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6th International Conferences on Science and Technology

Budva, Montenegro

Life Science and Technology

Abstracts & Proceedings Book

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ICONST LST 2023

International Conferences on Science and Technology

Life Science and Technology

August 30 - September 1, 2023 in Budva, MONTENEGRO

ABSTRACTS
&
PROCEEDINGS BOOK

ICONST LST 2023

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International Conferences on Science and Technology

Life Science and Technology

August 30 - September 1, 2023 in Budva, MONTENEGRO

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ICONST LST 2023

International Conferences on Science and Technology

Life Science and Technology

August 30 - September 1, 2023 in Budva, MONTENEGRO

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International Conferences on Science and Technology

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Dear Readers;

The sixth of ICONST organizations was held in Budva/Montenegro between August 30 - September 1, 2023 with the theme of '***science for sustainable technology***' again. In recent years, weather changes due to climate change have reached a perceptible level for everyone and have become a major concern. For this reason, scientific studies that transform technological progress into a sustainable one is seen as the only solution for humanity's salvation. Here we ask ourselves "which branch of science is responsible for sustainability?". Sustainability science is an interdisciplinary field of study that covers all basic sciences with social, economic, ecological dimensions. If we consider technology as the practical application of scientific knowledge, the task of scientists under these conditions is to design products that consume less energy, require less raw materials, and last longer.

ICONST organizations organize congresses on sustainability issues of three main fields of study at the same time in order to present different perspectives to scientists. This year, 136 papers from 22 different countries presented by scientists in **ICONST Organizations**.

89 papers from 14 countries presented in our **International Conference on Engineering Science and Technology** organized under ICONST organizations. Türkiye leads the way with 48.8% of the participants, followed by Poland with 17.9%, Kosovo with 8.3%, Algeria, Azerbaijan and Montenegro with %4.8, Hungary with 2.4, Italy, Iraq, North Macedonia, Netherland, Iran, Bangladesh and South Africa with 1.2%.

25 papers from 11 countries presented in our **International Conference on Life Science and Technology** organized under ICONST organizations. Türkiye leads the way with 40% of the participants, followed by North Macedonia with 13%, Kosovo and Poland with 8.7%, Sweden, Finland, United Kingdom, Czech Republic, Portugal, Iran and Slovakia with 4.3%.

Finally, 22 papers from 9 countries presented in our **International Conference on Natural Science and Technology** organized under ICONST organizations. Türkiye leads the way with 45.5% of the participants, followed by Kosovo, Russia, Poland and Azerbaijan with 9.1% and India, Ethiopia, Serbia and Albania with 4.5%.

As ICONST organizations, we will continue to organize organizations with the value you deserve in order to exchange ideas against the greatest threat facing humanity, to inspire each other and to contribute to science. See you at your future events.

ICONST Organizing Committee

ICONST LST 2023

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Decay Resistance and Weathering Properties of Thermally Modified on Black locust Wood

Abdullah Beram*[1]

Abstract: In this study, the decay resistance and weathering properties of sapwood and heartwood of black locust (*Robinia pseudoacacia* L.) wood was determined. As described in the EN 113 test standard, the decay test was carried out using and brown rot fungus; *Inonotus hispidus* (Bull.: Fr.) Karst.and white rot fungus; *Heterobasidion annosum* (Fr.) Bref. sensu stricto. The thermal modification process was applied in a laboratory environment at 160 °C, 180 °C and 200 °C. The highest weight loss was detected in the sapwood of the brown rot fungus. It was observed that as the degree of thermal modification applied increased, the weight loss decreased. In the heartwood, no weight loss was detected in heat-treated samples caused by fungi. At the end of the study. It has been determined how resistant the wood is to the studied fungi both naturally and by thermal modification.

Keywords: Decay, weathering, thermal modified, brutian pine

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Acoustic Characterization vs. Luthier's Senses to Select Local Substitutes for Exotic Famous Tonewoods

Mehran Roohnia*[1], Tuğba Yılmaz Aydın[2]

Abstract: Luthiers typically rely on their senses for choosing appropriate wood for crafting musical instrument bodies. They assess wood through touch, smell, sight, and even by listening to its taptone when struck. However, these sensory evaluations cannot reveal the wood's history, including preparation and transport, nor microscopic issues from drying cycles during storage. This reliance on empirical methods can lead to errors.
Contrastingly, experience with local and affordable wood has yielded outstanding results, surpassing foreign counterparts. For instance, using indigenous woods like Caucasian Spruce instead of costly exotic alternatives has notably enhanced classical guitar soundboards, showcasing potential for luthiers.
Therefore, employing acoustic tests, closely similar to auditory assessments, supported by modern precision tools, is crucial, especially for experimental luthiers. Academic researchers should share these tools' mechanized accuracy with the luthier community.
This article reintroduces density, elastic stiffness, damping capacity, acoustic velocity ratio, sound radiation coefficient, mechanical impedance, and acoustic conversion efficiency as parameters. It presents findings from research on various wood samples from the Middle East to the Caspian Sea, including special types like Caucasian Spruce as well as some outstanding examples of hard woods, comparing them with known exotic tonewoods. Suggestions for enhancing or moderating these parameters are also offered. Some chosen woods also possess aesthetic value on par with foreign counterparts, are illustrated through accompanying visuals.

Keywords: acoustic, exotic, grading, luthier, musical instrument, Tonewood

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Modeling of importance values of *Pinus nigra, Pinus brutia,* and *Cedrus libani* species using random forest method

Kürşad Özkan[1], Serkan Özdemir*[2], Mehmet Güvenç Negiz[2], Özdemir Şentürk[3], Nurbanu Bursa[4]

Abstract: Importance value is a metric of the relative dominance of a tree species within a specific forest area. It serves as a standardized methodology employed by forestry professionals for the purpose of forest inventory. Rather than attempting to count all individual trees, foresters typically adopt a sampling approach by selecting specific points within the forest and assessing a designated area surrounding those points. It is typically calculated based on various factors, including relative frequency, relative density, and relative basal area within the community. Each of these values is expressed as a percentage, ranging from 0 to 100. The importance value is derived by summing these three measures, resulting in a range of 0 to 300. A high importance value indicates that species X is well represented within the stand due to a combination of factors: a) a substantial number of individuals of species X compared to other species in the stand, or b) a lower number of individuals of species X, but with larger tree sizes compared to other species in the stand. Based on this, data were obtained that enable the calculation of importance values for *Pinus brutia*, *Pinus nigra*, and *Cedrus libani* species distributed in the Aegean Region using the point-centered quarter method. The random forest method was performed to reveal the relationships between the importance values, which can be associated with species dominance, and environmental variables. As a result of the modeling conducted using the random forest method, the R-squared (r2) values for *P. nigra*, *P. brutia*, and *C. libani* species were determined as 0.46, 0.32, and 0.97, respectively. The variables that created the models were found to be bio7, bio3, slope, bio1, bio12, topographic position index, bio4, heat index, bio14, and ruggedness for *P. nigra*; bio14, topographic position index, bio1, bio7, and bio12 for *P. brutia*; and bio14, hillshade, heat index, and topographic position index for *C. libani*. The obtained results indicated that climatic factors could have a significant impact on the dominance of species within their distribution ranges. The mentioned results also highlighted the importance of considering climate variables in future planning related to modeled species.

Keywords: Black pine, Climate change, importance values, random forest, red pine, species distribution, taurus cedar

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Acknowledgements: In this study, data obtained from the TÜBİTAK project with the reference number 220 O 007 and titled "Distribution Modeling of the Main Forest Tree Species Under Climate Change in the Aegean Region" has been used.

Contamination Agent Application to Prevent Airborne Contamination in Tissue Culture Application of *Bacopa monnieri*

Onur Sinan Türkmen[1,2], Zeynep Karaceylan[2], Melike Küçük[1,2], Refika Ceyda Beram[3*]

Abstract: Airborne bacterial and fungal contamination is one of the most common biological contamination problems in plant tissue culture applications. In this study, it was carried out to determine the airborne bacterial and fungal contamination types in a tissue culture laboratory growth room and to determine the type and dose of contamination agent that can be used to prevent these contamination types. In the study, the *B. monnieri* plant propagated by the meristem culture method and the media covers were left open for 3 days. In the experiments carried out with three replications, the control group that did not contain any contamination agents and 3 and 6 mg/L PPM and Contaminacide agents were used to protect against contamination factors. The types of contamination were identified by keeping the lids closed for 35 days following the closing of the lids. In the study, *Bacillus* sp., *Clostridium* sp. *Lactobacillus* sp. bacteria and *Aspergillus* sp. and *Cladosporium* sp. fungal species were found in the control and 3ml/L PPM vessels. No development of airborne contaminants was observed in the tissue culture vessels of the two doses of the contamination agent named Contaminacide and the 6mg/L PPM dose of the contaminants. In conclusion it was concluded that both contamination agents can be recommended with different doses for disinfection against airborne contamination agents.

Keywords: Bacteria, fungus, disinfection, PPM, Contaminacide

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Efficacy of biological treatments on birch against Heterobasidion root rot

Sezer Olivia Kaya[1], Jonas Rönnberg[1], Michelle Cleary[1]

Abstract: Root rot caused by the fungal species complex Heterobasidion spp cause severe economic losses for the forest industry in the northern hemisphere. Although it is economically the most important fungus of conifers in the boreal forests, broadleaved trees can also become infected. Birch is the third most common species in Sweden and in Finland, with up to 13% and 16% of the total timber supply, respectively. It is one of the dominant species in Latvia, constituting 28% of standing forest. In Sweden, the birch plantations are planned to be increased in accordance with the aim to diversify the forests with fast growing broadleaves to sustainably meet the increasing demand for forest products. However, studies have shown that birch trees have risk of getting infected if planted on previously infected area, resulting in a decreased yield or death of the trees. Besides, stumps can be infected after thinning and become an entry point for Heterobasidion spp to the stand. Heterobasidion infection on conifers can be prevented to a high extend using biocontrol treatments RotStop, which contains Phlebiopsis gigantea saprophytic fungus spores, and Basinox, which contains Pseudomonas spp. bacteria. This study aims to analyse the efficacy of biological treatments Rotstop and Basinox on birch in the field by treating freshly cut birch stumps and comparing the Heterobasidion infection levels between treated and untreated stumps.

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Defining the unknown distribution of Diplodia sapinea in Finland

Eeva Terhonen[1]*, Markus Melin[1], Tiina Ylioja[1], Suvi Sutela[1]

Abstract: *Diplodia sapinea* is a newly identified pathogen affecting Scots pine (*Pinus sylvestris*) and juniper (*Juniperus communis* subsp. *communis*) in Finland. While it maintains an endophytic lifestyle within its life cycle, various environmental factors such as drought, elevated temperatures, and solar radiation are believed to trigger its transition into a pathogenic state, leading to the development of a disease known as 'Diplodia tip blight'. First inventories based on citizen science indicated that *Diplodia sapinea* presence was restricted to the southwest coastal region of Finland. Citizen science proved effective in assessing the distribution of *D. sapinea*; in fact, as much as 30% of the collected samples tested positive for this fungal pathogen. Yet, the assessment was primarily focused on the citizens´ own properties, and mostly along the coastal regions. Therefore, a more systematic and targeted census was conducted on Scots pine growing in drought-prone areas.

For this census, spatial data on the locations of rocky/rugged areas (areas with surfacing bedrock) was downloaded from the topographic database of the National Land Survey of Finland. This was merged with raster data (volume of pine) on forest structure based on National Forest Inventory. The outcome allowed us to identify areas where pine-dominated forests were growing on rocky/rugged, i.e. drought-prone areas (all of the used datasets are open access and cover the entire country). Next, our area of interest (central and southern Finland) was delineated into 25 km grid cells and five locations of the identified rugged pine forests were randomly selected for each grid cell. Finally, field samples (twigs, cones) were collected from these locations to detect the presence of *D. sapinea.*

The results showed that *D. sapinea* presence extends to inland regions of Finland as well and is very likely more extensive than previously assumed. Further surveys are aiming to determine the northernmost range of the pathogen, being made possible by the nationwide open access data on forest structure, topography, and the environment.

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Human Activities and Global Biota Distribution: Challenges and Potential Solutions

Marta Bełka[1]*

Abstract: Over the past 500 years, the geographical barriers that maintained a relatively stable distribution of biota worldwide for millions of years have been dismantled due to human activities, leading to the expansion of organisms beyond their natural ranges (Richardson et al., 2000). In the last century, the expansion of organisms has significantly escalated, primarily driven by the increase in international travel and trade, resulting in extensive disruptions to ecosystems and serious socio-economic consequences (Aukema et al., 2011). Consequently, previously absent pathogens are increasingly emerging in certain areas, along with the appearance of new, pathogenic strains. The potential impact of these invasions on our trees and ecosystems is a pressing concern. Can we prevent such invasions, and what measures can we adopt to protect ourselves from their effects? This paper addresses these crucial questions and explores potential strategies for mitigating the threats posed by the disruption of natural biota distribution.

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Unravelling Fungal Communities in Pinus pinea Seed

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Abstract: *Pinus pinea*, a keystone species in Mediterranean ecosystems, has a prominent economic role due to its highly valued edible seeds. However, climate change and invasive pests, particularly *Leptoglossus occidentalis*, have caused a decline in pine nut production in Mediterranean countries, including Türkiye. This has resulted in significant economic losses and a reduction in the availability of healthy seeds. Therefore, it is crucial to consider the factors that affect seed development, storage, and movement to ensure the health of future forests. Fungi that colonize seeds can act as pathogens, decay agents, or biological control agents that protect the seed from biotic and abiotic disturbances. However, fungal communities associated with *P. pinea* seeds and pine nut yield loss still require further exploration. This study aimed to investigate the fungal communities in *P. pinea* seed.

