/vegetable samples from Myzeqeja field



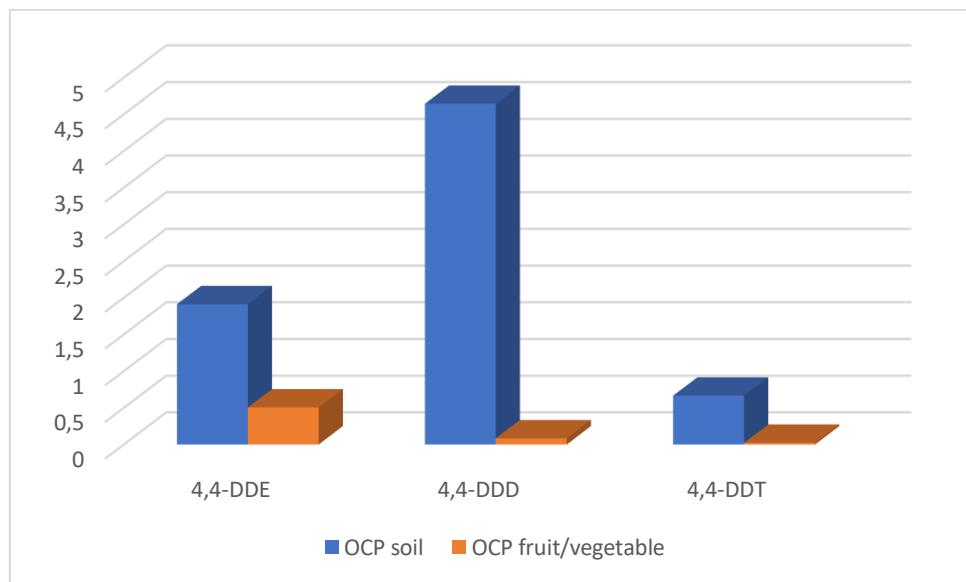
**Figure 4.** Lindane and its isomers in soil and fruit/vegetable samples from Myzeqeja field



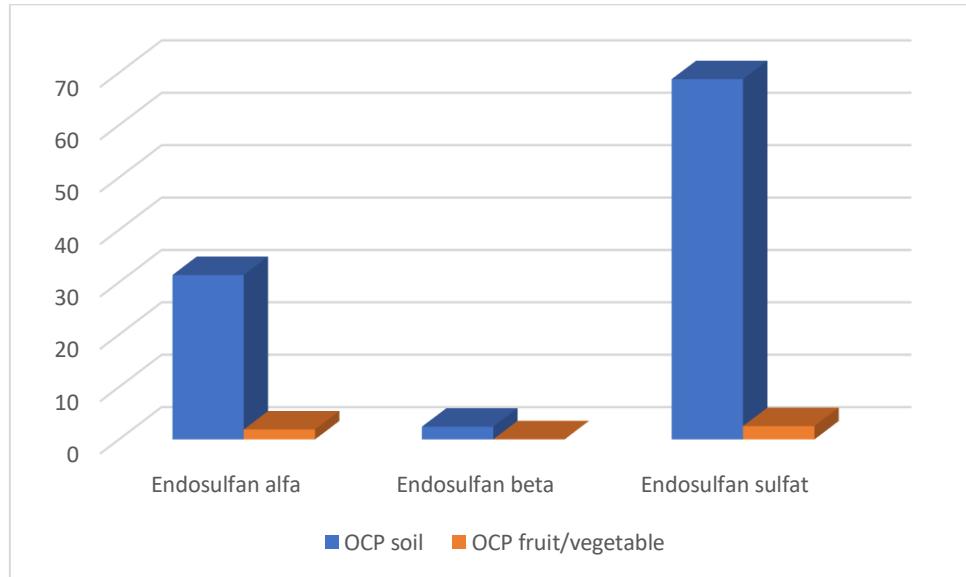
**Figure 5.** Heptachlores in soil and fruit/vegetable samples from Myzeqeja field



**Figure 6.** Aldrines in soil and fruit/vegetable samples from Myzeqeja field

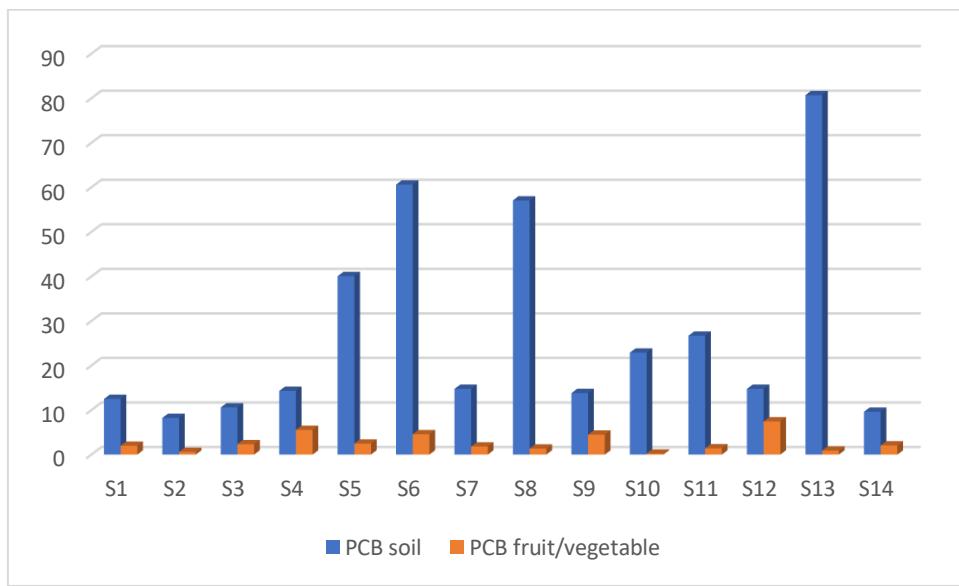


**Figure 7.** DDTs in soil and fruit/vegetable samples from Myzeqeja field

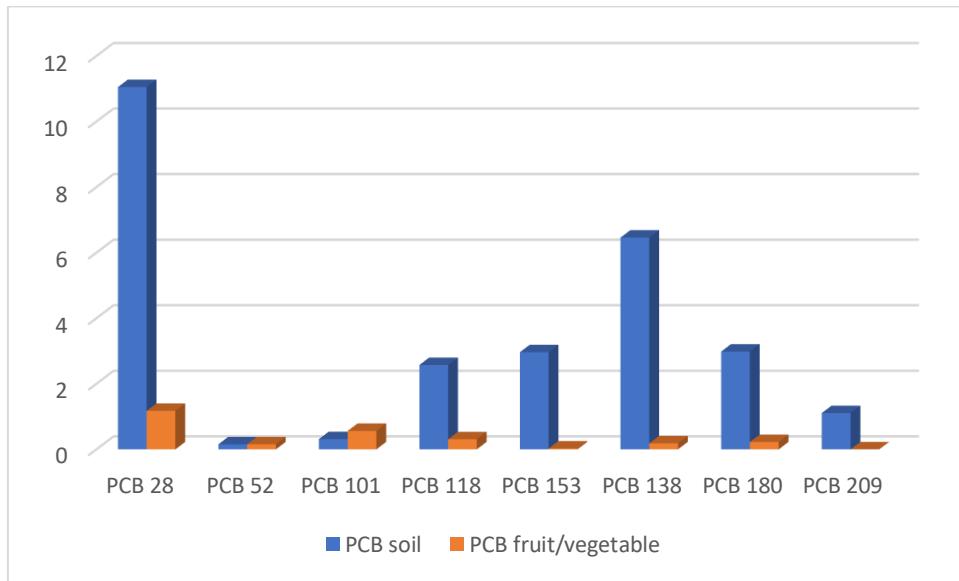


**Figure 8.** Endosulfanes in soil and fruit/vegetable samples from Myzeqeja field

Figure 9 shows the total of PCB markers in soil and fruit/vegetable samples from Myzeqeja field. PCBs were found in all soil samples and fruit/vegetable samples. Their mean concentration was 27.6 ng/g in soil samples and 2.6 ng/g in fruit/vegetable. Their total was found 3-20 times higher in soil samples. Their range in soil samples was from 8.2 to 80.7 ng/g (27.6 ng/g mean value) and in fruit/vegetable samples was between 0.2 and 7.5 ng/g (2.7 ng/g mean value). S13 soil sample and lettuce sample (S12) were the most polluted samples with PCBs. Distribution of PCBs was almost the same for all soil and fruit/vegetable samples because of the same origin of pollution. Figure 10 shows profile of PCBs in soil and fruit/vegetable samples from Myzeqeja field. Profile of PCBs in soil samples was: PCB 28 > PCB 138 > PCB 153 > PCB 180 > PCB 118. PCB 28 was found in higher level almost for all samples. Its origin could be because of atmospheric deposition. Almost the same profile was found in fruit/vegetable samples. Their presence in fruit/vegetable could be because of atmospheric deposition and bioaccumulation process. Presence of some heavy congeners of PCBs (PCB 180 and PCB 209) could be terrestrial origin. Discharging of wastewaters from industries and mechanical businesses could affect the found level and their profile.



**Figure 9.** Total of PCBs in soil and fruit/vegetable samples from Myzeqeja field



**Figure 10.** Profile of PCBs in soil and fruit/vegetable samples from Myzeqeja field

## CONCLUSIONS

The objective of this study was evidence of organochlorine pesticides, their residues and PCB markers on soil and fruit/vegetable samples from the Myzeqeja field. It is the main agricultural area in Albania. Determinations of organochlorinated pesticides and PCBs in soil and fruit/vegetable samples were realized based in EU protocols for soil and non-fatty food samples. Organochlorine pesticides and their residues were found in all soil samples taken from 14 stations of Myzeqeja area. Organochlorine pesticides are not used in Albania after the 90'. These data show the presence for pesticide residues in water samples because of their previous use. Their total was found 2-100 times higher for the soil samples due to previous uses of the compounds in this areas for agricultural purposes. Pesticide 323eglisatio process on lands is relatively strong and consequently they will continue to be there for a long time. Their profile in all analyzed samples was: Endosulfanes > Aldrins > Methoxychlor > DDTs > Heptachlors > HCHs. Their concentrations and profile could be connected with their previous uses in agricultural and because their individual physical-chemical properties. Individual levels of pesticides for all samples were lower than the allowed values in the soil and fruit/vegetable samples based on Albanian and EU 323egislation. Exception was for endosulfanes in soil samples which could have been used recent years in these area under a falce trade-marks. PCB markers were found for all soil and

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fruit/vegetable samples from Myzeqeja field. Average for the total of PCBs were found 2-20 times higher in soil samples. Volatile PCBs were found in higher level in all analyzed samples because of their atmospheric deposition origin. Presence of heavy PCBs on these areas could be as result of terrestrial sources by agricultural mechanic, mechanical businesses, etc. Presence of organochlorine pesticides and PCBs in soil and fruit/vegetable samples from Myzeqeja field should encourage the institutions responsible for ongoing analysis in this area.