Seed were collected from the Kozak (İzmir), Türkiye, where pine nut decline and *L. occidentalis* presence are pronounced. Fungal communities of the seed were investigated via culture-based methods followed by ITS sequencing. Although a fraction of fungi (8.2%) remained unidentified, seed were primarily colonized by pathogenic fungi. *Alternaria* spp. emerged as the predominant colonizers of the seed (66 %), followed by *Sydowia polyspora* (14.1%). Other pathogenic fungi – *Diaporthe* spp., *Cytospora* sp., *Fusarium* spp., and *Diplodia sapinea* - accounted for 4.1%, 2.4%, 1.2%, and 0.6% of isolates, respectively. While *D. sapinea* and *S. polyspora* have a history of association with pine and *P. pinea* seeds, to our knowledge, *Cytospora* spp. and *Diaporthe* spp. have not been reported to colonize seed of *P. pinea* to date.

The dominance of pathogenic fungi colonizing seeds raises concerns about their impact on seed and seedling health, forest sustainability, and the potential risk posed by seed movement. While further investigation is needed to confirm the identity of these fungi, as well as their pathogenicity on seed and seedlings and their implications for ecosystem resilience, these results emphasize the need for intensified attention to seed and seedling production, as well as implementing effective biosecurity measures. This study also highlights the intricate role of fungal interactions in shaping the future of *P. pinea* in Mediterranean ecosystems.

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Risk Of Lyme Disease For Humans And Animals Following A Tick Bite In City Parks In Wrocław, Poland

Sara Al-Ameri*[1], Daria Będkowska[1], Jan Baran[1], Natalia Ozierańska[1], Magdalena Karwańska[2], Magdalena Siedlecka[2], Marta Miszczak[2], Jarosław Pacoń[3], Karolina Bierowiec[2]

Abstract: Ticks of the species *Ixodes ricinus* and *Dermacentor reticulatus* are common parasitic arachnids in Poland. They are of great importance as a reservoir and vector of pathogens such as *Borrelia burgdorferi*, which causes Lyme disease in humans and animals. The aim of the study was to determine the habitat of particular ticks species and the frequency of *B. burgdorferi* carried by them. The ticks were collected in three of the largest and the most frequently visited city parks from May to October 2022. A total of 385 individuals representing both species of ticks were collected (*I. ricinus* n=236 and *D. reticulatus* n=149). During the next stage of the research, the presence of *B. burgdorferi* genetic material was detected using the real-time PCR method. The prevalence of *B. burgdorferi* in ticks was 44.30% in *I. ricinus* (CI 95%: 33.35 - 55.26%) and 1.23% (CI 95%; 0 - 3.64%) in *D. reticulatus*. Occurrence of the ticks was seasonal - the most frequent *I. ricinus* were collected in July (n=139) and the peak occurrence of *D.reticulatus* was in October (n=141). Research shows that a tick bite in a city park carries a real risk of *B. burgdorferi* infection for humans and animals. The research was co-financed by the Student Activity Fund (FAST 2022) of the Wrocław City Hall.

Keywords: Lyme diseases, public health, tick-borne diseases, Borrelia, veterinary epidemiology

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Utilization of Melamine Impregnated Paper Waste Water as a Humidity Regulator in the Manufacturing of Particleboard

İbrahim Halil Başboğa*[1], Özcan Yüce[2]

Abstract: Three-layer particleboards are the most preferred wood-based boards in modular furniture manufacturing due to their ease of processing and low cost. In the production of three-layer particleboard, mat moisture is one of the factors affecting the board properties. Especially the moisture content of the chips in the surface layers is vital for the heat transfer required for the curing reaction of the resin in the core layer. Within the scope of this study, it is aimed that the core layer moisture values set to between 8-9% and the surface layer moisture values set to between 11-12%. For this purpose, MIPW water obtained using by melamine-impregnated paper waste (MIPW), which is a waste of particleboard production, was used as a humidity regulator. In producing particleboard, Urea Formaldehyde resin (1.3 moles and with 65% solid content) was used at 5 different rates. Ammonium Chloride, with a solid content of 25%, was used as a hardener, and paraffin, at a solid content of 60%, was used as a water-repellent chemical. The effects of reducing UF adhesive usage on particleboards' technological properties in the board groups in which MIPW water is used as a humidity regulator were investigated. In addition, panel groups in which only melamine-impregnated paper wastes were used as adhesive were produced and comparisons were done between the groups. The mechanical (internal bond strength, screw withdrawal strength, bending strength, modulus of elasticity), physical (density, surface soundness, thickness swelling and water absorption) and formaldehyde emission properties of the particleboards were determined in accordance with the relevant standards. As a result, in the board groups where only MIPW water was used as an adhesive, the chips did not adhere, and the board production could not be realized. Although the mechanical and physical properties of the particleboards deteriorated with the adhesive content reduction, the adhesive amount was reduced by half with the usage of MIPW water. Moreover, the mechanical values of this group, where the resin content is reduced by 50%, provided results above the desired values in the standard (except screw holding strength). However, the amount of resin was successfully reduced in the MIPW water-used groups. As a result, it is possible to say that MIPW waters contain Melamine Formaldehyde resin and that these waters can be used as humidity regulators in the production of three-layer particleboard.

Keywords: Particleboard, MIPW, Humidity regulator, Mechanical and physical properties.

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Financial Education of Consumators for Insurance in Albania

Marsela Resulaj*[1],

Abstract: In Albania, there are 35 types of insurance which make it possible to cover every area from health, accidents, life, property and business. Education on insurance is still a package for consumers and their knowledge is minimal, analyzing in this article that Albanians are more preoccupied with insuring the car than their health.
What is insurance in Albania? From a legal point of view, insurance in Albania is divided into: Mandatory Insurance
Voluntary Insurance. Mandatory insurance is insurance defined by a special law of the Albanian State. Even in Albania, as in many countries of the world, some businesses that with their activity present a high risk to third parties, are obliged by law to provide compulsory insurance to damages caused to third parties. In Albania, compulsory insurance before 1991 was applied to some types of property insurance, but not to third party liability insurance. In 1993, compulsory third-party insurance of motor vehicle owners began. Importance of compulsory insurance:
– Safe compensation of third party damages
– The security it offers to the injured
– Avoids social conflicts between the parties (the injured and the cause of the damage).
Insurance is a contract, represented through an insurance policy, in which individuals or entities receive financial protection or indemnification against losses that may be incurred as a result of an unexpected life event. Insurance companies build the "customer pool", assess the risks, enabling affordable payments for those who want to be insured.
But financial education is a 'set' of essential life skills that should be nurtured as early as possible in order to foster responsible financial behaviour, to understand why it is important to be insured and what is insurance culture and how, through these, they will be good at controlling their finances, today as the new generation, and tomorrow as responsible citizens of a society. Education is a matter of national importance, many countries around the world have already accepted and included this component of financial and insurance education as part of their school curricula. One of the main challenges in Albania, as everywhere, is the increase of knowledge and awareness on financial issues, the role of financial knowledge in changing current individual behaviors such as maintaining personal financial expenses, planning and long-term financial management, as well as the choice of different financial products based on informed decisions and on available evidence.

Keywords: Insurance, culture, knowledge, financial education.

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Habitat Suitability Mapping of Cinereous Vulture within the Scope of Sustainable Forestry

Ahmet Acarer*[1]

Abstract: For migratory birds, there are 4 important bird migration routes in the world. It is refuge to various bird species as two of the migration routes in the world pass through Turkey. In other words, Turkey has many endangered or migratory bird species thanks to its geographical location. Cinereous vulture which is an endangered species is distributed in Turkey. However, there is no study that reveals suitable habitats based on numerical and model for the Cinereous vulture in Turkey. Therefore in this study, it was aimed to reveal the numerical and model-based habitat suitability of the Cinereous vulture. For this purpose, 352 present data of the Cinereous vulture were obtained from the GBIF. Then, 40 environmental variables that may influence the species and 19 current chelsa climate variables were produced based on the study area boundaries. Before starting the modelling phase, environmental and chelsa climate variables were statistically evaluated by correlation and factor analysis. According to the results of the analysis, the modelling phase was started with 32 variables that may be effective in the species distribution. According to the results of 31 different models using the maximum entropy, it was revealed that the 28 model is a valid model with 3 replication training data (AUC: 0.856) and test data (AUC: 0.842). It has been revealed that the variables contributing to the model are Bedrock, Precipitation seasonality, Isothermality and Landform Classification. As a result, according to the variable value results that may be effective in the distribution of the species, areas that are important for the conservation and sustainability of the species have been determined.

Keywords: *Aegypius monachus* L., Forestry management, Wildlife diversity, Numerical and model-based mapping,

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Green Management İn Privately Owned Hospitals

Pelin Yılık[*1]

Abstract: Hospitals and health institutions, which were established to provide the best service to people, serve to help people with their physiological and psychological states. These institutions also work on considering the built environment and green hospital designs to minimize environmental damage, meet changing consumer demands, and meet the needs of future generations in a sustainable manner. These facilities, called green buildings, are defined as structures that respect nature, are ecological, comfortable and minimize energy consumption. The green hospital concept can also be preferred by healthcare institutions in terms of minimizing costs through recycling and renewable energy sources in the face of increasing costs. Increasing awareness, sensitivity and sensitivity about the consumption of scarce resources due to the increasing elderly population, urbanization and increasing education levels have further increased the importance of the green hospital concept.

The study highlights the definition and characteristics of green management and green hospitals. The concept of green management includes practices such as energy and water efficiency, waste reduction, use of environmentally friendly materials and reducing the carbon footprint. These approaches contribute to hospitals increasing their environmental sustainability, efficiency and acting in accordance with their social responsibilities.

The study aims to guide hospitals trying to reduce the environmental impact of the healthcare sector and increase their sustainability and efficiency by emphasizing the importance and application areas of green management in private hospitals.

Keywords: Green management, green management in private hospitals, green hospital.

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Comparison of Paraffin, Resin and AKD in Viol in Terms of Hydrophobicity and Strength

Arif Karademir[1] and Hülya Varlibaş Başboğa*[1]

Abstract: In our country and in the world, the issue of recycling in the paper industry continues to take more and more place as it is case in many products market today too. World countries aim to contribute to their economic policies by increasing recycling rates. It is naturally much more economical to use waste paper instead of primary fiber, especially in outer packaging boxes and molded products such as disposable egg trays. However, converting waste paper into a new product is not that easy, depending on the characteristics of the fiber in the waste paper, the components they contain and the number of recycling. In viol production, the visuality of the product, its strength value and its resistance level against water/liquid penetration are extremely important. In addition, viols produced from waste paper can retain the perspiration and ambient humidity that may occur in the eggs. In addition, they are not affected by the ambient temperature, do not produce static electricity and have important advantages such as odor trapping. Moreover the use of hydrophobic chemicals makes a multifunctional additive, as the water vapor and water absorption value directly affect the strength of the material in viol and paper-based products. In this study, the strength and water resistance values of paraffin, resin and AKD emulsions in viol pulp were tried to be analyzed comparatively.

Keywords: Waste paper, Packaging, Viol, AKD, Paraffin, Resin.

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Damage of *Diplodia sapinea* in the *Pinus pinea* Plantation in Sinop Province

Ayşe Gülden Aday Kaya[1]

Abstract: *Diplodia sapinea* is an opportunistic pathogen that can acquire pathogenic character on hosts exposed to abiotic stress factors such as drought caused by climate change. The presence of Diplodia shoot blight in *Pinus pinea* plantations was determined in Inceburun-Sinop province. The sampled trees showed symptoms of *Diplodia sapinea* infections. Fungus isolates obtained from affected trees were identified as *D. sapinea*, based on morphological characteristics of cultures and conidia grown on agar plates. The identifications were confirmed by sequence analysis of the ITS rDNA of a subsample of isolates. *D. sapinea* inoculations caused dark brown to black discoloration around the inoculation points in twigs tested. It had serious impacts on *P. pinea* in the surveyed plantation, and is likely to have been the main causal agent of shoot blight and reductions in seed production at this location.

Keywords: shoot blight, fungal pathogen, stone pine

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1. INTRODUCTION

Conifers are particularly vulnerable to climate change because of their lengthy lifespans, which prevent them from quickly adapting to changes in their environment (Lindner et al., 2010). They are also closely linked to abiotic and/or biotic variables (Ben Jamâa et al., 2005; Hasnaoui et al., 2005; Sanchez et al., 2003).
The stone pine (*Pinus pinea*) is one of the most distinctive tree species in Mediterranean ecosystems, particularly because its edible pine nut kernel seeds have been consumed for centuries. Due to the development of multiple-use forest management, stone pine is regarded as the most valuable pine species in Turkey. Natural and planted forests dominated by *P. pinea* are mainly distributed in Spain (490,000 ha), Portugal (130,000 ha), Italy (40,000 ha) and Turkey (183,128 ha; Kılcı et al. 2014). The General Directorate of Forestry, the largest producer, provided the data for the inventory studies, which determined that there were 27,880 tons of viable pine nuts spread throughout an area of 84,809 hectares.

Diplodia sapinea (Fr.) Fuckel is an endophytic fungus in the Ascomycota phylum and is commonly seen in coniferous trees. It is also an opportunistic pathogen that can acquire pathogenic character on hosts exposed to abiotic stress factors such as drought caused by climate change. The fungus penetrates the host through damaged tissues, stomata, or needle punctures. Ghelardini et al. (2016) reported that cryptic and hidden pathogens such as *D. sapinea* are among the most critical causes of fungal diseases in forests. This pathogen is common in North America (Stanosz et al., 2001; Stanosz et al., 2007; Paez and Smith 2018), Central Europe (Langer et al., 2011; Fabre et al., 2011; Busskamp et al., 2020), and Southern Europe. Considering the reports (Feci et al., 2002; Hernandez-Escribano et al., 2018), it poses a significant threat to the Northern Hemisphere. Recently, sudden outbreaks of the diseases caused by the fungus have also been reported in northern Europe. It is well known that warming and drought-related stresses enable *D. sapinea* to change its mode of life from endophytic to pathogenic (Blodgett et al., 1997a; Stanosz et al., 2001; Blumenstein et al., 2020). Due to prolonged high temperatures and drought exacerbated by intense sunlight, trees lose vigor due to this fungus (Blumenstein et al., 2021). Studies have reported that pines stressed by drought and/or hail are more susceptible to disease outbreaks from this factor (Swart and Wingfield, 1991; Busskamp, 2018). Increased plant susceptibility to fungal pathogens has also been mentioned, as drought-induced metabolic disturbances often lead to pathogen infestations (Desprez-Loustau et al., 2006; Sturrock et al., 2011; Sherwood et al., 2015). Recently, Diplodia shoot blight has been reported to gradually increase in forests due to temperature and drought (Blumenstein et al., 2020).

In June 2023, shoot blight symptoms were observed on *Pinus pinea* plantation located in Inceburun-Sinop. The aim of the present study was to determine the causal pathogens of shoot blight in the area.

2. MATERIAL AND METHOD

The stand was located 80 m a.s.l., in Sinop- Inceburun province. The stand was degraded oak and fir forest and in 2013 was afforested with *Pinus pinea*. Twenty symptomatic and symptomatic shoots taken from ten pine trees were examined

for the presence of pycnidia typical of *D. sapinea* under a dissecting microscope. Pycnidia were transferred to potato dextrose agar (PDA Merck 1.10130) and incubated at 24°C for 5 d. In total, 6 isolates were obtained. Morphological features of the conidia collected from pynidia on shoots were examined under a binocular microscope, and cultural characteristics of the isolates were examined using pure cultures grown on fresh PDA. Isolates were sub-cultured to cellophane membranes covering PDA and incubated at 24°C for 7 d. The mycelium was then scraped of the membrane surfaces and ground in liquid nitrogen using a mortar and pestle. DNA was extracted using DNeasy Plant Mini Kits (Qiagen) following the manufacturer's instructions. PCR amplification of the internal transcribed spacer (ITS) region of the rDNA gene was performed using the primer set ITS1 (5'–TCCGTAGGTGAACCTGCGG–3') and ITS4 (5'–TCCTCCGCTTATTGATATGC–3') (White et al. 1990) in 50 µL reactions. Each reaction containing 50 ng genomic DNA, 250 nM of each primer, 200 µM of each dNTP, 25 mM MgCl2, 1U Taq polymerase, 1 × Q solution, and 1 × PCR buffer (Promega Corporation). PCR was conducted in a Biorad MJ Mini Personal Termal Cycler. PCR conditions were denaturing at 95°C for 10 min, followed by 30 cycles of amplification (20 s denaturation at 94°C, 25 s annealing at 55°C, and 2 min extension at 72°C). PCR products were separated by electrophoresis in 1% (w/v) agarose.

Pathogenicity of the *D. sapinea* isolates was performed using 20 cm twig of *P. pinea* which was obtained from 20 years old tree located in Isparta. Five isolates of *D. sapinea* grown on PDA were used for the inoculations.
The inoculation point was cleaned with 70% (v:v) ethanol. A circular 3 mm diam. wound was made in the stem of each twig using a sterilized cork borer to remove the bark. An equal-sized agar plug colonized by *D. sapinea* was inserted into each wound and wrapped with Parafilm M®. Experimental controls were mock-inoculated with non-colonized agar plugs. Inoculated twigs were incubated in the growth chamber for 4 weeks, after the incubation period, the lesion lengths were measured. Random re-isolations were made onto fresh PDA to confirm *Diplodia* sp. as the causal agent of the lesions.

3. RESULTS

Trees assessed in the plantation had symptoms of *Diplodia* infections. Needles on infected shoots were brown to black. Needles that were dead for longer periods were greyish brown or dark grey. Shoots from all sampled trees yielded conidia characteristic of *D. sapinea*. Pycnidia were abundant on the color changed shoots. Healthy-looking shoots did not have any pycnidia. A total of 6 isolates were obtained from shoot and cone samples and identified as *D. sapinea*. Conidia were brown to dark brown, thick-walled, with a mean width of 18.0 µm (SD ± 2.7) (range 10 to 21 µm) and mean length of 34.0 µm (SD ± 5.2) (range 21–41 µm) (n = 100). Morphological identifications of the isolates were confirmed by sequence analysis of the ITS rDNA of representative isolates. The sequences showed homologies > 99% with GenBank accessions of *D. sapinea*.

Diplodia sapinea inoculations caused dark brown to black discoloration around the inoculation points in twigs tested. Infection frequency in the inoculated twigs was 100%. The pathogen was successfully re-isolated from symptomatic stem tissues, thus fulfilling Koch's postulates.

4. DISCUSSION AND CONCLUSIONS

It was evident that *D. sapinea* was the cause of shoot blight and decreased seed production in *P. pinea* trees at this location based on the morphological characteristics of the pathogen in culture, ITS sequencing of isolates obtained from sampled trees with the symptoms, and the pathogenicity tests carried out on excised twigs of the same host. Throughout the tree crowns, typical Diplodia shoot blight signs (Maresi et al., 2007) could be seen. The middle and upper crowns suffered the most significant damage. Colony morphology of the isolates obtained here was identical to that of the *D. sapinea* described in Aday Kaya et al (2019). The presence of abundant pycnidia on branches, stems and cones of infected trees illustrated the potential of this fungus to cause epidemics when conditions are favourable for infection and disease development (Nicholls and Ostry, 1990). *Diplodia sapinea* causes degeneration of edible seeds on *P. pinea,* with direct economic consequences (Santini et al., 2008). Moreover, the frequent occurrence of *Diplodia* symptoms on pine trees planted in urban landscapes and recreational areas has raised awareness of this pathogen among public administrations. Pathogens will expand their geographic range in response to climate change, which poses a severe concern, changing the effects of forest diseases on forest ecosystems. Since latent infections, which are frequently responsible for diseases brought on by drought, can remain in tissues without causing symptoms, the issue is even more serious. This study demonstrated unequivocally that Stone Pine trees are at risk from *Diplodia sapinea*.

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Author Contributions

Conflict of Interest
The authors have no conflicts of interest to declare.

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Investigation of Different Gelator Agents Efficiency of Spreadable Tahini

Dilara Top[1], Şerife Çevik[2*], Gülcan Özkan[1]

Abstract: Tahini is a food with high nutritional value, which is used extensively in our country. Turkish cuisine, tahini is consumed with molasses or honey in breakfast. However, apart from this, tahini can be consumed as a dessert by turning it into halva. Tahini is also frequently used in various desserts, cookies, cakes and pastries. In this study, it is to produce tahini as breakfast in the spreadable form that can be taken. Different gelling agents were used to make tahini spreadable form and were evaluated for its textural and sensory properties. The production of tahini spread in different concentrations with mono-di glyceride, stearin and beeswax, and the hardness and stickiness values of the obtained tahini in spreadable form were determined from the textural values. Mono-di glyceride was added to the tahini sample at 3%, 4% and 5% ratios and the hardness and stickiness values of the added samples were determined. The hardness value was determined in the range of 101.60- 373.34 g force, and the adhesive value was determined in the range of -22.27- -102.14 g force. Stearin, another gelling agent, was added to tahini at rates of 3%, 4% and 6%, and the hardness value was determined between 133.87-811.48 g force and the adhesive value between -51.16- -97.88 g force. Beeswax wax was added to tahini at the rates of 5%, 6% and 8%, and the hardness value was determined between 148.2-279.4 g force and the adhesive value between -49.56- -87.00 g force. The color, taste and odor characteristics of the tahini spread samples were evaluated sensorially and the tahini spread containing 4% mono-di glyceride was the most appreciated.

Keywords: Tahini, gelator, texture and sensory properties.

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1. INTRODUCTION

Sesame and tahini have an important place in Turkish history and gastronomy culture. Since the time of Ottoman Empire sesame and tahini have played crucial roles in pastry products serving as garnishes for bread, halva, pita bread, and buns. In addition, tahini is a product that consumers delight in, especially during winter breakfast when it is mixed with molasses (Batu, 2020). Tahini is derived through a series of processes involving the cleaning, shelling, roasting, and grinding of sesame seeds. Due to its nutritional and flavorful properties, tahini is widely consumed either on its own or in combination with other foods in various Asian, Middle Eastern, and Mediterranean countries. In the literature research, it was seen that numerous studies have been conducted on sesame and sesame oil, but there exists a limited number of studies on tahini. The composition of tahini primarily comprises 55-60% fat, 23-27% protein, 6.4-20% carbohydrates and 1-3% water (Özcan and Akgül, 1994, Batu, 2020). Tahini must possess distinct color, taste and smell. It must contain at least 55% sesame oil, a minimum of 1.5% water, a minimum of 22% protein, and a maximum of 0.1% salt. The acidity level should not exceed 2%, expressed as oleic acid (in the extract of sesame oil), and the crude cellulose content should not exceed 2.4%. Additionally, it should not contain any foreign matter. To prevent phase separation antioxidant and stabilizing substances permitted by the Turkish Food Codex may be added (Turkish Food Codex Communiqué on Tahini Halva [TGK], 2015b).

2. MATERIAL AND METHOD

Tahini, stearin and mono-diglyceride (gelling agent) supplied from Toposmanoğlu company in Isparta. The refined beeswax was obtained from the Kahlwax brand from Ejder Kimya A.S.

2.1. Spreadable Tahini Production

In the study, tahini served as the base material while beeswax, stearin and mono-diglycerides were utilized as gelling agents for producing spreadable tahini. The spreadable tahini was obtained by adding beeswax, stearin and mono-

diglyceride to tahini in accordance with the specified ratios provided in Table 1. In spreadable tahini production, the mixing temperature was adjusted according to the wax melting temperature (90 ◦C) and after the wax completely melted in the mixture, it was kept at this temperature for a certain time (5 minutes).

Table 1. Gelling Agents Ratio Used in Spreadable Tahini Production

Beeswax (%)	**Stearin** (%)	**Mono-di glyceride** (%)
5	3	3
6	5	4
8	6	5

2.2. Determination of Textural Properties of Spreadable Tahini Samples

To determine the textural properties of the spreadable tahini, the tahini spread samples were refrigerated overnight at A temperature of +4 °C after production. Following this period, the hardness and stickiness values of the samples were determined using a Texture Analyzer equipped with stainless ball probe (P/0.75S). The probe's speed was set at 1 m/s before the test and 2 m/s after the test. As soon as the probe reached a force of 0.5 g during the test, it penetrated the sample by 15 mm and then the hardness and stickiness values of the samples were recorded (Moskowitz, 1987).

2.3. Color Analysis

Spreadable tahini samples were storage overnight at refrigerator temperature (+4 °C) after production. The color values of these samples were determined using a Minolta Color Measurement device (CR-10, Konica Minolta, Osaka, Japan). Color measurements are expressed with the CIE (L*, a*, b*) color system. Three different measurments were taken for each sample under room conditions and the samples's color was determined by averaging these values.

2.4 Sensory Analysis

To determine the appropriate gelling agent and its proportion in the production of spreadable tahini, gelling agents were added to the tahini in specified proportions and left at room temperature overnight to achieve a spreadable consistency. Subsequently, sensory analysis of the samples that had attained a spreadable form was conducted using a hedonic scale. On this scale, evaluation of spreadable tahini samples was based on criteria such as surface appearance (color : dull white-light yellow, matte-shiny, homogeneous color distribution, oily appearance, rough appearance), structure (hardness, elasticity, chewability, rough structure, wetness in the mouth), odor (bad smell, unique pleasant smell) and taste (bland-pleasant, rancid taste, unpleasant foreign taste). This analysis helped determine which gelling agent would be suitable for use in the production of spreadable tahini.

3. RESULTS

Different gelling agents (mono-di gliserit, stearin and beeswax) were used to make spreadable tahini form and were evaluated for its textural properties, color values and sensory properties. The production of tahini spread at various concentrations with mono-di glyceride, stearin and beeswax as well as the hardness and stickiness values of the resulting resulting spreadable tahini were determined based on the textural values provided in Table 2.

Table 2. The spreadable tahini samples textural values (hardness and stickiness values)

Samples	Concentration(%)	Hardness (g, force)	Stickness (g, force)
Mono-di gliserit	3	101.60	-22.27
Mono-di gliserit	4	209.38	-69.76
Mono-di gliserit	5	373.34	-102.14
Stearin	3	133.87	-51,16
Stearin	5	250.56	-87,5
Stearin	6	811.48	-97,88
Beeswax	5	148.2	-49.56
Beeswax	6	189.81	-61.50
Beeswax	8	279.4	-87.00

The production of spreadable tahini with different concentrations of mono-diglyceride, stearin and beeswax is detailed in Table 2, along with the associated textural values (hardness and stickiness values). Mono-di glyceride was added to the tahini sample at ratios of 3%, 4% and 5% and the hardness and stickiness values of these samples were determined. The hardness value was determined in the range of 101.60- 373.34 g force, and the adhesive value was observed in the range of -22.27- -102.14 g force.
Stearin, serving as another gelling agent, was added to tahini at concentrations of 3%, 4% and 6%. The corresponding hardness values were found to be between 133.87-811.48 g force while the adhesive values ranged from -51.16- to -97.88 g force. Beeswax wax was added to tahini at the rates of 5%, 6% and 8%, resulting in hardness values ranging from 148.2 to 279.4 g force and the adhesive values between -49.56- and -87.00 g force.
In a study conducted by Öğütcü et al., (2018) aimed at preventing phase separation in sesame paste and developing two spreadable sesame paste products, specific concentrations of sunflower wax (1 and 3%) and beeswax (1, 3 and 5%) were added to sesame paste.The textural measurements of the spreadable sesame paste samples showed that sesame paste prepared with 3% sunflower wax exhibited firmer and stickier characteristics compared to the sesame paste prepared with 1% sunflower wax and 5% beeswax (Öğütçü et al., 2018). These differences can be attributed to variations in gelling agents employed, their usage rate and storage conditions between current study and Öğütçü et al.'s research..