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**O 52. SOME PHARMACEUTICAL ACTIVE COMPOUNDS IN SURFACE WATERS OF TIRANA CITY**

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**ABSTRACT:** Personal care products and Pharmaceutical Active Compounds (PhACs) used for health treatments are commonly reported as pollutants in urban waters and especially in hospital waste waters. PhACs are present not only primary substances used as drugs for the treatment of various diseases but also by the secondary substances which are the products of the metabolism of these drugs. These substances are found in surface waters, urban waters and hospital waters due to their excretion by patients who use them both in home use and in hospital treatments. A large number of these substances have harmful effects on the environment and on living organisms. The determination of antibiotics (amoxicillin, ciprofloxacin and tetracycline) and anti-inflammatory drugs (diclofenac, ibuprofen and nimesulide) in water samples of Lana and Tirana rivers was performed by HPLC/DAD technique. After the validations of analytical method, were taken water samples on 7 stations of Lana River and 5 stations of Tirana River. Samples were taken in February 2021. Drugs isolation is achieved by using the SPE extraction technique using C18 cartridges. Qualitative and quantitative determination is performed using Agilent model 1260 HPLC equipped with quaternary pump and DAD detector. S8 Zorbax-C18 column (15 m x 4 mm x 0.5 um) was used for their separation. Pharmaceutical compounds (antibiotics and anti-inflammatory drugs) taken in the study were detected in almost in all water samples of Lana and Tirana rivers. Their presence was result of direct discharges into this river from both urban and hospital wastewaters. The highest level was found for amoxicillin (antibiotic) and ibuprofen (anti-inflammatory). This may be related to their various uses especially during this Covid-19 pandemic period.

**Keywords:** *Pharmaceutical active compounds, antibiotics, anti-inflammatories, HPLC/DAD.*

**INTRODUCTION**

In 2005, EPA began studying environmental contamination by pharmaceuticals, detergents, natural and synthetic hormones, and other chemicals. These contaminants are commonly referred to collectively as contaminants of emerging concern. Hospital wastewater represents a particular type of effluent; this assumption has been often objected and rejected since 1980. Scientists have demonstrated and confirmed that the hospital effluents present really different qualitative and quantitative characteristics (Liu et al., 2010; Verlicchi et al., 2010a) in compared with the urban wastewater. Hospitals generate 2-5 times higher than urban flow rates, which refer to one inhabitant equivalent. As a result, the collection of hospital wastewater together with domestic wastewater has been criticised and a dedicated pre-treatment of hospital wastewater has been recommended (Verlicchi et al., 2010; Pauwels and Verstraete, 2006).

Referring to pharmaceuticals, large amounts of different compounds are used worldwide and, in the last years because of Covid-19 Pandemic, their sales have been continuously increasing. In particular, the annual consumption of most used drugs such as ibuprofen (an analgesic), amoxicillin (antibiotic), etc was grow up in very higher quantities in almost all countries. Thousands of pharmaceutical chemicals are in use today, particularly in developed countries (Rounds et al., 2009); approximately 3000 to 4000 different pharmaceuticals ingredients are used in the EU today, including painkillers, antibiotics, blockers, contraceptives, lipid regulators, antidepressants, antineoplastic, tranquilizers, impotence drugs and cytostatic agents. Pharmaceuticals are used extensively in human and veterinary medicine. More than 3000 different chemical substances are used as human medicines and in farming and aquaculture applications, in which antibiotic is one of the most important groups of common pharmaceuticals in our daily lives. The use of pharmaceuticals it is a necessity but we must consider also their environmental and adverse health effects. Pharmaceutical compounds when arrived to the environment are one of the

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main emerging contaminant groups, as long as those can be biologically active at very low concentrations, which imply the use of advanced analytical techniques to study their occurrence. Furthermore, beside the parent molecule, they are often excreted as metabolites that can be even more toxic than the native molecule.

Pharmaceutical active compounds (PhACs) are molecules that enter to the environment as active remain, either as unmetabolized parent compounds or as pharmaceutical active metabolites. Drugs are administrated to humans and reach the environment via excretory system in unmodified, partially metabolized or completely metabolized state (Ebele et al, 2017). The main source of their presence in environment are hospital wastewaters. These molecules can promote drug tolerance or resistance to the target organisms (e.g. antibiotic resistance in bacteria, or analgesic tolerance in humans) and unwanted effects in non-target organisms (alteration of sex ratio and decreased fertility) even in low concentration. Their levels in hospital wastewaters and environment are reported from ppb to ppm levels. Study of Pharmaceutical Active Compound and also Personal Care Products (PPCPs) have obtained increasing attention over the past decade. These compounds are a set of chemicals pollutants resulting from pharmaceutical and products for personal hygiene. They include a wide and diverse range of chemicals, including prescription drugs and medicines, perfumes, cosmetics, sunscreens, cleansers, shower gel, shampoo, deodorant and other. When these substances are freely discharged into the environment, they could cause some impact on aquatic and terrestrial organisms (Fent et al., 2006; Jjemba, 2006), since they have been specifically designed to produce biological effects even at very low concentrations. This broad collection of substances includes any products consumed by individuals or domestic animals for any number of countless reasons pertinent to health, performance, cognitive and physical function, or appearance (Petrovic and Barcelo, 2007). The intended biological active allowed scientist to categorize several compounds into families: analgesics and anti-inflammatory, antibiotics, psychiatric drugs, beta-blockers or lipid regulators among many others.

Hospital waste waters are of major concern as they contain pharmaceuticals residues, pathogens, chemical reagents, radionuclide, and other harmful matter. Even though, these specific effluents are usually discharged in the municipal sewer system and co-treated with domestic wastewaters. Recently, with the development of sensitive analytical techniques, which make possible the detection of more and more active pharmaceutical compounds, it is well established that pharmaceuticals and their metabolites are present in the environment (Kümmerer, 2004b) with wastewater being the primary entry route. Sources that include HWW are often pointed out as a hot spot to pharmaceutical residues in influents of municipal wastewater treatment plant. Hospital wastewaters mainly comprise products used in everyday life in large quantities, such as endocrine disrupting compounds (EDCs), pharmaceutical and personal care products (PPCPs), surfactants and surfactants residues, and various industrial additives.

## **MATERIAL AND METHODS**

### **Reagents and standards**

For this study were used analytical standards of 1 mg/ml dissolved in methanol for amoxicillin, ciprofloxacin, tetracycline, diclofenac, ibuprofen, and nimesulide. Methanol, trifluoracetic acid and acetic acid suitable for chromatography were purchased by Sigma Aldrich. Bi-distillated water was used to prepare all standard working solutions.

### **Standard solutions**

For preparing calibration solutions of each antibiotic (amoxicillin, ciprofloxacin, tetracycline) and anti-inflammatory (diclofenac, ibuprofen, nimesulide), the standard solution of 1 mg/ml were dissolved in 100 ml of methanol. This stock solution (10 ug/ml or ppm) was used to prepare 5 ppm, 2.5 ppm, 1 ppm 0.5 ppm, 0.25 ppm and 0.125 ppm working solutions. These solutions were used to prepare calibration curves for each of the analytes taken in the study. Stock solution and standard solutions were stored in the refrigerator at + 4°C.

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### Water sampling in Lana and Tirana rivers

Water samples from Lana and Tirana rivers were taken according to the protocol established by Water Resources Company Management which takes into account the sampling time, sampling stations, sampling vessel, sample pre-treatment, notes and label accompanying the sample, mode of transport of samples and storage of the sample before their analysis. Water samples from 7 stations of the Lana River and 5 stations of Tirana River (two rivers of Tirana city) were taken in this study. Samples were taken in February 2021. Water samples of Lana River were taken starting from New Maternity - LN1 to Astiri - LN7 while stations of Tirana River were taken from Paskuqani – TR1 to Instituti – TR5. Sampling stations of both rivers are shown in the map below (Figure 1).



**Figure 1.** Sampling stations for water samples in Lana and Tirana rivers, February 2021

### Pretreatment of water samples for HPLC-DAAD analyze

1 liter of water was taken at each station. Water samples were filtered to remove suspension particles and then 5 ml of glacial acetic acid was added to each sample. Water samples were stored at + 4°C until their analysis. Water samples were degassed for 30 minutes using ultrasonic bath. Then the water samples passed to a C18, SPE column. The column was conditioned with 10 ml methanol / water (50/50) and eluted with 15 ml methanol. The samples were evaporated to a volume of 3 ml. 20 ul of each sample was injected at 30°C in HPLC/DAAD equipment.

Each sample was analyzed in three parallel injections. Recovery of antibiotics and anti-inflammatory drugs for C18 column was as follows: for amoxicillin  $83.2 \pm 11.5\%$ , for ciprofloxacin  $75.3 \pm 14.2\%$ , for tetracycline  $82.9 \pm 9.7\%$ , for diclofenac  $77.5 \pm 17.1\%$ , for ibuprofen  $79.6 \pm 16.6\%$ . A mixture of antibiotics and anti-inflammatory drugs with a concentration of 1 ppm in 1 liter of distilled water (9; 10) was used to calculate the recovery of analytes.

### Liquid chromatography analyzes of PhACs in water samples

The analysis of antibiotics and anti-inflammatory medicaments in water samples of Lana and Tirana rivers was performed using the HP 1260 Series Chromatograph (Agilent Technologies, USA) equipped with internal degasser, Radeon manual injector (20ul loop), quaternary pump, thermostat for the column and diode detector (DAD). PhACs separation was performed on the S8 Zorbax C18 column (150 mm × 4.6 mm x 0.5 um). The mobile phases used for the separation and isolation of antibiotics were: Phase A - 0.02M aqueous solution of trifluoroacetic acid (TFA) and Phase B - methanol.

For simultaneous determination of antibiotics and anti-inflammatory in water sample, the mobile phase was initially with 30% (Phase A) and 70% (Phase B) at a flow of 1 ml/min. After 1 minute, the 0.02M TFA solution changed from 30% to 60% for 15 minutes with the same flow of 1ml/min. In this percentage of phases, A and B (60/40) the column was rinsed for 10 minutes. Qualitative and quantitative analyze of amoxicillin, tetracycline, diclofenac, ibuprofen and nimesulide were performed

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at wavelength  $\lambda = 220$  nm. Determination of ciprofloxacin was performed at wavelength  $\lambda = 280$  nm (11; 12).