Table 3. Color Values of Spreadable Tahini Produced by Different Gelling Agents

Samples	Concentration(%)	L*	a*	b*
Mono-di gliserit	3	55.41±2.45	0.56±0.05	15.93±0.81
Mono-di gliserit	4	58.56±0.66	0.96±0.12	18.51±0.31
Mono-di gliserit	5	56.30±0.46	0.52±0.05	16.62±0.06
Stearin	3	58.58±0.40	1.81±0.20	19.59±0.26
Stearin	5	61.77±0.64	0.88±0.06	19.63±0.10
Stearin	6	61.44±0.21	1.17±0.18	19.73±0.16
Beeswax	5	59.77±0.76	1.06±0.04	18.90±0.27
Beeswax	6	58.37±1.02	0.89±0.06	18.54±0.28
Beeswax	8	62.05±0.81	0.46±0.04	18.92±0.19

Beeswax, stearin and mono-di glyceride were added to tahini at different concentrations and stored one night at room temperature to obtain a spreadable consistency. Subsequently, color values were measured from different parts of the sample. The color values of the spreadable tahini samples which had beeswax, stearin and mono-di glyceride added to the tahini, were investigated. The L*, a* and b* values were found to vary within in the ranges of 55.41 -62.05; 0.46-1.81 and 18.51- 19.73, respectively. The highest L* , a* and b* values were observed in the samples of spreadable tahini containing 8% beeswax, 3 % stearin and 6 % stearin respectively. Thses variations in the spreadable tahini samples are believed to be a result of differences in the gelling agents added to the tahini and their respevtive ratios. In a study conducted by Öğütcü et al., aimed at preventing phase separation in sesame paste and developing spreadable sesame paste products, specific concentrations of sunflower (1 and 3%) and beeswax (1, 3 and 5%) were added to sesame paste. They determined that the L, a* and b* values of the samples ranged from 58,63 to 56,67; -0,39 –to -0,29, and 16,34 to15,67 respectively. (Öğütçü et al., 2018).

Sensory Analysis

Quality controls of foods are commonly carried out with objective evaluation methods, although sensory evaluation methods are still used. Sensory evaluation is an analytical method that involves createing and measuring the reactions of the senses such as sight, smell, taste, touch and hearing to assess the quality characteristics of foods. Sensory methods are also very important in taste evaluation and they remain widely and effectively employed to establish quality criteria that affect consumer acceptance. (Altuğ vd., 1995). For the general acceptability evaluation of spreadable tahini samples a hedonic scale (1: I didn’t like it at all; 2: I neither liked nor disliked it; 3: I kind of liked it; 4: I like it; 5: I liked it very much) was utilized. This method allowed us to better observe the impact of different properties and flavors on spreadable tahini. Upon examining all spreadable tahini samples, it was evident that the sample containing 4% mono-diglyceride received higher scores in terms of taste, texture and overall appreciation compared to other samples.

4. DISCUSSION AND CONCLUSIONS

In the literature research, it was seen that there are a limited number of studies on tahini. When we evaluated the spreadable tahini samples in terms of spreadability, color and sensory properties, the sample containing 4% mono diglyceride was liked more than the others.

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Analysis of Waste Management Development in Slovakia

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Abstract: One of the important tasks of the state is the management of waste and the protection of the environment associated with it. The main duty of all entities is to prevent the generation of waste. If its creation is inevitable, the waste must be handled in such a way that there is no risk of an environmental pollution, disproportionate nuisance to the environment and adverse impact on the landscape. To comply with the principles of sustainability, it is necessary to have a developed waste management system. The paper provides an overview about waste management within Slovak republic and thus policies, regulations and directives related to the waste management. The time series analysis focuses on the amount of the municipal waste generated in Slovakia within the last years, the amount of waste per capita in individual regions, where the municipal waste ends up and how it is used and disposed in Slovakia. We used the basic statistic tools to describe the development of chosen waste management indicators of Slovakia. Results point out that the amount of waste is increasing from year to year, the recovery of the waste treatment is gaining importance and thus citizens pay more attention to it. The area of waste management affects the daily life of every individual, entrepreneur or company and is probably one of the most cross-cutting areas that has ever existed. The waste management in Slovakia has passed a significant change since the first law on waste was approved in 1991. Nowadays, there is still a space to enhance the waste management and be comparable with other countries of European Union. There is a substantial potential in the topic of waste management because of the new innovations and technologies used for the waste processing. Waste management itself, however, is an area that is dynamically developing and due to this development, it is able to attract the investments and attention of companies engaged in the innovative solutions for waste management.

Keywords: waste, management, environment, policies, sustainability

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1. INTRODUCTION

It is agreed that waste is a direct result of human interaction and activities. Nevertheless, there seems to be several opinions as to what constitute a waste. Several researchers however agreed that wastes are materials whose owners no longer have a need for. Therefore, it is obvious that waste is indeed subjective in meaning, as the term is open to several interpretations and also influenced by personal opinion. Nevertheless, it is important to provide a definition or at least a guide for the purposes of policies and legislations. This is evident from the fact that, it is the knowledge of what specifically constitute a waste and the categories of waste that determines how waste is dealt with or managed. (Amasuomo & Baird, 2016).
A substantial increase in volume of wastes generation began in the sixteenth century when people began to move from rural areas to cities as a result of industrial revolution (Wilson, 2007). This migration of people to cities led to population explosion that in turn led to a surge in the volume and variety in composition of wastes generated in cities. It was then that materials such as metals and glass began to appear in large quantities in municipal waste stream (Williams, 2005).
Waste management is challenged by increasing complexity of the waste entering the system and the demand for sustainable solutions that are affordable, protect the climate and contribute to a circular economy. (Christensen, et. al., 2020)
Every year 2.2 billion tonnes of waste are generated in the EU. More than a quarter of it (27%) is municipal waste: everyday waste collected and treated by municipalities, which is mainly generated by households. Data shows that the amount of waste and the way it is managed varies a lot across EU countries, but there has been a shift to more recycling and less landfilling. To reduce waste and its impact on the environment, the EU has adopted ambitious targets on recycling and landfill and is working on packaging waste. The goal is to promote the shift towards a more sustainable model known as the circular economy. (European Parliament, 2023).

The issue of the circular economy is resonating increasingly intensely in Slovakia as well, and it is also supported by the Ministry of the Environment. Like the other Member States, Slovakia has followed the direction of the EU and implemented the new direction of waste management in its development of documents and objectives. Although the country's starting position in meeting the new targets is not the worst (Slovakia has long been

recording low-waste production compared to other EU countries), there is still room for improvement in its overall approach to waste management, since the rate of efficient treatment is still relatively low. (Škamlová-Klobučník, 2021)
Since 1995, analysis of the generation and management of waste in the Slovak Republic has been based on the nationwide regional information system on waste (RISO). (Ministry of Environment of the Slovak Republic, 2015)
The Slovak Waste Management Program for the years 2021 - 2025 is the sixth national program establishing basic requirements, goals and measures focused on the field of waste management. This document for the years 2021-2025 contains a separate section containing a list of existing and planned prevention measures generation of waste for the fulfillment of obligations arising from Article 9 (1) of the framework directive on waste and the contribution of tools and measures to prevent the generation of waste arising from Article 29 (2) above directive, amended by EP and Council Directive (EU) 2018/851 of 30 May 2018, which was necessary adopt to achieve full transposition of the Waste Framework Directive. (Ministry of Environment of the Slovak Republic, 2021)
Recycling of municipal waste is one of the indicators of the circular economy. From the point of view of the difficulty of meeting the goals set by the framework directive on waste, the recycling goals represent the greatest challenge for the majority of member states in the EU. In order to meet the requirements of the framework directive on waste and to get closer to the European circular economy with a high level of efficient use of resources, the member states had to take the necessary measures to achieve a goal in a given area. This means that the goal "by 2020 to increase preparation for reuse and recycling of household waste such as paper, metal, plastic and glass and according to options from other sources, as long as these sources contain similar waste to household waste, at least 50% by weight'. Directive 2018/851/EC of the European Parliament and of the Council amending the Framework Directive on waste, sets progressively stricter goals for the member states in the horizon of 2025, 2030 and 2035. The directive allows to SR to postpone the deadlines for achieving the set goals by five years.

Table 1. Recycling targets for municipal waste

	2020	2025	2030	2023
target	50%	55%	60%	65%
postponement		50%	55%	60%

Source: Directive 2018/851/EC of the European Parliament and of the Council

Despite the growing volume of municipal waste, a positive development was recorded in waste recycling, analyzing the development of local analytical indexes of municipal waste treatment in the context of social and economic indexes in individual regions of the Slovak Republic. According to the analysis of waste recycling at the EU level, the Slovak Republic is a country with a waste recycling rate below the average measure of municipal waste recycling. The vision of the country is to achieve a better quality of the environment and sustainable circular economy using the minimum of non-renewable resources and dangerous elements—what could lead to the improvement of inhabitants' health. The aim is to increase the measure of waste evaluation with an orientation to prepare the waste for repeated use and recycling, as well as the support of avoiding waste rising. (Taušová, et.al., 2020)

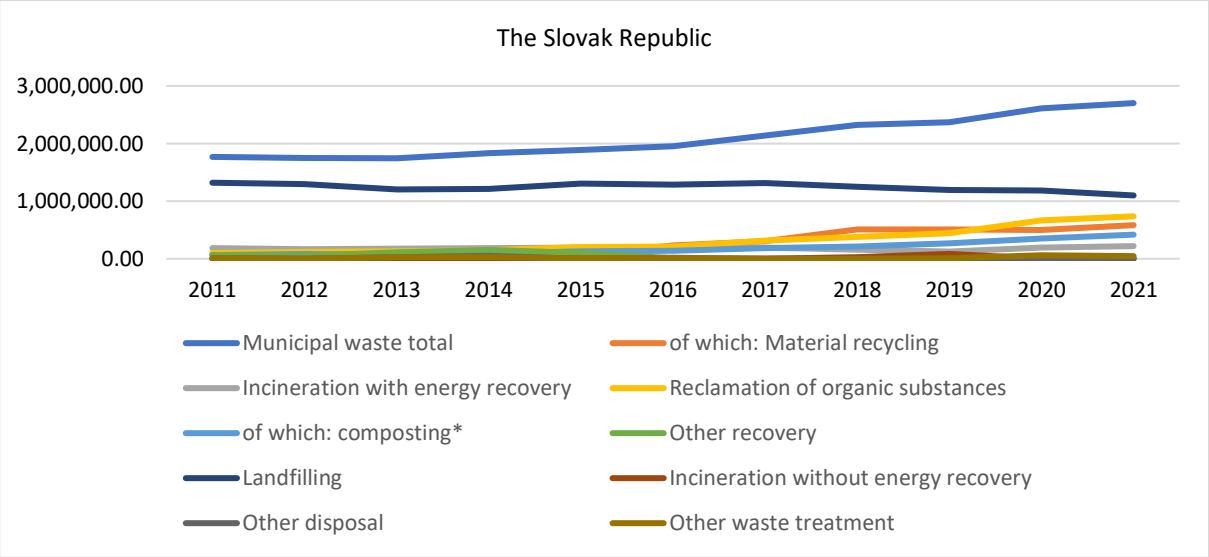
2. MATERIAL AND METHOD

This study points out the amount of municipal waste according to the waste treatment categories in the time period from 2011 till 2021. The timeframe was selected because there were the most data available for processing in further analysis. Comparative method was used for monitoring the amount of waste processed in individual regions of the Slovak Republic and comparison of the amount of processed waste in the given regions. Frequency distribution was used for processing the data about revenues, expenditures and investment connected to the waste processing. To detect if there is a correlation among expenditures, revenues and investments, a correlation analysis was used. The correlation coefficient, which ranges in value from -1 to +1, shows how closely two variables are related to one another. All data used in the article are from the Slovak statistical database DataCube and statdat.statistics.sk.

3. RESULTS

The further, the more waste is produced in municipalities and it is necessary to process this waste in a certain way. In the following section, we compare the amount of waste according to the method of processing in individual regions of the Slovak Republic.

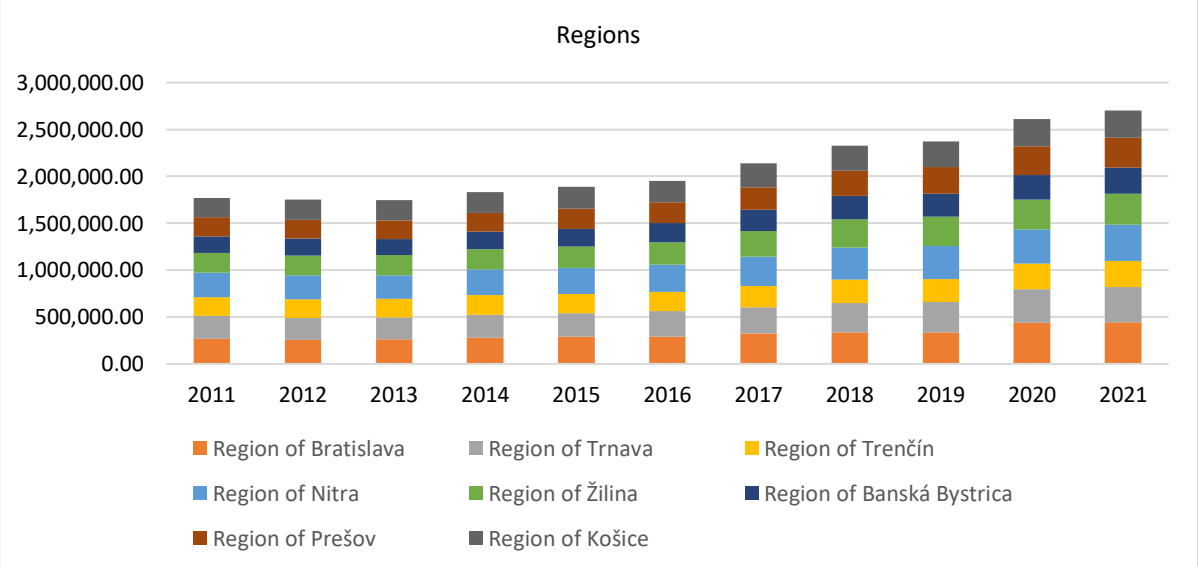
Figure 1. Municipal waste and small construction waste from municipalities according to the waste treatment categories in tonnes



Source: Own elaboration based on data from datacube.statistics.sk

In Figure 1 above, we can see an increase of the amount of a municipal waste in total from 1 766 990,50 tonnes in 2011 up to the 2 702 186,30 tonnes in 2021. There is a decrease in amount of waste treated by landfilling and increase of other ways of the waste treatment such as reclamation of organic substances, recycling, composting and others.

Figure 2. Municipal waste and small construction waste from municipalities according to the waste treatment categories in tonnes – Regions



Source: Own elaboration based on data from datacube.statistics.sk

In Figure 2 there is an amount of waste divided into eight regions of the Slovak Republic. The biggest amount of waste in 2021 was produced in the smallest region, in the Region of Bratislava – 446 068,90 tonnes. The region is located in the west of Slovakia together with the capital city Bratislava. Among the most important branches of industry are the chemical and automotive industries, engineering, electrotechnical and food industries. In the evaluation of the economic status in terms of gross domestic product (GDP), the Region of Bratislava has long been the best-performing region in Slovakia.

In 2021, the lowest unemployment rate was reached and people travel there not only from the whole region, but from the whole country. As a result, a large amount of waste is also concentrated here. (slovak.statistics.sk, 2023) The following region is Region of Nitra – 386 640,80 tonnes, Region of Trnava – 371 442,50 tonnes, Region of Žilina – 332 821,80 tonnes, Region of Prešov – 314 277,40 tonnes, Region of Košice – 292 576,40 tonnes, Region of Trenčín – 280 245,50 tonnes and on the last place with the lowest amount of waste produced Region of Banská Bystrica – 278 113,10 Tonnes of waste. In terms of industry sectors in Region of Banská Bystrica, the most represented are the production of metals and metal products, the production of other non-metallic mineral products, the production of food and beverages, and the production of machinery and equipment. In 2021, the population density of the region was the lowest of all regions, and there is a long-term overall population decline here, which is caused by a higher number of deaths than births. (slovak.statistics.sk, 2023)

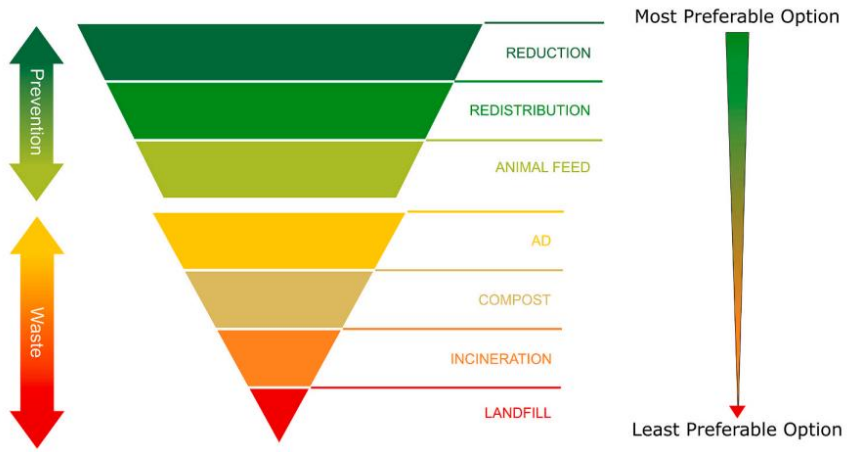
Table 2. Amount of produced waste per capita by region in tonnes

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Region of Bratislava	0,45	0,43	0,43	0,45	0,47	0,46	0,51	0,52	0,51	0,66	0,62
Region of Nitra	0,38	0,37	0,37	0,40	0,41	0,43	0,46	0,50	0,52	0,54	0,57
Region of Trnava	0,44	0,42	0,42	0,44	0,44	0,48	0,50	0,48	0,57	0,63	0,66
Region of Žilina	0,31	0,31	0,31	0,32	0,33	0,35	0,40	0,43	0,45	0,46	0,48
Region of Prešov	0,25	0,24	0,24	0,24	0,26	0,28	0,29	0,33	0,34	0,37	0,39
Region of Košice	0,26	0,27	0,27	0,28	0,29	0,29	0,32	0,33	0,34	0,36	0,37
Region of Trenčín	0,33	0,33	0,34	0,36	0,35	0,35	0,38	0,42	0,42	0,47	0,49
Region of Banská Bystrica	0,27	0,27	0,26	0,28	0,28	0,31	0,35	0,38	0,38	0,41	0,44

Source: Own elaboration based on data from statdat.statistics.sk

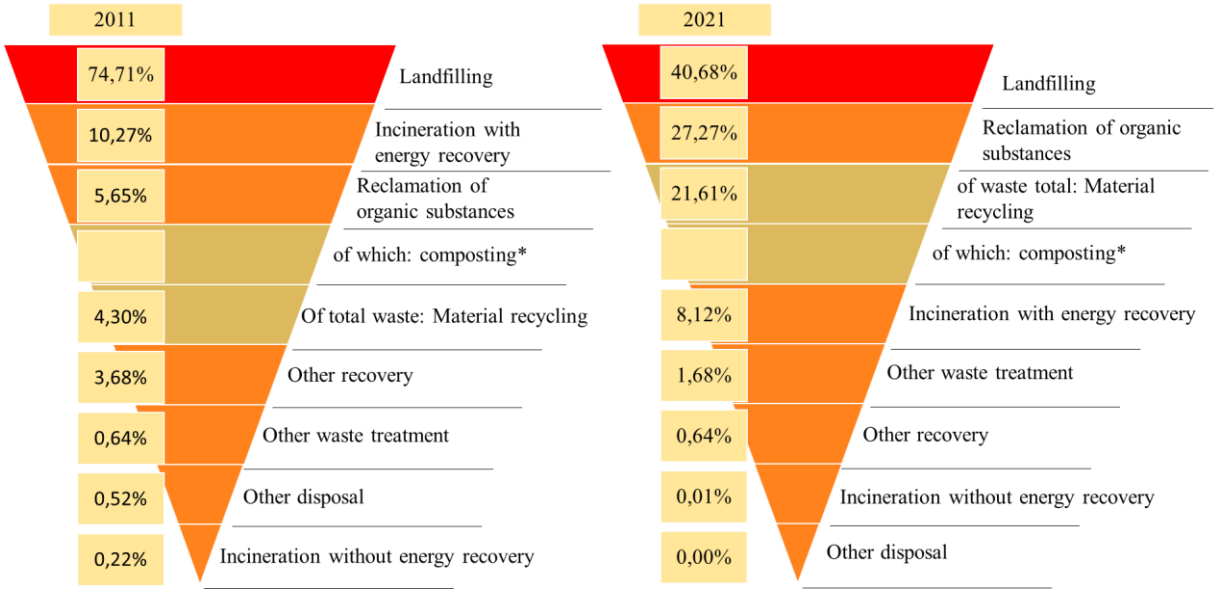
Table 2 shows the amount of waste produced per capita in regions of the Slovak Republic. Since the Bratislava region is the most populated region, until 2015 the most waste was produced here per capita. On the second place there is the Region of Trnava in 2016, 2019 and 2021. The Region of Trnava is characterized by a number of industrial and agricultural enterprises and a wide network of services together with a good location and infrastructure.

Figure 3. Food surplus and waste hierarchy



Source: (Ali Asghar Parsa et al., 2023)

Figure 4. Food surplus and waste hierarchy, the Slovak Republic 2011 and 2021

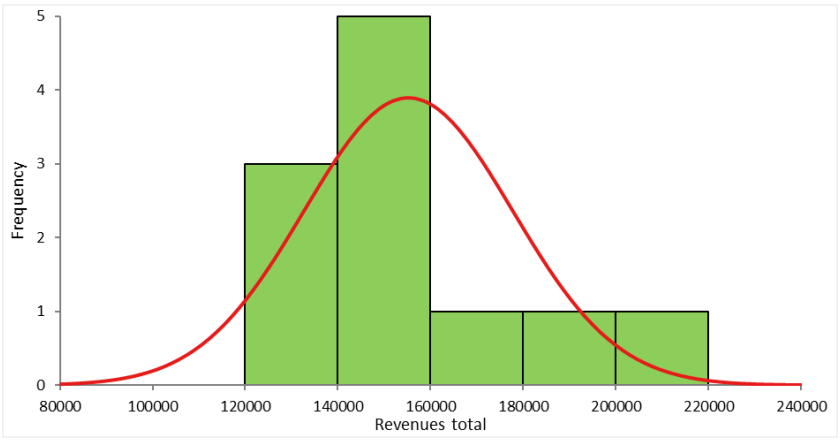


Source: Own elaboration based on data from datacube.statistics.sk

If we compare the hierarchy of waste treatment in the Slovak Republic in Figure 3 and the hierarchy of waste treatment in Figure 4, we can see a big difference. In case of waste treatment in the Slovak Republic, there is a landfilling on the first place with 40,68% followed by reclamation of organic substances. From the more preferable ways of waste treatment there is material recycling with composting on the third and fourth place in the hierarchy with 21,61%. On the other hand, according to the environmental portal, the waste recycling rate was 2% in 2005. (enviroportal.sk) From a historical perspective, the 2021 recycling rate is a step forward for the country's waste treatment. The next method of waste processing is incineration with energy recovery with 8,12%, other waste treatment with 1,68%, other recovery with 0,64%, incineration without energy recovery with 0,01% and the least significant was is other disposal. In comparison of the amount of processed waste in 2011 and 2021, the share of landfilling decreased from 74.71% to 40.68%, the ratio of recycled waste increased from 4.30% to 21.61%.

3.1 Analysis of revenues, expenditures, and investment in environmental protection

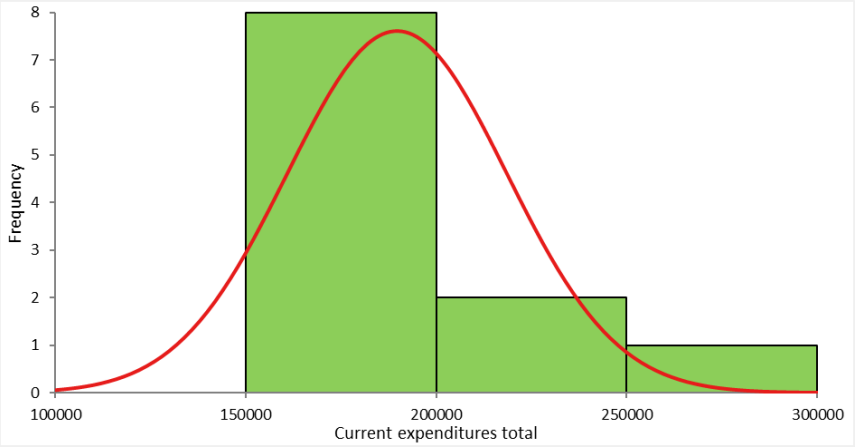
Figure 5. Distribution: Revenues total



Source: Own elaboration

In Figure 5 we can see the distribution of revenues from the waste management and processing in the Slovak Republic. In the diagram there are revenues divided into 5 groups with the most frequent in revenue at the level of ≥140000€ to <160000€. The largest part of revenues was from waste management.

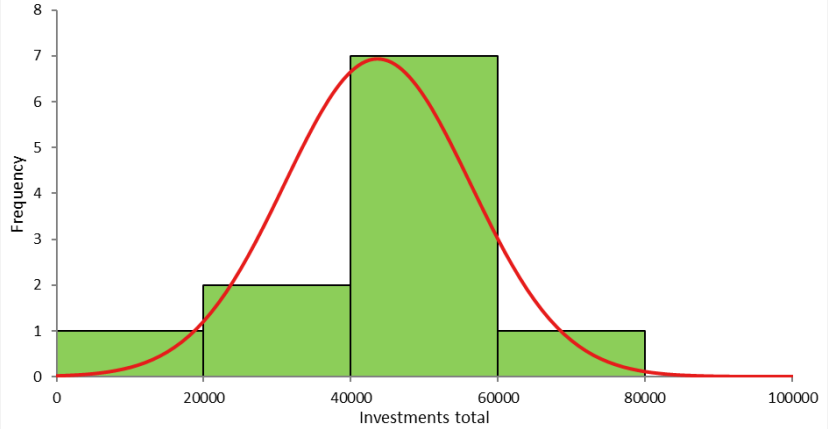
Figure 6. Distribution: Expenditures total



Source: Own elaboration

Figure 6 shows the distribution of the total expenditures on waste processing. The most frequent expenditures are from ≥150000 to <200000€. Total expenditures are divided into 3 groups according to the distribution chart. Out of all expenses for environmental production in the Slovak Republic, the majority was for waste management.