### **Method validation**

Method validation was done according to Commission Decision 2002/657/EC. Parameters such as linearity, specificity, precision, accuracy, Limit Detection (LOD) and Quantification Limit (LOQ) (5; 6) were evaluated for each analyte (analyzed antibiotics and anti-inflammatory medicaments). Linearity was tested using test solutions from 0.125 - 5 ppm. Blank solution and “home standards” (pure bi-distilled water and fortified in several concentrations) were done frequently. Some validation data of the method are given in the following table 1:

**Table 1.** Validation parameters of the HPLC/DAD method used for analyzes of pharmaceutical compounds in Lana and Tirana rivers, 2021

Medicaments	Correlation coefficient (R)	LOD (ppm)	LOQ (ppm)
Amoxicillin	0.9945	0.037	0.114
Ciprofloxacin	0.9522	0.095	0.298
Tetracycline HCl	0.9847	0.038	0.102
Diclofenac	0.9044	0.074	0.223
Ibuprofen	0.9207	0.042	0.133
Nimesulide	0.9819	0.085	0.247

## **RESULTS AND DISCUSIONS**

Some of the most widely used antibiotics and anti-inflammatory drugs were taken in the analysis, especially during the Covid-19 Pandemic period, the period in which the work coincides. These pharmaceutical compounds have been analyzed in water samples of Lana and Tirana rivers. These aquatic ecosystems are important for Tirana city but unfortunately in waters of these rivers discharged directly in many points' hospital and urban wastewaters. Hospital and urban wastewaters are the main sources of pharmaceutical compounds in these surface waters. These drugs are used for the treatment of various diseases (in hospital and home treatments). The main parts of these excreted unchanged by patients and a part of these drugs are metabolized by the body. Both unchanged drugs or primary products and metabolized products (by-products) have been observed to cause various environmental problems (2; 5; 12). Antibiotics that were analyzed in surface waters of Tirana city were: amoxicillin, ciprofloxacin and tetracycline as well as anti-inflammatory drugs: diclofenac, ibuprofen and nimesulide. Their analysis was performed simultaneously combined SPE (C18 cartridge) followed by HPLC/DAD technique. Separation of these pharmaceutical compounds was performed in column S8 Zorbax C18 (150 mm x 4.6 mm x 0.5um). The mobile phases used for the separation and isolation of PhACs was 0.02M solution of trifluoroacetic acid and methanol.

Tables 2 and 3 provide the average data obtained for antibiotics and anti-inflammatory drugs found, respectively in water samples of Lana and Tirana rivers. It was noted the presence of analyzed pharmaceutical compounds in all analyzed samples. Figure 2 shows the total antibiotics in water samples of Lana and Tirana rivers. The highest level in Lana River was found for the LN5 station (near the “Palace of the Arrows” station) with a total of 0.221 ppm while for Tirana River the higher level was found for TR5 station (Institute station) with 0.158 ppm. The lowest level for Lana River was found for sample LN1 (on New Maternity station) while for Tirana River the low level was found for TR1 station (Paskuqani station) with 0.025 ppm. The distribution of Antibiotics in water samples of Lana and Tirana rivers was shown in Figure 3. It was observed an individual distribution for each of the antibiotics taken in the analysis. For amoxicillin and tetracycline were found high levels of them starting from LN2 station (below New Maternity station) to LN7 station (Astiri station) in Lana River and for Tirana River was observed almost the same starting from RT3 to TR5 stations. The increase of concentrations for these antibiotics can be related to the inflows of these compounds from both hospital spills and urban spills

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near these stations. The profile of antibiotics in the water samples of both, Lana and Tirana rivers (Figure 4) was: amoxicillin > tetracycline > ciprofloxacin. This profile should be related to the relative amounts of each individual for medical treatments. It should be noted that the Covid-19 Pandemic has significantly increased the use of antibiotics which are used in different stages of treatment of patients with this virus. Note that, their use in many cases in Albania is done without a doctor's recommendation in home treatments.

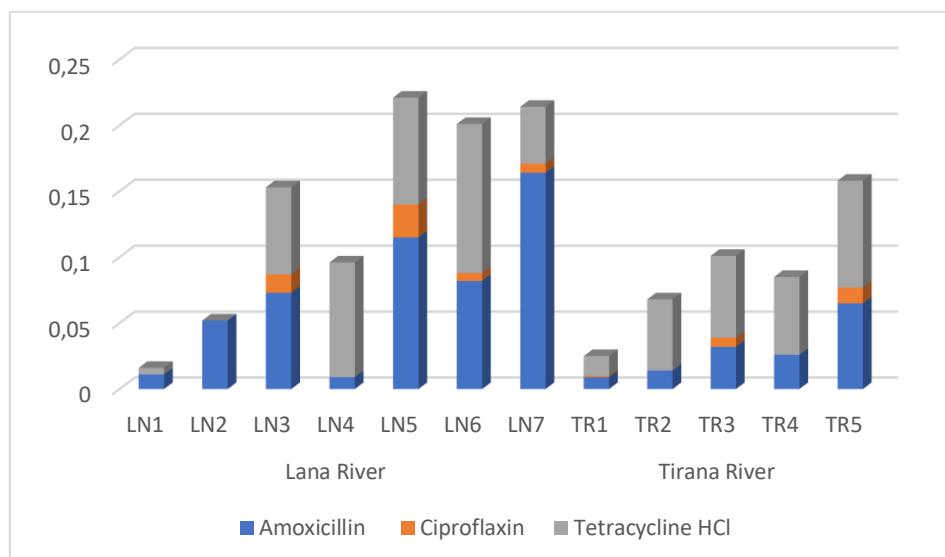
Figure 5 shows the total of the anti-inflammatory drugs (diclofenac, ibuprofen and nimesulide) analyzed in the water samples of Lana and Tirana rivers. Also, their lowest level was found in the LN1 station with 0.047 ppm for Lana River and in TR3 station with 0.023 ppm of Tirana River. The maximum level of anti-inflammatory drugs was found in the LN7 station (0.354 ppm) for Lana River and in TR5 station (0.116 ppm) for Tirana River. As for the antibiotics, this should be linked to hospital and urban spills into the Lana and Tirana rivers, leading to an increase in their concentrations from stations in the first part to the stations in the second part of both rivers. Figure 6 shows the distribution of anti-inflammatory drugs in water samples of Lana and Tirana rivers. Again, it was observed an individual profile of them in both rivers which have the same upward trend of their concentrations from starting stations to the lowest parts of the rivers. Even for this group of drugs can be said that there is an increase in their use, especially for Covid-19 treatments in both hospital and home treatments. Figure 7 shows the profile of anti-inflammatory drugs in water samples of Lana and Tirana rivers. It was notable the highest level of ibuprofen followed by diclofenac in both rivers. Nimesulide is found in smaller amounts. This is related to the degree of their use but also to the stability and other physical-chemical properties of these molecules.

**Table 2.** Average data of antibiotics (ppm) in water samples of Lana and Tirana rivers

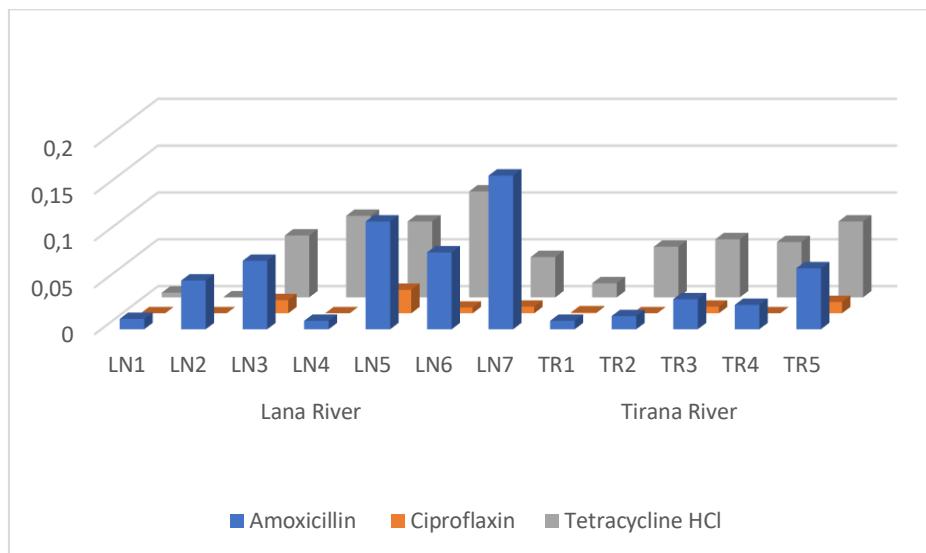
Antibiotic's	Lana River							Tirana River				
	LN1	LN2	LN3	LN4	LN5	LN6	LN7	TR1	TR2	TR3	TR4	TR5
Amoxicillin	0.01 1	0.05 2	0.07 3	0.00 9	0.11 5	0.08 2	0.16 4	0.00 9	0.01 4	0.03 2	0.02 6	0.06 5
Ciprofloxacin	N.D.	N.D.	0.01 4	N.D.	0.02 5	0.00 6	0.00 7	0.00 1	N.D.	0.00 7	N.D.	0.01 2
Tetracycline HCl	0.00 5	N.D. 6	0.06 7	0.08 1	0.08 3	0.11 3	0.04 5	0.01 5	0.05 4	0.06 2	0.05 9	0.08 1
<b>Total</b>	<b>0.01 6</b>	<b>0.05 2</b>	<b>0.15 3</b>	<b>0.09 6</b>	<b>0.22 1</b>	<b>0.20 1</b>	<b>0.21 4</b>	<b>0.02 5</b>	<b>0.06 8</b>	<b>0.10 1</b>	<b>0.08 5</b>	<b>0.15 8</b>