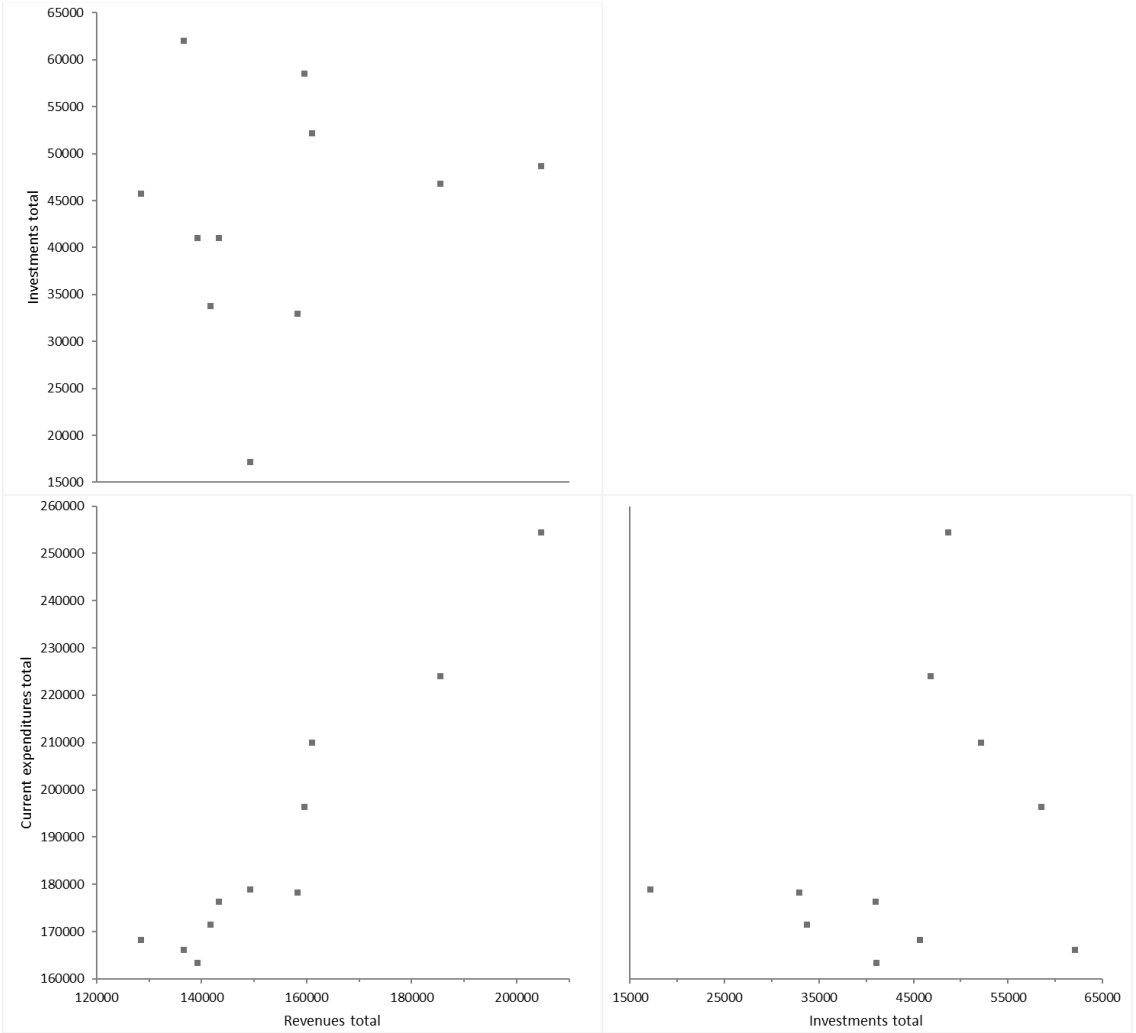
Figure 7. Distribution: Investments total



Source: Own elaboration

We can see 4 groups of investments into the waste processing in Figure 7. The most frequent investments are from ≥40000 to <60000€. One of the examples of investments in waste management is the project Investing in the waste management sector. This project was implemented in the years 2015 - 2023. The aim of the project was to achieve in the area of waste management, in particular, an increase in the rate of recovery of waste with a focus on preparing it for reuse and recycling and supporting the prevention of the creation of biodegradable municipal waste. The authorized territory for the implementation of activities is the entire territory of the Slovak Republic. (partnerskadohoda.gov.sk)

Figure 8. Correlation: Revenues total, Investments total, Current expenditures total



Source: Own elaboration

Figure 9. Correlation

Correlation

Pearson's r	Revenues total	Investments total	Current expenditures total
Revenues total	-	0,138	0,962
Investments total	0,138	-	0,253
Current expenditures total	0,962	0,253	-

Source: Own elaboration

The positive coefficient of 0.96 (rounded to two decimal places) shows a strong direct correlation between Total revenues and Current expenditures, with the expenditures increasing as more revenues are generated through waste processing.

4. DISCUSSION AND CONCLUSIONS

To explore the waste processing management in the Slovak Republic, we compared the types of waste processing within individual regions. The region with the highest amount of waste produced is the Region of Bratislava and the lowest amount is the Region of Basnká Bystrica in both years 2011 and 2021. The most common way of waste processing is landfilling, which is also the least preferable way of waste processing. On the other hand, even if this method is the most common one, it is slowly decreasing, and the other ways of waste processing are increasing which indicates a positive

trend into the future. From the historical point of view the ratio of recycled waste increased. This development in the analysed time period indicates that the Slovak Republic is gradually introducing other, more preferred methods of waste processing.

From a comparison of the hierarchy of waste processing according to Ali Asghar Parsa et al., 2023, and the hierarchy of waste processing in the Slovak Republic in 2021, the current situation needs improvement. There are many options how to decrease the amount of landfilling within the country. The most important way of decreasing the amount of landfilled waste is the reduction of produced waste in general. As another way of decreasing landfilled waste are various recycling programs or composting innitiatives. It is important to raise awareness about waste reduction programs that already exist, to focus on the primary transfer of information to the educational program. In 2018, the Waste Prevention Program of the Slovak Republic for the years 2019-2025 was adopted. (isoh.gov.sk) In 2019, 9 producer responsibility organizations were active on the Slovak market. According to data published by the Ministry of the Environment, OZV ENVI – PAK has the highest share in collection targets for packaging and non-packaged products on the Slovak market (104,881 tons). (Stričík, et al., 2019) We also propose to increase investment into the waste management of municipalities. By increasing investment into technology, waste can be processed more efficiently in coordination with the waste hierarchy in Figure 3.

Author Contributions
Conceptualization: A.J., Z.B., T.B., N.T; Investigation: A.J., Z.B,; Material and Methodology: A.J., T.B.,; Supervision: Z.B., T.B., N.T.; Visualization: A.J., N.T.; Writing-Original Draft: A.J.; Writing-review & Editing: A.J., Z.B., T.B., N.T; Other: All authors have read and agreed to the published version of manuscript.

Conflict of Interest
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Investigation of Fatty Acid Composition, Total Tocopherol Content, and Total Antioxidant Activity of Clary Sage (*Salvia sclarea* L.) Seeds

Ümit Erdoğan*[1], Sabri Erbaş[2], and Mustafa Karaboyacı[3]

Abstract: Knowledge on the composition and antioxidant activity of clary sage seeds, which are considered native to Southern Europe, is limited. In this study, clary sage seeds oil (CSSO) was obtained from clary sage seeds collected from Isparta region by using n-hexane with a soxhlet device. Next, defatted seeds were extracted using methanol-water (80:20, v/v) with ultrasonic-assisted extraction. Thus, clary sage seed extracts (CSSE) were obtained The extracts obtanied were then filtered through a whatman no :1 filter paper (Isolab, Germany) and filtered aliquots were stored in the dark at +4 °C until further analyses. The fatty acid composition of CSSO was investigated using the GC-FID analysis. Total tocopherol content of CSSO was measured by *in vitro* spectrophotometric method. Moreover, we determined the radical scavenging activity and antioxidant capacity of CSSO and CSSE using the 1,1-diphenyl-2-picryl-hydrazil (DPPH) and the copper ion (Cu^{2+}) reducing antioxidant capacity (CUPRAC) assays, respectively. GC-FID findings showed that the oil content of clary sage seed is composed of fatty acids composition linolenic acid (50.64 %), linoleic acid (21.16%), oleic acid (14.5%), palmitic acid (6.83%), and stearic acid (1.94 %). The total tocopherol content of clary sage seed oils was calculated to be 2940.69 ± 19 ppm. The total antioxidant capacities of CSSO and CSSE were calculated to be 9.45 and 32.99 micro moles trolox equivalent/g extract, respectively, while the DPPH• radical scavenging activities of CSSO and CSSE was calculated to be 2.92 and 14.49 micro moles trolox equivalent/g extract (µmol TE/g-extract). As a result, the results obtained in our study demonstrate that clary sage seeds have the potential to be used in applications such as food and cosmetics due to their rich in unsaturated fatty acids and effective antioxidant properties.

Keywords: *Salvia sclarea*, clary sage seed, total tocopherol content, total antioxidant capacity, CUPRAC, DPPH.

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1. INTRODUCTION

Clary sage (*Salvia sclarea* L.), native to Southern Europe, is cultivated worldwide as an ornamental, industrial and essential oil-containing plant (Aćimović *et al*., 2018). Commercially, in large scale it is cultivated in Russia, Bulgaria, France and Morocco, with annual world production of about 150 t of essential oil (Džamić *et al*., 2008; Hristova *et al*., 2013; Yaseen *et al*., 2015). Clary sage is well known for its high value essential oil, widely used in perfumery industries as a source of fragrance with refreshing and long lasting note. The flowers, leaves and stems of sage are widely consumed in Turkish folk medicine, as an anti-diarrheal and calming medicine, in food applications and in herbal teas (Gulcin *et al*., 2004; Tulukcu *et al*., 2012). Although many studies have been done on clary sage, almost all have focused on the aerial parts, not the seed. However, sage seeds are rich in unsaturated fatty acids such as linoleic acid and linolenic acid, as well as have a high tocopherol content. Moreover, it also has antioxidant and antiradical activities. Thanks to these properties, it may contribute to an alternative use for sage seeds (Yalçın *et al*., 2011).

Considering all these, it has become important to reveal the chemical composition of clary sage seeds. Therefore, the objective of this study was to determine the fatty acid profile of clary sage seeds, including their total antioxidant activity, radical scavenging activity, and total tocopherol content.

2. MATERIAL AND METHOD

2.1. Plant material

The plant material used in the study was harvested from the field of Agriculture faculty of Isparta University of Applied Sciences (Figure 1).

Figure 1. Flowers and seeds of clary sage (*Salvia sclarea* L.)

2.2. Extraction of clary sage seeds

In this study, clary sage seeds oil (CSSO) was obtained from clary sage seeds collected from Isparta region by using n-hexane with a soxhlet device. Next, defatted seeds were extracted using methanol-water (80:20, v/v) with ultrasonic-assisted extraction. Thus, clary sage seed extracts (CSSE) were obtained The extracts obtanied were then filtered through a whatman no :1 filter paper (Isolab, Germany) and filtered aliquots were stored in the dark at +4 °C until further analyses.

2.3. GC-FID analysis of clary sage seed oil

Fatty acid profile analyses of the oils of clary sage seeds (CSSO) were performed according to the conditions in our previous study (Erdoğan and Homan Gökçe, 2021). The fatty acid methyl esterification (FAME) procedure was as follows (Aldai et al., 2005). The oil sample (20-40 mg) was dissolved in 0.5 mL of n- hexane, 2 mL of 0.5M sodium methoxide (metallic sodium in anhydrous methanol) was added, and the samples were kept in a water bath at 60°C for 20 min. A few drops of glacial acetic acid are then added to remove excess methoxide, followed by 2 ml of saturated NaCl solution (20%, w/v) and added 2 ml of n-hexane and vortex vigorously. A 1 µL of the upper phase in which the esterified fatty acids (FAME) were collected, was withdrawn and injected into the gas chromatography (GC-FID). A chromatographic analysis was carried out ona Shimadzu GC-2010 gas chromatograph equipped with a flame ion-izing detector and TR-CN100 Capillary Column (100 m × 0.25 mm,0.20 µm. film thickness, Teknokroma). This was performed under the following conditions: oven temperature program, 140°C for 10 min raised to 240°C at a rate of 3°C/min and then kept at 240°C for15 min; injector and detector temperatures, 250 and 260°C, respectively; carrier gas, nitrogen at a flow rate of 40 ml/min; split ratio,1/20 ml/min. Peak identification was performed by comparing therelative retention times with those of a commercial standard mix-ture of FAME (Sigma, Supelco 37 Component FAME Mix). The yields of the independent ingredients on oil content and palmitic, stearic,oleic, linoleic, and linolenic acid concentrations of the oil were examined on a percentage basis.

2.4. *In vitro* spectrophotometric assays of extracts of clry sage seeds

We applied DPPH (Bener *et al*, 2022) and CUPRAC (Apak *et al*., 2006) assays to measure free radical scavenging capacity (FRC), total antioxidant capacity (TAC), of extracts of clary sage seeds, respectively. In each method, all tests were repeated three times for samples and evaluated with a UV-Vis spectrophotometer (UV-1280, Shimadzu, Japan). A calibration curve was constructed using Trolox and results were expressed as mmol TE /g- clary sage seed for DPPH and CUPRAC method**s.** Total tocopherols were determined using the method of Wong et al. (1988). The procedures of the applied methods were summarized in Table 1.

Table 1. Procedures of *in vitro* spectrophotometric assays

Assays	Procedures	References
DPPH	Added to a glass tube X mL of extract solution (diluted 100 times), "2 – X" mL 99% ethanol, and 2 mL of 0.2 mM of DPPH˙ solution. Incubated at 25 ºC in the dark for 30 min. Recorded at 515 nm against ethanol (absorbance values) $\boldsymbol{FRC\ (mmol\ TE/g-extract)} = \frac{\Delta_A}{\varepsilon_{TR}} x\ \frac{V_m}{V_s}\ x\ D_f\ x\ \frac{V_E}{m}$ where $\mathcal{E}_{TR}$: molar absorption coefficient of TR compound in the DPPH method (2.19 × 10^4 L $mol^{-1}.cm^{-1}$) , Vs is the sample volume, *Vm* is the total volume of method (4 mL), *Df* is dilution factor (when needed), *VE* is the extract volume and, *m* is the mass of DFS. (Δ_A was calculated by subtracting the absorbance of the sample solution from the absorbance of the control solution. The control solution contained 2 mL of 0.2mM DPPH˙ solution and 2 mL of ethanol (99%)).	Bener *et al*, 2022
CUPRAC	Added into a glass tube 1 mL of copper(II) solution (Cu(II)), 1 mL neocuproin solution (Nc), 1mL ammonium acetate buffer (NH_4Ac), 0.5 mL sample solution (diluted 100 times), and 0.6 mL distilled water respectively. Reagent blank solution: 1 mL Cu(II) + 1 mL Nc + 1 mL NH_4Ac + 1.1 mL H_2O Sample solution: 1 mL Cu(II) + 1 mL Nc + 1 mL NH_4Ac + 0.5 mL sample + 0.6 mL H_2O. Incubated at 25 ºC in the dark for 30 min. Absorbance values were recorded at 450 nm against reagent blank solution $\boldsymbol{TAC\ (mmolTE/g\ -extract)} = \frac{A}{\varepsilon_{TR}} x\ \frac{V_m}{V_s}\ x\ D_f\ x\ \frac{V_E}{m}$ where $\mathcal{E}_{TR}$: molar absorption coefficient of Trolox compound (1.67 × 10^4 L $mol^{-1}.cm^{-1}$),Vs is the sample volume, *Vm* is the total volume of method (4.1 mL), *Df* is dilution factor (when needed), V_E is the extract volume (50 mL) and, *m* is the mass of DFS (5 g)	Apak *et al*., 2006
TOTAL TOCOPHEROL CONTENT	Total tocopherols were determined using the method of Wong et al. (1988). Approximately 0.01 g of oil was placed in a volumetric flask (10 mL), to which was added: 5 mL of toluene; 3.5 mL of 2,2 bipyridine (0.07% weight per volume (w/v) in 95% ethanol); and 0.5 mL $FeCl_3$. $6H_2O$ (0.2% w/v in 95% ethanol). The solution was added with 95% ethanol to 10 mL, and the absorbance was measured at a wavelength of 520 nm. A blank was made the same way without the sample. The total tocopherol concentration was calculated based on a standard curve of α-tocopherol (25–300 ppm in toluene) (Figure 2). Total tocopherols in the oil sample were calculated from the following equation and results are expressed as equivalents of α-tocopherol in milligrams [mg of α-tocopherol /g] per gram of sample. **Total tocopherols (ppm)=** (As-Ab)/(M*W) where As = sample absorption in 10 mm cell, Ab = blank absorption in 10 mm cell, M = absorbance versus weight plot for calibration of α-tocopherol (M=0,0022), and W = weight of sample (g).	Wong et al., 1988

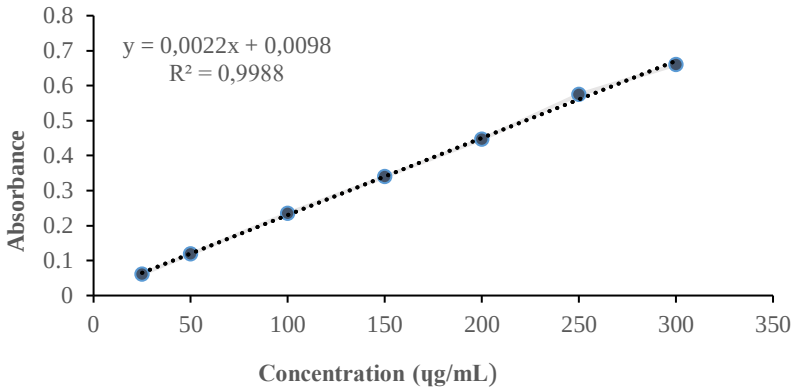

Figure 2. The calibration curve of a-tocopherol (at 520 nm)

3. RESULTS AND DISCUSSION

The fatty acid composition (% weight of FAME) of the investigated clary sage seed is summarized in Table 2. Clary sage seed oil (CSSO) consisted of varying amounts of fatty acids, as well as saturated fatty acids (SFAs), monounsaturated fatty acids (MUFAs), and polyunsaturated fatty acids (PUFAs). It was determined that α-linolenic acid (ω-3**,** 50.64%) was the most abundant major fatty acid in CSSO. α -Linolenic acid was followed by linoleic acid (21.16%) and oleic acid (14.50%), respectively. GC-FID analyses revealed that sage seed oils are characterized by high PUFA content (71.86%) followed by monounsaturated fatty acids (MUFA, 14.57%), while lower amounts of unsaturated fatty acids (SFA, 9.01%). Živković et al., (2017) reported that a-linolenic acid was the dominant one (54%), followed by linoleic acid (18%), and stearic acid (13%) in S. sclarea fixed seed oil. In an another study, Tulukcu *et al*.,(2012) found that the most dominant fatty acid was linolenic acid (51.88-53.69%), followed by oleic acid (20.1-22.97%), linoleic acid (15.54-18.06%) and palmitic acid (6.07-7.27%), depending on the year harvested in salvia sclarea seeds. our data were found to be in complete harmony with their findings.

Table 2. Fatty acid composition of oils obtained from *clary sage seed*

Fatty acid	***Name***	**%**
C:14:0	Myristic acid	0.04
C16: 0	Palmitic acid	6.83
C18: 0	Stearic acid	1.94
C18: 1	Oleic acid	14.50
C18: 2	Linoleic acid	21.16
C18: 3	a-Linolenic acid	50.64
C20: 0	Arachidic acid	0.16
C20:1	cis-11-Eicosenoic acid	0.07
C20:2	11,14-Eicosadienoic acid	0.06
C21:0	Heneicosanoic acid	0.03
C23:0	Tricosanoic acid	0.014
Σ SFA		9.01
Σ MUFA		14.57
Σ PUFA		71.86
ω-6/ω-3 ratio		0.42

*Data obtained by GC-FID are expressed as relative values (%): mean % of total FAs ± SD; **Σ** SFA, sum of saturated fatty acids; **Σ** MUFA, sum of monounsaturated fatty acids; **Σ** PUFA, sum of polyunsaturated fatty acids*

It is well known that the most nutritionally valuable source of **ω** -3 is α-linolenic acid. At the present, it is well known that the ratio of **ω** -6 and **ω** -3 fatty acids should be less than 5:1 in order to reduce the risk of cardiovascular diseases and thus improve health (Amato et al., 2015). For S. sclarea oil this ratio was lower than 5:1 (0.42). According to our findings, consumption of clary sage seeds could be considered as an alternative option to balance the fatty acid content in the daily diets of Western countries, which usually contain ω-6 fatty acids.

To measure the total antioxidant capacity of CSSE and CSSO, we performed two different methods (CUPRAC and DPPH), which are frequently preferred, reproducible and easy to apply. It is recommended to apply at least two methods to determine the total antioxidant capacity in extracts (Önder *et al*., 2023). By using Cu(II)-neocuproin (Nc) reagent, which is a chromogenic oxidant, in the CUPRAC test, the total antioxidant capacity of plasma antioxidants, flavonoids, and food polyphenols can be easily measured (Apak *et al.,* 2004). Appropriately positioned phenolic hydroxyls transform into corresponding quinone structures by the CUPRAC redox reaction, and the Cu(I)-Nc chelate formed as a result of this redox reaction gives maximum absorbance at 450 nm. The findings of the copper (II) ion reducing ability of extracts obtained from clary sage seeds were presented in Table 3. The CUPRAC value in CSSO and CSSE was 9.45 and 32.99 mmol TR /g-extract, respectively. Tulukcu *et al.* (2012) reported that the antioxidant activity of sage seeds differed between 50.45 and 74.04 mg AAE/g-dry extract depending on the harvest year according to the phosphomolybdenum method.

Table 3. Findings of total antioxidant capacity, free radical scavenging capacity, and total tocopherol content of extracts obtained from clary sage seeds

Samples	TAC (mmol TR/ g-extract)	FRC (mmol TR/ g-extract)	Total tocopherol content (mg of α-tocopherol /kg-oil
CSSO	9.45±0.59	2.92±0.66	2940±19.6
CSSE	32.99±0.35	14.49±1.67	-

CSSO, clary sage seeds oil; CSSE, clary sage seed extracts; TAC, total antioxidant activity; FRC, free radical scavenging capacity

Today, many bioanalytical methods have been developed to estimate the antioxidant effect. Among these, the 1,1-diphenyl-2-picrylhydrazil (DPPH) scavenging test is the most putative, popular, and commonly used method to meausure antioxidant capacity. In present study, free radical scavenging activity of clary sage extracts was measured by DPPH test. The free radical scavenging capacity (FRC) value in CSSO and CSSE was 2.92 and 14.49 mmol TR /g-extract, respectively.

Tocopherols are commonly found in edible oils and exhibit strong antioxidant activity. Since oils rich in unsaturated fatty acids are prone to oxidation, lipolic antioxidants such as tocopherols are often present in these oils, extending the shelf life of the oil and delaying the oxidation process (Tang *et al*., 2015). In the present research, the total tocopherol content in clarry sage seed oils (CSSO) was determined spectrophotometrically. The data revealed that CSSO is rich in tocopherol content (2940 mg of α-tocopherol /kg-oil). Considering that tocopherols exhibit strong antioxidant activity, it can be mentioned that they contribute to CUPRAC and FRC activities.

4. CONCLUSIONS

As a result, the results obtained in our study demonstrate that clary sage seeds have the potential to be used in applications such as food and cosmetics due to their rich in unsaturated fatty acids and effective antioxidant properties. According to our findings, consumption of clary sage seeds could be considered as an alternative option to balance the fatty acid content in the daily diets of Western countries, which usually contain ω-6 fatty acids.

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It should be written as short as possible and expressing the contribution made without giving the number.

Author Contributions
Conceptualization: Ü.E., S.E., M.K; Investigation: Ü.E.; Material and Methodology: Ü.E., S.E.; Supervision: S.E., Ü.E., M.K.; Visualization: S.E., Ü.E., M.K.; Writing-Original Draft: Ü.E.; Writing-review & Editing: S.E., Ü.E., M.K..; Other: All authors have read and agreed to the published version of manuscript.

Conflict of Interest
The authors have no conflicts of interest to declare.

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Comparative Analysis between Green Space Geometries and Local Climate Zones in Hot-Arid Climate Zones

Muge Unal*[1,2]

Abstract: In recent years, strategies for mitigating urban heat stress have increasingly utilized 3D climate models. Alongside urban 3D morphology, geometry, and surface characteristics, urban green infrastructure plays a vital role in creating cooler urban surfaces. This study aims to determine statistically suitable urban green space (UGS) geometries in different local climate zones (LCZs) for hot-arid climates by combining LCZ classification, 3D model results, and statistical analysis. The study methodology consists of three stages. First, the geometric characteristics of green spaces (such as area size, aspect ratio, and orientation) and building types within each LCZ (LCZ 1-6) are determined. Second, mean Physiological Equivalent Temperature (PET) values for each UGS and LCZ class are obtained from ENVI-met for three canopy cover scenarios (0%, 50%, 100%). Finally, suitable and least suitable UGS characteristics are determined based on the statistical significance of PET differences ($p > 0.05$) using one-way ANOVA with post-hoc Tukey-HSD test analyses for pairwise comparisons. The results reveal the following key findings:

- Mean PET values for green spaces were determined for each LCZ and canopy cover scenario.
- All results indicate extreme thermal stress categories due to the extreme climatic conditions of the hot-arid climate, particularly in Arizona. The scenario with 100% grass cover exhibits the highest PET values (52-55°C), while the scenario with 100% tree cover shows the lowest PET values (50-52°C). Vegetation has a positive impact on the thermal condition of green spaces due to its shading effect.
- The height of buildings also influences the thermal condition of green spaces. PET values generally increase in low-rise classes (LCZ 3 and LCZ 6) but remain low in high-rise classes (LCZ 1 and LCZ 4). Compact midrise (LCZ 2) and open high-rise (LCZ 4) exhibit similar PET values for 50% and 100% canopy cover scenarios.

Overall, this study provides insights into the suitable UGS geometries for different LCZs in a hot-arid climate. The findings underscore the importance of considering both green space characteristics and building heights in urban planning to optimize thermal comfort and mitigate heat stress.