**Table 3.** Average data of anti-inflammatories (ppm) in water samples of Lana and Tirana rivers

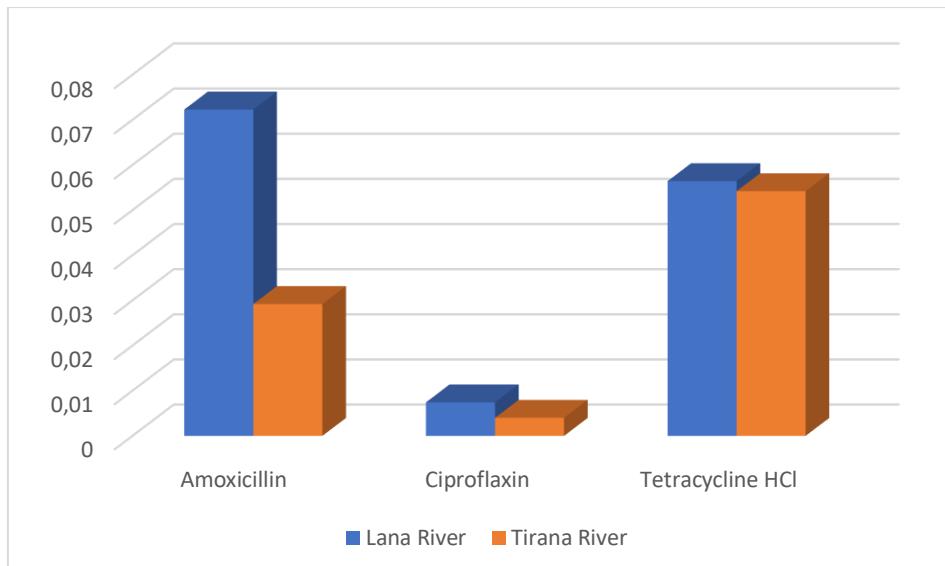
Anti-inflammatory	Lana River							Tirana River				
	LN1	LN2	LN3	LN4	LN5	LN6	LN7	TR1	TR2	TR3	TR4	TR5
Diclofenac	N.D.	N.D.	0.01 7	0.00 9	0.01 3	0.05 6	0.22 3	0.05 2	0.06 6	N.D.	N.D.	0.08 9
Ibuprofen	0.04 4	0.05 0	0.04 1	0.06 3	0.02 7	0.14 2	0.09 3	0.01 1	0.05 1	0.02 3	0.04 7	0.07 3
Nimesulide	0.00 3	N.D.	0.00 4	0.02 7	0.05 8	0.00 8	0.03 8	N.D.	N.D.	0.00 4	0.00 2	0.00 5
<b>Total</b>	<b>0.04 7</b>	<b>0.05 2</b>	<b>0.06 9</b>	<b>0.09 8</b>	<b>0.09 6</b>	<b>0.20 6</b>	<b>0.35 4</b>	<b>0.06 3</b>	<b>0.11 1</b>	<b>0.02 7</b>	<b>0.04 9</b>	<b>0.16 6</b>



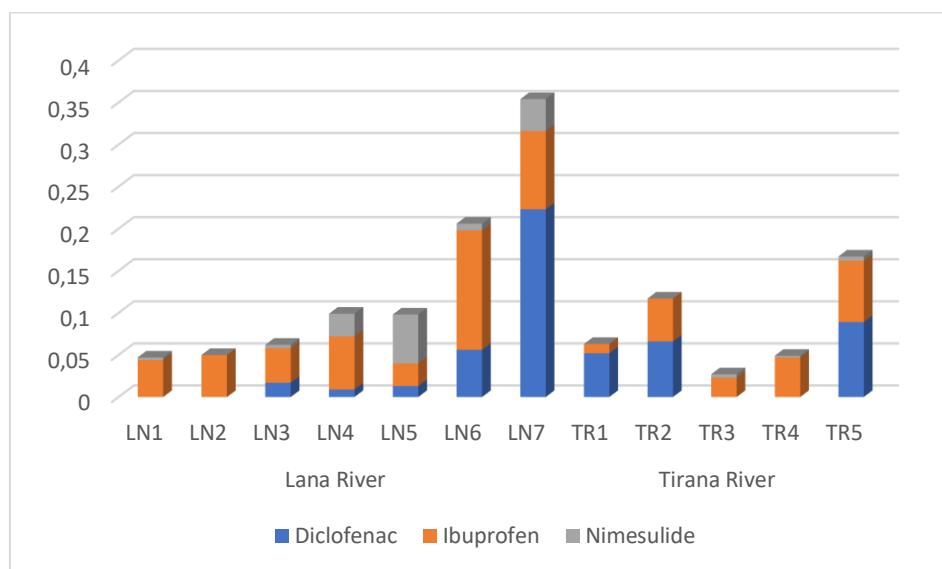
**Figure 2.** Total of antibiotics (ppm) in water samples of Lana and Tirana rivers



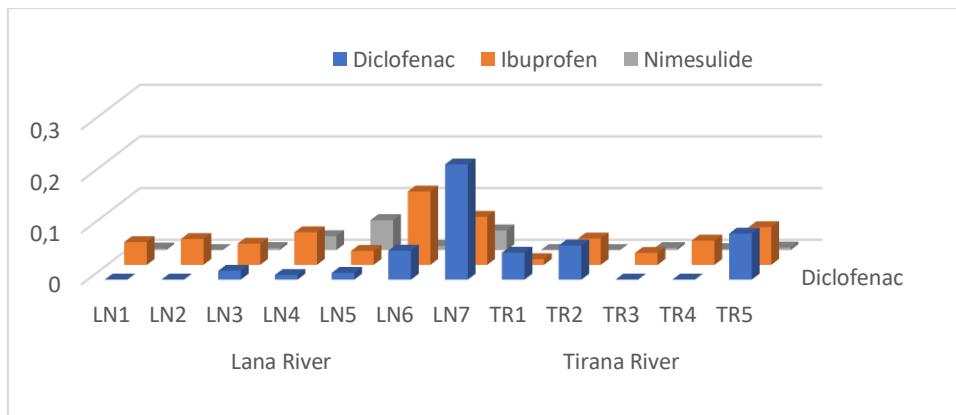
**Figure 3.** Distribution of antibiotics (ppm) in water samples of Lana and Tirana rivers



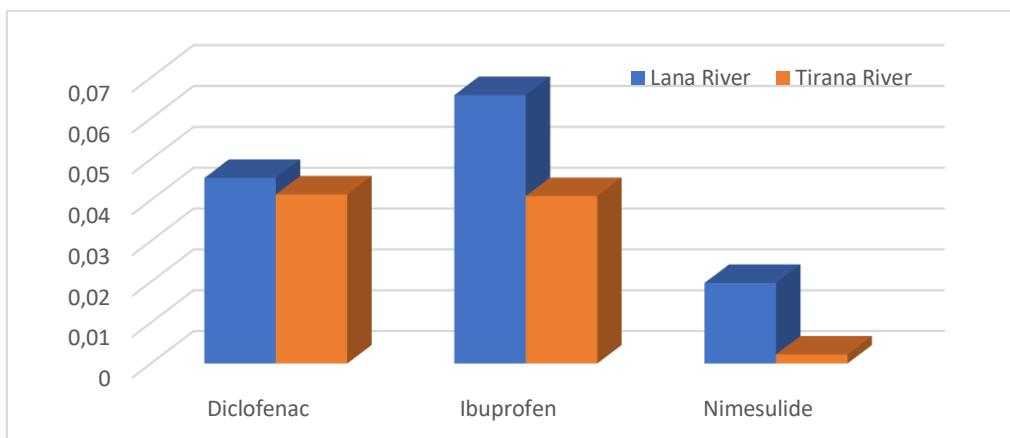
**Figure 4.** Profile of antibiotics (ppm) in water samples of Lana and Tirana rivers



**Figure 5.** Total of anti-inflammatory medicaments (ppm) in water samples of Lana and Tirana rivers



**Figure 6.** Distribution of anti-inflammatory (ppm) in water samples of Lana and Tirana rivers



**Figure 7.** Profile of anti-inflammatories (ppm) in water samples of Lana and Tirana rivers  
**CONCLUSIONS**

The purpose of this study was to determine the level of some antibiotics (amoxicillin, ciprofloxacin and tetracycline) and some anti-inflammatory drugs (diclofenac, ibuprofen and nimesulide) in water samples of Lana and Tirana rivers. Unfortunately, in these rivers discharge without any treatment's hospital, polyclinic and urban wastewaters. These spillages are the main source of pollution with pharmaceutical compounds of these important aquatic ecosystems. The analyzes of PhACs were performed using the

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HPLC/DAD technique. The technique is recommended by international and Albanian norms for the analysis of antibiotics and anti-inflammatory drugs in surface waters. From antibiotics and anti-inflammatory drugs were selected those that have wider use in hospital and home medical treatments nowadays in the Tirana city, in this period that coincides with Covid-19 Pandemic. The use of medical drugs in this period has been a significant increase in this period. In the water samples of Lana and Tirana rivers the highest levels of antibiotics belong to amoxicillin while for anti-inflammatory drugs the highest level was found for ibuprofen. This fact must be a consequence of their more frequent uses in the treatment of infections and pain relief during the period.

Analysis of PhACs should be applied regularly by the responsible institutions in the surface water analysis not only for the Lana and Tirana rivers but also for other water ecosystems where it is thought that there is discharge of hospital or urban wastewaters. Also we suggest further work to increase analytical performance using LC/MS/MS analytical techniques for the identification and quantification of pharmaceutical compounds in surface waters.

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**O 53. RECYCLE ALUMINIUM INDUSTRY IN ALBANIA**

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**ABSTRACT:** Aluminium is an element that has found wide usage due to its mechanical and physical characteristics, such as cars (motor parts, discs, etc.), food packaging, pharmaceuticals, profiles – windows frame, electronics, including the waste from said aluminium part manufacturing. All of these together with other waste aluminium from consumption or manufacturing are separated into post-consumer scrap, also known as waste from aluminium usage, such as cans, cars, profiling, which must be packed and separated before recycling, and pre-consumer scrap, which is generated during the manufacturing process. This kind of scrap can be reinstated into the process to be remelted. The demand for aluminium leads us to recycle this waste and turn them into raw materials for aluminium production. Aluminium scrap is an infinitely recyclable, harmless material and a considerably valuable raw material. The raw material used for secondary aluminium production is scraps, slugs and waste from this industry. The companies that recycle aluminium are mainly small-/medium-sized enterprises; it can be assumed that the statistics for recycling are incomplete.

**Keywords:** Waste, Reuse/Recycle, Secondary Aluminium, Scrap.

## **INTRODUCTION**

Albania is a developing country with a noticeable population growth and an increase of consumption per capita. For this reason, it is developing policies regarding the recycling industry in general and aluminium industries specifically. The total amount of aluminium in Municipal Urban Waste (MUW) is estimated to be about 1.4% of all MUW by mass. The biggest source in the MUW flow is aluminium cans and other packaging, 55% of which are recycled. The aluminium recycling industry in Albania is relatively new (after 2011), and it's undergoing a series of challenges to form as efficient a recycling economy as possible.

It is located in the Tirane-Durres area for logistical reasons, being near the main national port and easily reachable from Kosovo thanks to Administrative Instruction for Export, Import and Transit of Waste of the Kosovo Government. The aluminium recycling facilities installed in Albania generally use newer (post-1990) technology and follow closed cycles. For example, the majority of air emissions is trapped and circulated within the furnace chimney which allows them to burn completely within the line, also improving energy efficiency. These facilities operate in accordance to ISO 9001 and OSHAS 18001. The recycling unit produces a variety of aluminium alloys in bars or in semispheres. The aluminium scrap recycling process starts with the very important stage of rigorous selection to eliminate undesired components, such as tailing and iron.

## **MATERIALS AND METHODS**

Albanian recycling facilities have 2 main sources of raw material: - local market (60-70% by mass) and - importing (30-40%). On average, during one year, a recycling facility exports roughly 400'000 kg aluminium scraps (17 04 02) and imports about 700'000 kg aluminium wastes. It also generates, on average, 360t of aluminium slag in the same reporting period. This activity is all in accordance to the Basel Convention and the Albanian legal framework. The aluminium content in materials obtained from the local market varies between 92-96% and 96-99% for imports.

The main marks produced in recycling lines in Albania are ENAB 46 000, ENAB 47 000, AlSi25, AlMg3.

Mark's with special advantages intended for the automotive industry are also produced.

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Scrap that is processed divided into four major groups:

- Pure waste consisting of only one alloy of steel, iron, lead that may be of one or more alloys.
- Residues with foreign materials such as Fe, Pb, Zn-Al bond may also have one or more alloys.
- Lathes
- Slag

Always when it comes to aluminium scrap the initial operation has to do with pressing the pieces. This of course must be done accurately and in a linear manner. We further classify these wastes into two categories:

- Plates and profiles
- Diffusions (residues with aluminium content)

The former are lightweight and have no foreign materials, but may have aluminium alloys with iron-reinforced plastics. Parts that have iron separated by magnetization. Other impurities such as Pb, Zn, and Sn must be separated by hand. The parts that have iron inside melt at a low temperature of 650°C so that the aluminium passes into a liquid state and the iron passes into the slag channel. However, this process has high costs as it loses a lot of aluminium during oxidation. The obtained materials are pressed and analysed to be ready in the melting furnace. After sorting, the material is fed automatically into a rotary furnace and melted down under salt, in a mixture of sodium chloride to prevent oxidation. When the molten metal is ready to move in to the holding furnaces, it undergoes a corrective treatment including degassing, surface cleaning and filtration.

When it meets the quality specification, the metal is convoyed to the continuous casting plant from which it comes out in the form of bars or sferes

The melting cycles vary between 35-40 calendar days. Throughout a year there are generally up to 4 melting cycles.

## **RESULTS AND DISCUSSION**

The main product obtained from the processing of aluminium waste (aluminium scraps) is the Aluminium Ingot or the main compensating product.

There are no secondary products because even waste classified as:

- a) Colatice
- b) slag obtained from a product (or aluminum scrap) are recycled during production.



**Figure 1.** Colatici 85 %

The materials used are specified in DCM No. 99 “For the approval of the Albanian Catalog of Waste Classification”.

The total installed power is 350 KWh. It is split between almost all machinery in the facility as follows:

- a) Funnel – 7 kWh
- b) Slag Discharge Baths 7 kWh
- c) Homogenizing Furnace 15 kWh

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- d) Powder opening system (filter) 60 kWh
- e) Ingotier 5 kWh
- f) Press 40 kWh
- g) Selection line 10 kWh
- h) Compressors 50 kWh



**Figure 2.** Soft aluminum Briquettes - 60%

In addition to electricity used for technological line machinery, part of the installed power is used for offices, depending on the required consumption. For example lighting, air conditioning, scales and the whole computer system and monitors. This installed power is about 60 KWh.

The fuels used for the ovens are:

- For rotary furnace Gas, Oxygen and Air.
- For the homogenizing furnace only gas.

For the wastes processed in this technological line, the consumption of gas in kg per kg of raw material varies from 0.1 kg to 0.75 kg of gas per kg of raw material and of oxygen from 0.14 kg to 0.41 kg of oxygen per kg of raw material elaborated.

The utilization coefficient of the main compensating product or commodity (Aluminum Ingots) is calculated for each production cycle as a ratio of the compensating product (Aluminum Ingots) obtained by processing with the quantity of raw material used classified as aluminum scrap or aluminum scrap expressed as a percentage. This coefficient is variable and ranges from 34% to 90%. Products with colaric and slag designations from production, which are recycled (ie put into processing) as a ratio expressed as a percentage between the quantity of these products initially obtained with the raw material introduced into processing ranges from 1.18% to 12%. This is related to the components of aluminum scrap, which dictate features in processing operations in terms of their separation.



**Figure 3.** Aluminium shredder 70 %

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Losses in the production process are the difference left by 100% after deducting the sum of the percentage that the main compensating product occupies with the raw material used. Losses are in direct proportion and conditioned to the utilization coefficient of the main compensating product (Aluminum Ingots). The higher the utilization coefficient of the main compensating product or commodity, the lower the losses and vice versa. It all depends on the percentage of aluminum found in the variety of aluminum slag that society uses as a raw material and the features of the technological process. So the loss is generally determined by these factors:

- a) use of the material according to the meaning of its name - aluminum scrap or scrap,
- b) losses created by metal oxides due to the technological process at high furnace temperatures,
- c) from the burning of paints with which Iyer wastes, plastic parts found in scrap, inert or other contaminants, lubricating oils located in the aluminum parts of vehicles, etc.

After the melting process the losses, i.e. the ratio of the raw material and the obtained product, are 15-22% for Albanian scraps and 5-9% for imported ones.

The norm of use of the main compensating product or commodity (Aluminum Ingots) is calculated for each production cycle as a ratio of the compensating product {Aluminum Ingots} obtained from the processing with the quantity of raw material used qualified aluminum scrap or aluminum scrap expressed in aluminum . This normative is variable and ranges from up to 90% by weight.

The formula for its calculation is expressed as follows:

$$losses \% = \frac{scrap\ quantity - alloy\ quantity}{scrap\ quantity} * 100$$

Working hours for the preparation of the finished product are 7-12 hours depending on the quality of the scrap that goes to the foundry. During the control of the consumption of raw materials which are mainly: (Motor parts, discs, etc.), food packaging mainly cans, lathes, waste resulting from the work of various aluminum accessories, durals, etc. notice losses and sales during the smelting process of various aluminum scarring games which were influenced by these factors:

- a) use of the material according to the meaning of its name - aluminum scrap or scrap
- b) losses created by metal oxides due to the technological process at high furnace temperatures,
- c) losses created due to evaporation, release in the form of gas
- d) from the burning of paints with which the waste is painted, plastic parts are found joined in scrap, inert or other contaminants, lubricating oils are located in the aluminum parts of vehicles, etc.,

Based on these parameters, the rate of losses in the processing of aluminum scrap presented in the table below was calculated.

**Table 1.** Lost mass during processing

No	Product Category (Scrap)	Lost mass percentage during processing
1	Briquetted soft aluminum 60 %	40 %
2	Strong aluminium 75 %	25 %
3	Shreder Aluminimi 70 %	30 %
4	Colatice 85 %	25 %
5	Difuzione 90 %	10 %
6	Automobile discs 75 %	25 %
7	Strong profile 75 %	25 %
8	Profile 65 %	35 %
9	Canned Briquettes 50 %	50 %
10	Aluminium foil 45 %	55 %
11	Slag 30 %	70 %
12	Slag 40 %	60 %
13	Slag 45 %	55 %
14	Aluminim taps	80 %
15	Lathes 55 %	45 %
16	Lathes 60 %	40 %

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For the producing 1 tonne of aluminium ingots in one of the recycling unit in Albania need

**Table 2.** Quantity for production

No.	Category	Consumption (kg)
1.	Scraps	1794
2.	Salts	800
3.	Oxygen	300
4.	Gas (LPG)	280
5.	Silica	48
6.	Electricity (not in the process)	240

The impact from aluminium recycling facilities is local, measurable and controllable via contemporary techniques:

**Table 3.** Environment impact

Process	Raw material	Air emissions	Process wastes	Other wastes
Bauxite processing	Bauxite, caustic soda	Particles (Pm)	-	Excess contain Si, Fe, Ti
Purification of alumina ( $\text{Al}_2\text{O}_3$ ) and precipitation	Aluminum sludge ( $\text{Al}_2\text{O}_3$ ), aluminum powder and water	-	Aqueous wastes contain aluminum powders, sand and abrasives	-
Calcification of alumina	aluminum hydrate ( $\text{Al(OH)}_3$ )	Particles and vapours	-	-
Melting of secondary aluminum scrap	Aluminum scrap, oils and gases, chlorine or other additives $\text{AlCl}_3$ , $\text{AlF}_3$ , $\text{KCl}$ , Na and fluorure	Particles and $\text{HCl}/\text{Cl}_2$	-	Sludges contain magnezium Mg and chlor Cl
Recycling of secondary aluminum slag	Aluminum slag water	Particles (Pm)	Aqueous wastes, salts	-

## **CONCLUSIONS**

The consequences of aluminium scrap recycling include:

- Economical profits
- More stable environment
- Social wellbeing
- All the water used is recycled, purified and cooled in special plant to prevent the problem of waste water disposal.
- The flue gas purification plant is monitored continually and undergoes routine maintenance. The emissions from the smelting furnaces are analysed regularly to ensure that they comply with the applicable regulations.



**Figure 4.** Aluminium ingots

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**O 54. EFFECT OF ACID RAIN ON BUILDINGS AND BUILDING MATERIALS**

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**ABSTRACT:** Increasing industrialization and constant change, improving living conditions, bringing air pollution in every aspect of human life and has been negatively affected. It affects human health, all other living things and man-made objects. In this study, our aim is to focus on the structures of air pollution. In particular, the effects of acid rain on buildings were investigated. Even if the effects of acid rain are not observed in the short term, it has been determined that there are serious damages, discoloration and deformations on historical structures. Acid rains cause deterioration in structures by falling on the structures in the form of sulphuric acid and nitric acid drops, which are formed as a result of the reaction of fossil fuel wastes increasing with industrialization in the water cycle. Sulphur-oxide and nitrogen-oxide emissions cause acidification in the atmosphere. In order to reduce acid rain, forests and green areas should be protected and increased, unnecessary vehicle use in transportation should be minimized, the use of natural gas for heating should be increased, and the sulphur content in fuels should be reduced.

**Keywords:** Acid Rain, Acid Rain in Structural Materials, Structural Material Deformation, Acid Rain Effect

**P 1. THE INCIDENCE OF ACUTE LYMPHOCYTIC LEUKEMIA IN ALBANIA**

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**ABSTRACT:** Acute lymphocytic leukemia (ALL) is a blood cancer that affects both children and adults, peaking its incidence at a very young age, usually between 2 and 5 years old. The causes of ALL are considered multifactorial, including genetic, environmental, and chance. It is an aggressive disease that leads to the formation of immature lymphocytic cells at an increased rate and short time. Approximately 90% of children affected by ALL have made a complete remission from the disease. Our study aims to give a comprehensive analysis of ALL patients in Albania. Data was obtained from the registry of University Hospital “Nënë Tereza”, Tirana, Albania. We analysed factors such as age and gender and place of habitation to consider several variables that lead to the progression of the disease. Data showed that these factors have a statistical relevance for the development of the leukemia with  $p \leq 0.05$ . Male to female ratio was 1.52:1. Children from new-borns to teenagers comprised 67% of the study group which also shows the high incidence rate of ALL in young people. Incidence peaked at ages 2-5 and 6-10 where males to female ratio was 1.7:1. Overall the incidence in Albania is similar to Europe with an inclination towards males and children between the ages of 2-5 years.

**Keywords:** *Albania, Acute lymphocytic leukemia, Males, Females, statistics.*

**P 2. THE IMPACT OF COVID 19 ON CRYPTO CURRENCY FOCUSED IN EASTERN EUROPIAN SOCIETIES**

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**ABSTRACT:** The impacts of Covid-19 have been both negative and positive. While a significant portion of the economy has been affected negatively, the financial market experienced a major boost following increased digital currency transactions (Iqbal et al. 2021). The digital currency platform has registered significant gains during the Covid-19 pandemic as governments across the world formulated and implemented policies to discourage transactions in Fiat currency, which is considered a 'super spreader' (Assoumou-Ella, 2020; Chronopoulos et al. 2020). Governments in developing countries that are highly likely to be overwhelmed by the virus have taken key initiatives to encourage use of digital currency such as directing financial institutions to waive their transaction charges during the pandemic, a move that has encouraged more people to adopt use of digital currency (Kakushadze & Liew, 2020). The Western Balkan region has particularly experienced massive transformation of its financial markets, with digital currencies gaining more inroads in the industry layout. Jusufi and Bellaqa (2019) note that before the pandemic, many organizations in Balkan lacked the necessary infrastructure to support the digital currency framework. Broz et al (2020) found that Western Balkan countries still lagged behind EU's digital threshold in various aspects of the economy. With the changes that have taken effect, Western Balkan countries have put in place the necessary resources required to mitigate the spread of Covid-19 through developing the digital currency platform. Stojkovski (2020) notes that while cash may still be the most common method of payment, government financial policies adopted during the Covid-19 pandemic are fueling the culture of crypto currency. Golemi and Muco (2020) point out that using digital currency to complement other payment methods can hasten growth in the Western Balkan economies. These findings support the findings of numerous other studies whose findings pointed to adoption of digital currency being a major economic performance indicator (Gonzalez et al. 2020; Halaburda, 2016; Van Hoang & Syed, 2021). Thus, this paper will investigate the effects of Covid-19 on digital currencies in the last one year that the pandemic has been active, focusing on six Western Balkan countries; Serbia, Montenegro, Kosovo, Bosnia, Albania, and Macedonia. The methodology includes primary data collected from financial institutions in the region. The study hypothesizes that COVID-19 has a positive effect on Western Balkan societies' digital currencies.

**Keywords:** Cryptocurrency, Eastern Europe, Economy

**METHODOLOGY**

This study will rely on primary data collected from different financial institutions in the four Western Balkan countries selected. Due to the restrictions imposed to curtail the spread of Covid-19, the interviews were conducted via digital platforms. Doody and Noonan (2013) express that interviews are effective data collection methods because they allow a researcher to gain insights about a particular issue of interest. Williamson (2013) backs the above assertions, noting that focus groups in interviews allow a researcher to obtain accurate information on an issue being investigated. The questionnaire and the oral interviews are in the English language. The population for the data collection is digital currency stockers and investors. The linear regression method was used in the data analysis. The study will investigate the relationship between two variables; digital currency (dependent variable-Y) and Covid-19 (independent variable-X). The participants used in this study consisted of investors and owners from different financial institutions in the Balkan region. 8 participants were selected for every country which means that a total of 48 participants were included in the study. The investors will be the oral interview subjects while the owner will do the questionnaire. The research paper is centered on finding out the

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investors' feelings on the changes that digital currency has undergone amid COVID-19. The oral interviews were conducted by interviewers who could speak in the native language of the subjects. Therefore, before the interview, the clients were asked to state their first language.

### **Questionnaire**

Since the study brings two set of participants (investors and owners), questionnaires will only be administered to owners while investors will be engaged through oral interviews. The questionnaire contains the main questions that will be useful in collecting data for the verification of the hypothesis. The data collected will be analyzed using linear regression as it is an appropriate method of determining the relationship between the dependent and the independent variable. The interview questions and responses are shown in Appendix A.

## **RESULTS AND DISCUSSION**

### **Demographic Information**

#### **Country**

The population distribution per country is shown in the table below.

**Table 1.** Country distribution

<i>Country</i>		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Serbia	8	16.66	16.66	16.66
	Kosovo	8	16.66	16.66	33.32
	Montenegro	8	16.66	16.66	49.98
	Macedonia	8	16.66	16.66	66.64
	Albania	8	16.66	16.66	83.3
	Bosnia	8	16.66	16.66	100.0
	Total	48	100.0	100.0	

#### **Gender**

The respondents were asked to indicate their particular gender. It was observed that out of the 48 respondents, 30 of them were male, while the rest were female. This is illustrated in the table below.

**Table 2.** Gender distribution

<i>Gender</i>		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	30	62.5	62.5	62.5
	Female	18	37.5	37.5	100.0
	Total	48	100.0	100.0	

#### **Age**

**Table 3.** Age of the respondents

<i>Are you aged below thirty years?</i>		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	20	41.7	41.7	41.7
	No	28	58.3	58.3	100.0
	Total	48	100.0	100.0	

The respondents were asked to indicate their ages if they were above or below 30 years. The data clearly showed that most of the respondents were above 30 years (28 respondents). Those who were below 30 years had a frequency of 20 (41.7%).

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*Extent to which cash has been effective as a mode of transaction in the COVID 19 period*

**Table 4.** Extent to which using cash is the best mode of transacting

<i>To what extent do you agree that using cash is your best mode of a transaction?</i>		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	1	2.1	2.1	2.1
	Moderately agree	6	12.5	12.5	14.6
	Indifferent	11	22.9	22.9	37.5
	Moderately disagree	17	35.4	35.4	72.9
	Strongly disagree	13	27.1	27.1	100.0
	Total	48	100.0	100.0	

The respondents revealed that there has been a low implementation of cash as a mode of transaction during COVID 19 pandemic by the six countries, as per the table above. Most respondents disagreed to cash being effective (frequency=17 and frequency=13). Only 14.6% agreed to cash being the best method when doing transactions, while 22.9% were indifferent. This is an indication that with the advent of COVID 19 pandemic, there has been increased utilization of cashless transactions by various states as an effort to reduce the spread of the virus.

### ***Knowledge about Digital currencies***

The respondents were asked to rate the procurement performance before E-procurement implementation. Most respondents, as per the table below, indicated that they were familiar with digital currencies (frequency=30). Only 18 of them claimed that they were not aware of digital currencies before the pandemic. This is an indication that most of the people with knowledge of these currencies could implement them in place of using cash.

**Table 5.** Knowledge about Digital currencies

<i>Did you know about digital currencies before the COVID- 19 pandemic?</i>		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	30	62.5	62.5	62.5
	No	18	37.5	37.5	100.0
	Total	48	100.0	100.0	

### ***Impact on digital currencies on the spread of COVID 19***

**Table 6.** Impact on digital currencies on the spread of COVID 19

<i>Do you think that digital currencies have reduced the spread of COVID- 19 (Positive or negative)</i>		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Positive	29	60.4	60.4	60.4
	Negative	19	39.6	39.6	100.0
	Total	48	100.0	100.0	

The respondents indicated that digital currencies have significantly and positively reduced the COVID 19 spread (frequency=29). This further supports the significance of implementing use of digital currencies. Despite their importance, most of the people are illiterate and not well versed with their use, as evidenced by the responses from the table below, who claim it is too complicated (35.4%).

**Table 7.** Importance of digital currencies during COVID 19 pandemic

<i>What are you take about digital currencies during the Corona Virus Pandemic? [Digital currencies]</i>		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I like the turn of events; I like it	15	31.3	31.3	31.3
	I cannot see any difference	3	6.3	6.3	37.5

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It is complicated for me	17	35.4	35.4	72.9
I do not use digital currencies	13	27.1	27.1	100.0
Total	48	100.0	100.0	

### **Regression Analysis**

#### **Model Summary**

<b>Table 8.</b> Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.869 <sup>a</sup>	.755	.750	.245
a. Dependent Variable: Digital currencies				
b. Predictors: (Constant), COVID 19				

From the findings in the above table, the adjusted R squared ( $R^2$ ) is the coefficient of determination which shows the variance in digital currencies' usage due to changes in COVID 19 infections. As shown above, it is 0.750, which means that 75.0% of the total variance in digital currencies usage has been explained by the independent variable. The R squared ( $R^2$ ) is 0.755 which means that 75.5% of variation in the digital currencies' usage was explained by the changes in COVID 19 infections.

#### **Model Coefficients**

**Table 9.** Regression Coefficients

<i>Coefficients<sup>a</sup></i>					
Model	Unstandardized Coefficients			Standardized Coefficients	
	B	Std. Error	Beta	t	Sig.
1(Constat)	.174	.107		1.631	.110
COVID 19	.860	.072	.869	11.910	.000
a. Dependent Variable: Digital currencies					

From the findings, the following regression model was established;  $Y = 0.174 + 0.860X$

From the findings of the regression analysis, it was found that holding the COVID 19 variable at constant zero, the digital currencies variable would be 0. 174. The model further reveals that a unit increase in the COVID 19 infections would lead to an increase in the use of digital currencies by a factor of 0. 860. The finding indicates that the COVID 19 variable is statistically significant at 5% level of significance. Since the t-test values for the predictor variable is above the absolute value of 2, then the relationship between this variable and use of digital currencies is statistically significant.

## **DISCUSSION**

The aim of this study was to investigate the impact of Covid-19 on digital currency in the Western Balkan region. The study hypothesized that Covid-19 has a positive impact on digital currency in various ways. Primary data was collected from owners and investors in financial institutions across six countries in the Western Balkan and analyzed through linear regression. Generally, the results of the analysis conducted have revealed that Covid-19 has positively impacted digital currencies. Regarding the first interview question asked, 14.6% expressed that they considered cash the best method of transaction during Covid-19 pandemic. 22.9% were indifferent as to what method of transaction they preferred while the remainder preferred digital currencies. This finding is consistent with Kakushadze and Liew (2020) who found that most people preferred to transact in digital currencies following government measures put in place to discourage cash transactions. The second question tested participants' knowledge of digital currencies. The results of the analysis revealed that 62.5% had concrete knowledge about digital currencies such as cryptocurrency. However, this may not be reflective of the entire population as the sample was drawn from financial institution experts. This finding is consistent with Stojkovski (2020) who found that while cash is still preferred as the main medium of exchange across

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Western Balkan countries, more people are getting to learn about digital currencies. Regarding whether digital currencies had reduced the spread of Covid-19, 60.25 of the participants expressed their belief that digital currencies had helped curtail the spread of the virus. The findings are consistent with Assoumou-Ella, 2020 and Chronopoulos et al. 2020 who found that governments across the world had reduced the spread of Covid-19 by adopting digital transactions. Regarding the relationship between the two variables; Covid-19 and digital currency, the linear regression analysis revealed that holding the COVID 19 variable at constant zero, the digital currencies variable would be 0. 174 while an increase in the number of Covid-19 infections would lead to an increase in the use of digital currencies by a factor of 0. 860. This depicts a positive correlation between Covid-19 and digital currency. This finding is consistent with Assoumou-Ella, 2020 and Chronopoulos et al. 2020 who found that increased use of digital currencies resulted from increased cases of Covid-19.

## **CONCLUSION**

The results of this study have revealed that Covid-19 has a positive impact on use of digital currency. A number of factors have been highlighted as expressly behind the increased usage of digital currencies for transaction. Government policies adopted to encourage use of digital currencies have largely affected how people transact, with most people expressing their preference for digital currencies. Also, people have become more aware of the various digital currency options available. From the results of the linear regression, a positive correlation between Covid-19 and digital currencies has been established. Thus, the hypothesis formulated for this study is accepted as true.

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**APPENDICES**

**Questions**

Are you aged below thirty years?

Is using cash your best mode of a transaction?

What are you take about digital currencies during the Corona Virus Pandemic?

To what extent do you agree that using cash is your best mode of a transaction?

Did you know about digital currencies before the COVID- 19 pandemic?

Do you think that digital currencies have reduced the spread of COVID- 19 (Positive or negative)

What are you take about digital currencies during the Corona Virus Pandemic? [Digital currencies

**P 3. COMPARISON OF THE AVERAGE DIFFERENCES OF POSITIVE FREQUENCIES  
WITH Q FEVER AMONG FARM ANIMALS BETWEEN REGIONS OF THE WESTERN  
PART OF NORTH MACEDONIA WITH THE STATISTICAL METHOD ANOVA**

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**ABSTRACT:** Q fever is a zoonotic disease caused by the ubiquitous pathogen *Coxiella burnetii*, an obligate intracellular gram-negative bacterium. Farm animals and pets are the main reservoirs of infection, and transmission to human beings is mainly accomplished through inhalation of contaminated aerosols. The objective of this study was to investigate the comparison of the average differences of positive frequencies with Q fever in farm animals in five regions of western North Macedonia, with the statistical method of Anova and the homogeneity of the regions. From 1120 tested serums, 178 resulted positive, with deviation of the average from one region to another. The Kicevo region had the highest overall average of 0.28 compared to the Gostivar region average of 0.08. It was concluded that the difference between the groups is statistically significant for the level of reliability 0.01. Homogeneity with the Tukey method showed that the sample frequencies in the regions of Dibra and Kicevo were 0.26 and 0.28 above the general average, while in the regions of Gostivar, Tetovo and Struga were 0.15 below the general average and it was concluded that there is a connection between the regions in the spread of Q fever infection. The definite diagnosis of Q fever is made based on a significant increase in serum antibody titers. The serums were conserved in -30 °C and as a serological test ELISA from ID vet Monpelie France was used, which was carried out based on its relevant protocol using purified antigen of *C. burnetii*.

**Keywords:** *Q-fever, Zoonosis, Anova, Pathogen, Antibody.*

## **INTRODUCTION**

Q fever is a zoonotic bacterial infection caused by Gram-negative intracellular bacterium *Coxiella burnetii* (Eldin et al. 2017), which causes abortion in livestock and, acute and chronic illness in humans. Cattle, sheep and goat are considered the main reservoirs of the disease, although the infection has been identified in dogs, cats, wildlife, reptiles and birds (Das et al. 2013; OIE, 2013).

The disease is considered as endemic in more than 51 countries (Guatteo et al. 2011) but remains a largely ‘neglected zoonosis’ (Porter et al. 2011). In addition, the disease has been ranked as the most contagious and listed as one among the 13 ‘global priority zoonoses’ (Grace et al. 2012). In developing countries, the disease causes significant impact on public health as well as socio-economic structure of the animal husbandry sector. The prevalence in these countries has been reported around 25% and the infected animals are the major sources of infection to farmers and other contact groups (Grace et al. 2012). The Netherlands outbreak (2007–2010) of Q fever provided a clear demonstration of the serious threat posed to the public health in the absence of adequate diagnostic, therapeutic and epidemiological tools (Schimmer et al. 2012).

Infections caused by *C. burnetii* usually present asymptotically in livestock although the disease has been implicated in abortion, stillbirths, endometritis, mastitis and infertility (Radolakis et al. 2007; Angelakis and Raoult 2010; OIE, 2013). Infected animals shed *C. burnetii* in urine, faeces, milk, vaginal fluids, semen, placental and birth fluids (Guatteo et al. 2011; Rad et al. 2014).

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Humans become infected with *C. burnetii* through the inhalation of aerosolized bacteria (Ratmanov et al. 2013) and consumption of contaminated unpasteurized milk. An outbreak of human cases of Q fever reported in the Netherlands was linked to abortions in dairy goat and sheep farms (Angelakis and Raoult, 2010). Clinical cases of Q fever have been reported among the military and paramilitary deployed to Iraq (White et al. 2013). Clinical signs in humans include fever, fatigue, weight loss, pneumonia and hepatitis. Patients with underlying cardiac valve defects who get exposed to *C. burnetii* develop endocarditis or vascular infections (Wielders et al. 2015). Miscarriage and abortions have been reported as well (de Lange et al. 2015).

Regarding food and farm biosafety, *C. burnetii* is the most extreme risk to humans. Due to its qualities such as: small infectious doses, resistance to the environment, as well as air transmission routes, make it capable of causing non-communicable disease forms in groups with large populations. *C. burnetii*, is currently considered a potential bioterrorism agent and is classified by the CDC as a group B biological agent (Drancourt and Raoult, 2005; Kersh et al. 2010).

Given the mode of transmission and risk of exposure of Q fever to humans, a neglect of the disease among livestock farming communities could endanger the lives of those who work and live in close proximity to the livestock farms. The objective of this study was, by the statistical analysis of the data to investigate comparison of the average differences of positive frequencies with q fever among farm animals between regions of the western part of North Macedonia.

## MATERIAL AND METHOD

The study in question includes data related to the frequency of the Q-Fever in farm animals (sheep, goats and cows) in five regions of the western part of North Macedonia: Tetovo, Gostivar, Kicevo, Dibra and Struga. A total of 1,120 serums were collected. They were taken randomly without any preference. Blood samples were collected aseptically from the jugular vein directly into plain vacuum tubes. Samples were centrifuged at  $1500 \times g$  for 15 min to obtain sera. The serums after the 2ml plastic ampoule was set, they were kept at  $-30^{\circ}\text{C}$  until they were used. Antibodies to *C. burnetii* were detected by a commercial indirect enzyme-linked immunosorbent assay (ELISA test using microtitre plates pre-coated with the *C. burnetii* phase I and II strains). The ELISA kit was imported from ID vet – Montpellier in France. The functioning principle of the kit is as follows: the serums (that are to be examined) will be diluted in micro titration plates at 1:10. They are then incubated for 45 minutes and after rinsing, the conjugate is added and then other ingredients to finish with the stoppage solution. The incubation times have been strictly abode by in conformity with the preset criteria in the respective kit. The measurement of OD was made using a 450nm ELISA reader. The calculation of results (for every examined serum) was done based on the following formula:

$$S / P = \frac{OD_{\text{sample}} - OD_{\text{NC}}}{OD_{\text{PC}} - OD_{\text{NC}}}$$

Where upon: NC = Negative Control; PC = Positive Control; OPD sample = OD of the examined sample. The assessment of the examined serums is based on the data taken from the above-cited formula having in consideration that:

$$S/P \leq 40\% = \text{Negative}; 40\% - \leq 50\% = \text{suspicious}; \geq 50\% = \text{positive}$$

So, as recommended by the manufacturer, an animal was considered to be ELISA-strong positive if the optical density (OD) percent was over 80. An OD percent between 50 and 80 was considered positive. A doubtful ELISA result was noted if the OD percent was between 40 and 50, while an OD below or equal to 40 was considered a negative animal. The sensitivity and specificity of the ELISA test kit as provided by the manufacturer (ID vet – Montpellier in France) was 99% and 98%, respectively.

The study in question was carried out at the Virology Lab of the Faculty of Veterinary Medicine in Tirana, Albania.

Exploratory data analysis was performed to generate descriptive statistics. Categorical variables were compared using statistical methods Anova and Tukey. The Anova method was used with a confidence

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level of 0.01, to analyze the comparison of mean differences of the positive frequencies of Q fever between the regions. The homogeneity with the Tukey method was used with the reliability limits for the level of 95% of the sample in the regions grouping.

### **RESEARCH FINDINGS**

In our study, are involved 1120 samples of farm animals without any visible specific clinical signs in terms of the presence of the Q fever (508 sheep, 212 goats and 400 cows). The sample data have been separated from region to region (Tetovo, Gostivar, Kicevo, Dibra and Struga) in the western part of North Macedonia. The serologic examination confirmed the presence of antibodies to *Coxiella burnetii* in almost all zones, though with a different level in different areas and in different species. In the western part of North Macedonia, apart from the epidemiological situation of the Q fever in animals, we have investigated it also in the over-40 age group in the human population, in the same regions where also animals have been investigate, and we have noticed the presence of the infection with about 28.10% positivity from a total of 274 examined human serums (female gender with positivity 26.76% and male gender with 29.54%) (Reçi et al. 2020), yet, based on the findings of the foreign authors, we think that the infection of the people comes as a result of the presence of the infections in animals which plays an important role in spreading the cause in the environment, as well as through its airborne distribution. The results were processed with statistical methods Anova and Tukey, and are presented below:

#### **Comparison of the mean difference between animals infected (in total) between regions with the statistical method Anova**

By comparing the differences of the mean of positive frequencies with the Q fever between the regions, they were grouped and a comparison between them was made. For this conclusive analysis, the statistical method of Anova and the homogeneity of the regions were utilized.

**Table 1.** Comparison of the difference of the mean between the regions

Region	N	Mean	Std. Deviation	Std. Error	95% confidence		Min.	Max.
					Lower Bound	Upper Bound		
Tetovo	322	.13	.337	.019	.09	.17	0	1
Gostivar	298	.08	.273	.016	.05	.11	0	1
Dibra	151	.26	.443	.036	.19	.34	0	1
Kicevo	166	.28	.449	.035	.21	.35	0	1
Struga	183	.14	.350	.026	.09	.19	0	1
Total	1120	.16	.366	.011	.14	.18	0	1

In the first column from table 1 is shown the number of animals infected with Q fever between the regions, while in the second column is shown how the averages deviate from each other, e.g., the Kicevo region has the highest average of 0.28 compared to the Gostivar region average of 0.08 of the overall average.

**Table 2.** Coefficients obtained by the Anova method

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.159	4	1.540	11.959	.000
Within Groups	143.552	1115	.129		
Total	149.711	1119			

From the Anova table, we see and conclude that the difference between the groups is statistically significant for the level of reliability valued 0.01.

**Table 3.** Coefficients for multiple comparison

Region	Region	Std. Deviation	Std. Error	Sig.	Lower Bound	Upper Bound
Tetovo	Gostivar	.050	.029	.416	-.03	.13
	Dibra	-.134*	.035	.001	-.23	-.04
	Kicevo	-.147*	.034	.000	-.24	-.05
	Struga	-.012	.033	.997	-.10	.08
Gostivar	Tetovo	-.050	.029	.416	-.13	.03
	Dibra	-.184*	.036	.000	-.28	-.09
	Kicevo	-.197*	.035	.000	-.29	-.10
	Struga	-.062	.034	.359	-.15	.03
Dibra	Tetovo	.134*	.035	.001	.04	.23
	Gostivar	.184*	.036	.000	.09	.28
	Kicevo	-.012	.040	.998	-.12	.10
	Struga	.123*	.039	.016	.02	.23
Kicevo	Tetovo	.147*	.034	.000	.05	.24
	Gostivar	.197*	.035	.000	.10	.29
	Dibra	.012	.040	.998	-.10	.12
	Struga	.135*	.038	.004	.03	.24
Struga	Tetovo	.012	.033	.997	-.08	.10
	Gostivar	.062	.034	.359	-.03	.15
	Dibra	-.123*	.039	.016	-.23	-.02
	Kicevo	-.135*	.038	.004	-.24	-.03

Table 3 presents the analyzes with the Tukey method for detailed comparisons between one region with all other regions. Their statistical indicators and reliability limits for the 95% sample level are presented in the following table:

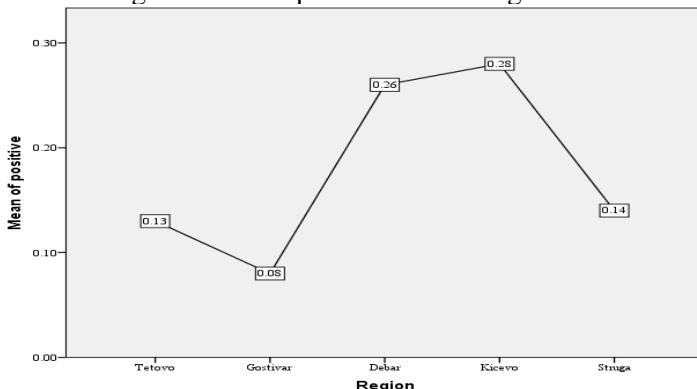
**Table 4.** Coefficients for ranking cities according to the mean difference

Tukey HSD			
Region	N	Subset for alpha = 0.05	
		1	2
Gostivar	298	.08	
Tetovo	322	.13	
Struga	183	.14	
Dibra	151		.26
Kicevo	166		.28
Sig.		.416	.997

Table 4 of homogeneity with the Tukey method, shows that the frequencies of our sample have grouped the regions into two groups according to similarity. In the first group: the regions of Gostivar, Tetovo and Struga are similar in terms of the mean difference, while the second group includes the regions of Dibra and Kicevo, all this for 95% of the sample. So, the regions of Dibra and Kicevo are by 0.26 and

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0.28 above the overall average in contrast to the regions of Gostivar, Tetovo and Struga which are below 0.15 lower than the overall average. All this is presented in the figure below:



**Figure 1.** Presentation of regions according to the mean frequencies of Q fever

### **Comparison of the means differences between animal species with the statistical method Anova**

To analyze the differences in means between animal species, descriptive statistics are firstly presented as follows:

**Table 5.** Comparison of the mean differences between animal species

	N	Mean	Std. Deviation	Std. Error	95% confidence interval for mean		Mean	Max.
					Lower Bound	Upper Bound		
Sheep	508	.26	.441	.020	.23	.30	0	1
Goats	212	.07	.249	.017	.03	.10	0	1
Cows	400	.08	.264	.013	.05	.10	0	1
Total	1120	.16	.366	.011	.14	.18	0	1

Table 5 shows that the mean of sheep moves by 0.26 above the total average, despite the low mean of cows and goats by 0.08 and 0.07 above the total average, with standard deviation from 0.249 to 0.441.

**Table 6.** Coefficients obtained by the Anova method

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10.232	2	5.116	40.970	0.000
Within Groups	139.479	1117	.125		
Total	149.711	1119			

The difference of the means between the groups is statistically significant for the level 0.01, ascertained from the Anova table above.

**Table 7.** Coefficients for multiple comparison

(I) Species	(J) Species	Mean Difference (I-J)	Std. Error	Sig.	95% confidence interval for mean	
					Lower Bound	Upper Bound
Sheep	Goats	.198*	.029	.000	.13	.27
	Cows	.189*	.024	.000	.13	.24
Goats	Sheep	-.198*	.029	.000	-.27	-.13
	Cows	-.009	.030	.952	-.08	.06
Cows	Sheep	-.189*	.024	.000	-.24	-.13
	Goats	.009	.030	.952	-.06	.08

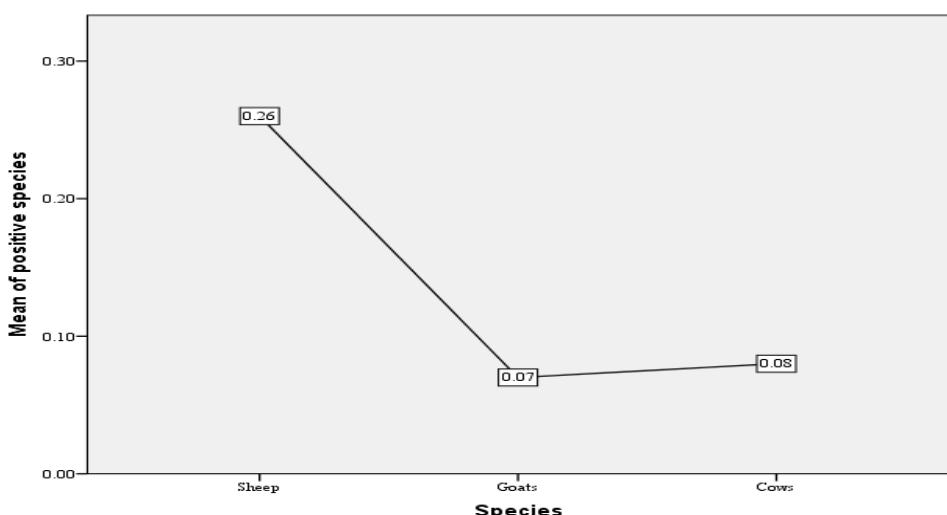
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From the multiple comparison in the table 7, can be noticed the differences between one type with other types as well as their reliability indicators.

**Table 8.** Coefficients for classification of species according to the mean difference

Species	N	Subset for alpha = 0.05	
		1	2
Goats	212	.07	
Cows	400	.08	
Sheep	508		.26
Sig.		.944	1.000

Based on the analysis in table 8, we can also divide the animal species into two groups according to the similarity of the positive frequencies. In the first group, goats with an average of 0.07 and cows with an average of 0.08 are distinguished, while in the second group, sheep with an average of 0.26 are distinguished from the first group. In the graph presentation, this movement of means looks like this:



**Figure 2.** Presentation of animal species according to the mean frequencies of Q fever

## **CONCLUSIONS AND DISCUSSION**

Although the chi-square method has proven that there is a relation among the five regions in the spread of Q fever infection (Reçi and Qoku, 2017), anyway, the statistical method of the mean differences between the regions has found that there is a mean difference between the regions and this difference distinguishes the regions of Dibra and Kicevo as regions with the highest prevalence of Q fever, in contrast to the regions of Gostivar, Tetovo and Struga, but with a higher standard error in the averages of Dibra and Kicevo, which indicates that this the phenomenon will not be constant with increasing sample number.

The difference in mean values among the different animal species affected by the Q fever in the five regions shows that sheep are the most affected compared to goats and cows, with a statistically significant mean variation. With the increase of the number of examined animals, the difference trend will also increase, i.e., the number of affected sheep in contrast to goats and cows will increase too (because the standard deviation does not differ much among the three species).

In animals, measures should be implemented to control Q fever, especially for domestic ruminants. Only a combination of measures can be effective in fighting this infection. Long-term options, including vaccination, changes in farm characteristics, manure management, animal shearing management, special places for giving birth and keeping little ones, elimination of risk materials, entry ban in stables, the total slaughter of infected animals, the identification and elimination of animals that are eliminators of the microorganism and the control of animal movement, are considered the most optimal measures in case of human outbreaks.

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Although in many countries of the world there is no accurate overview of the presence of this infection, in order to establish the rate of infection in other parts of the country and access the need for inclusion of Q fever among diseases under surveillance, action must be taken in order to recognize the situation and to stop outbreaks in animals and humans. Further study is required Collaboration between the Veterinary Services and Ministry of Health is the key to control diseases in the country.

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