Keywords: Green space geometries, local climate zone (LCZ), PET, hot-arid climate

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1. INTRODUCTION

The impact of urbanization on local climate is a well-known and extensively studied phenomenon. The three-dimensional (3D) structures of urban areas, which alter the physical and geometric characteristics of the land surface, have significant consequences in both developed and developing countries (Guo et al., 2020; Singh et al., 2017). To mitigate the urban heat island effect and create a cooler urban environment, the importance of urban green infrastructure cannot be overlooked, alongside considerations of urban 3D morphology, geometry, and surface characteristics.

Urban green spaces (UGS), particularly in public areas, have been a focal point in urban climate studies, aiming to achieve sustainable urban development (Kántor et al., 2018; Taleghani & Berardi, 2018). Various indicators have been used by researchers to examine the effects of UGS on the urban ecosystem (Crank et al., 2018; Makropoulou & Gospodini, 2016). However, previous studies have not provided standardized guidelines regarding the optimal location, aspect ratio, orientation, and area size of UGS in different urban landscapes to mitigate surface temperature. Therefore, there is a need to quantitatively and qualitatively evaluate the spatial suitability of UGS characteristics to enhance outdoor thermal comfort within different building types using mathematical models. Further investigations and

comprehensive studies are required to determine the appropriate green space characteristics in terms of thermal comfort across different building types, bridging the existing knowledge gap.

In recent years, models have contributed to the analysis of urban climatic differences at various resolutions, ranging from the local to regional scales, by considering urban morphology (Acero & Herranz-Pascual, 2015; Alchapar & Correa, 2016). Numerous studies have focused on the influence of planting scenarios on various urban spaces, such as pedestrian zones, squares, urban canyons, and morphologies, as well as green areas, particularly in hot-arid and hot-humid urban areas (Morakinyo et al., 2018; Unal Cilek et al., 2021; Unal et al., 2018). Design elements such as material albedo, water ratios, green areas, and impervious surfaces have been investigated to improve outdoor thermal comfort in urban public spaces (Chatzidimitriou & Yannas, 2016; Kántor et al., 2018; Perera, 2015; Unal et al., 2018; Zhu et al., 2021). Many studies have explored the reduction of micro-scale urban heat island effects through the integration of urban geometry, urban morphology, and Local Climate Zones (LCZ) (Karakounos et al., 2017; Unal Cilek & Uslu, 2021; Zhao & Fong, 2017). Proper design is crucial to enhance cooling performance. Previous research has demonstrated that determining urban thermal conditions is a complex process, involving the combination of climate, environment, and building indices. Recently, strategies for mitigating urban heat stress have been developed using 3D climate models, emphasizing the importance of urban green infrastructure, in addition to urban 3D morphology, geometry, and surface characteristics.

The research questions addressed in this study are as follows:

(1) Which geometric characteristics are suitable or unsuitable for specific LCZs?
(2) How do orientation and tree canopy affect the thermal comfort of UGS?
(3) How does tree canopy alter the thermal conditions of UGS?

The primary aim of this study is to statistically determine the suitable geometry of urban green spaces (UGS) in different local climate zones (LCZs) within a hot-arid climate. The study combines the LCZ classification, 3D model results, and statistical analysis to provide insights into the optimal UGS characteristics. This study presents preliminary results from a post-doctoral project titled "Determination of Optimum Green Space Characteristics in terms of Thermal Comfort for the Building Types in Local Climate Zone." The findings of this study will serve as a guide for future researchers and decision-makers, helping to standardize UGS characteristics in diverse urban morphologies and develop climatically comfortable UGS designs and planning strategies for future cities.

By exploring the relationship between 3D urban morphology, green space characteristics, and land surface characteristics, this study aims to bridge the existing knowledge gap and contribute to the development of sustainable urban environments in hot-arid climates. The research outcomes will provide valuable insights into the appropriate UGS geometries, orientations, and canopy cover to enhance thermal comfort and mitigate the adverse effects of urban heat stress. These findings will enable urban planners, architects, and policymakers to make informed decisions regarding UGS design and implementation, leading to more sustainable and livable cities.

In conclusion, understanding the influence of urban green space geometries in different local climate zones is essential for creating a cooler and more comfortable urban environment. This study aims to fill the research gap by statistically evaluating the suitability of UGS characteristics in a hot-arid climate through the integration of LCZ classification, 3D model results, and statistical analysis. The research questions address the spatial adequacy of UGS characteristics, the impact of orientation and tree canopy on thermal comfort, and the role of tree canopy in modifying the thermal conditions of UGS. The study's results will contribute to the standardization of UGS characteristics and guide future research and decision-making in urban planning and design. Ultimately, the aim is to create sustainable and climatically comfortable UGS designs that enhance the quality of life in urban areas.

2. MATERIAL AND METHOD

2.1. Materials

The focus of the conducted research was on Tempe, a city located in Arizona with coordinates 33°26′54″ North and 112°04′26″ West. The primary aim of the study was to investigate suitable green space characteristics for Tempe city's which has extreme climate condition in the summer season. According to the Köppen-Greiger climate classification, Tempe has a tropical and subtropical desert climate (*Bwh*). This climate is characterized by infrequent rainfall, resulting in an arid region with an average annual precipitation of 203.2 mm (Kottek et al., 2006). Tempe experiences dry summers with high daytime temperatures, while winters remain relatively mild. The peak temperatures are typically recorded in July and August, ranging from 41-53°C, whereas the lowest temperatures occur in January and February, ranging from 6-13°C (AZMET, 2022). In this hot-arid desert climate, the prevailing vegetation mainly comprises local

plant species that have adapted to thrive in drought conditions. Tempe climatic data were used for the microclimatic simulation of green space.

2.1. Methodology

The study methodology comprises four stages.

- *Determination of 2D and 3D characteristics:* The geometric characteristics of green spaces (area size, aspect ratio, and orientation) and building type of LCZ (LCZ 1-6) were determined (Figure 1).

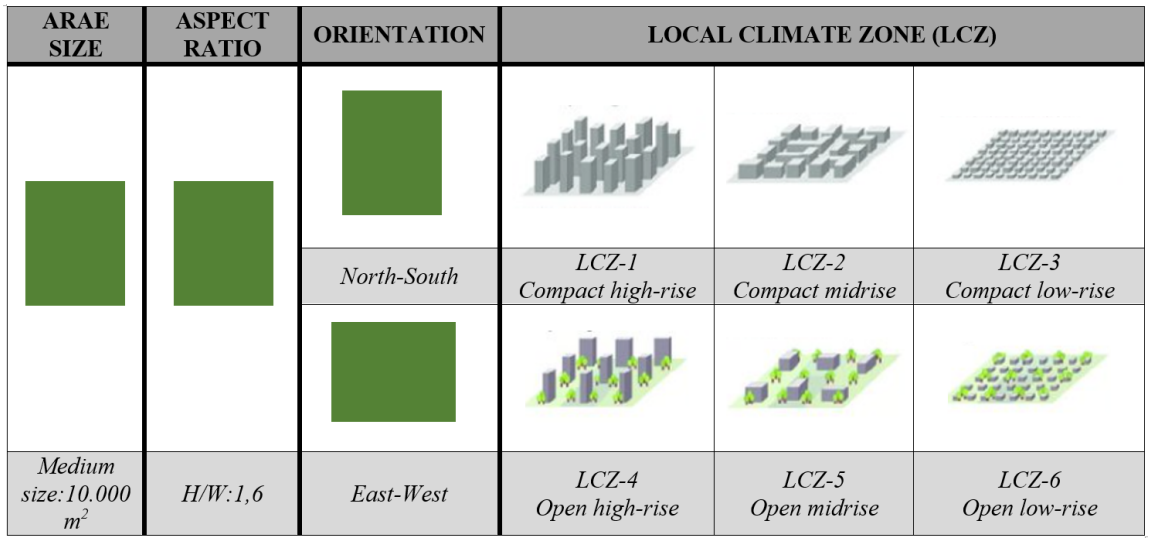

Figure 1. The 2D and 3D characteristics of green spaces

- *Determination of canopy cover:* There are three canopy cover were determined. These are 0% full grass cover, 50% canopy cover, and 100% canopy cover (Figure 2).

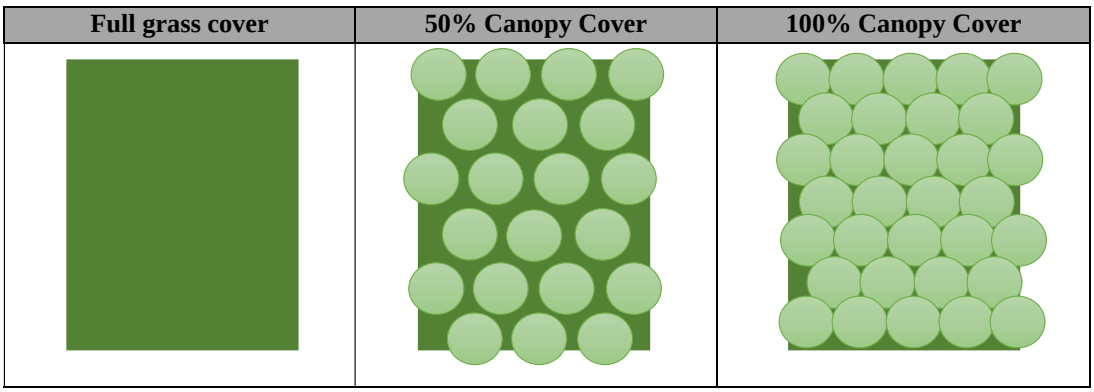

Figure 2. The canopy cover ratio of the scenario

- *ENVI-met analysis:* As a result of the combination of green space characteristics and canopy cover, 36 scenarios were determined to analyze in ENVI-met (Figure 3). Mean Physiological Equivalent Temperature (PET) for each green space and LCZ class were obtained from ENVI-met for three canopy cover (0%, 50%, 100%) scenarios. ENVI-met requires three basic types of data to start a simulation including spatial, simulation, and climate data. Firstly, spatial data, including land uses and their characteristics, were digitized in Sketchup software with ENVI-met pluggin. Simulation data including simulation date, start–finish, and simulation period. In this study, the spatial resolution was determined as 5 x 5 m, and the simulation period was determined as 8 hours. The simulation date was defined as 20 June 2017 according to the hottest day of the last 20 years (2000-2020). The start–finish times of the simulation were identified according to the hottest period of the day, from 10:00 to 18:00 (https://ag.arizona.edu/azmet/az-data.htm).

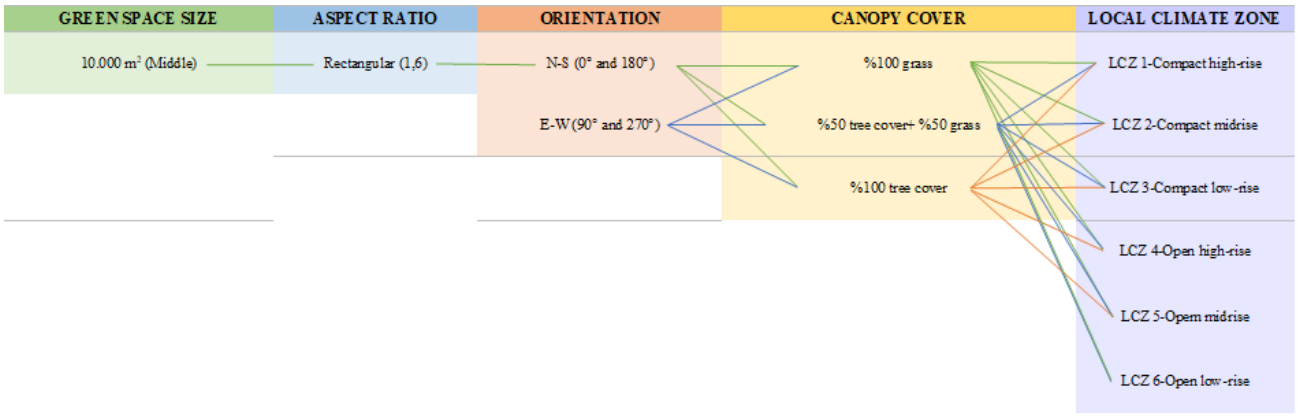

Figure 3. The number of scenarios with the combination of The 2D and 3D green spaces characteristics

- *Statistical analysis:* Finally, suitable and least suitable UGS characteristics were determined according to the statistical significance of PET differences ($p > 0.05$) using the one-way ANOVA with post-hoc Tukey-HSD test analyses of pairwise comparisons.

3. RESULTS

Firstly, the mean PET values of green spaces in six LCZ were determined for each scenario according to ENVI-met model results (Figure 4). All results are in the category of extreme thermal stresses due to Arizona's extreme climatic conditions. The 100% grass cover scenario has the highest PET (52-55°C), while the 100% tree cover scenario has the lowest PET (50-52°C). Results showed that vegetation has positively affected the thermal condition of green spaces because of the shading effect. Building height also affects the green space's thermal condition because of the shading effect. While PET values generally increase in the low-rise classes (LCZ 3 and LCZ 6), it is low in high-rise classes (LCZ 1 and LCZ 4). Compact midrise (LCZ 2) and open high-rise (LCZ 4) have similar PET in 50% and 100% canopy cover.

	MEAN PET (°C)					
	LCZ 1	**LCZ 2**	**LCZ 3**	**LCZ 4**	**LCZ 5**	**LCZ 6**
100% Canopy cover North-South	50,5	51,4	52,3	51,4	52,0	52,7
100% Canopy cover East-West	50,7	51,4	52,2	51,4	51,9	52,6
50% Canopy cover North-South	50,8	51,7	52,6	51,6	52,3	53,0
50% Canopy cover East-West	51,0	51,8	52,6	51,7	52,3	52,9
100% Grass cover North-South	52,9	54,3	54,9	53,9	54,7	55,4
100% Grass cover East-West	53,3	54,4	55,0	54,2	54,8	55,5

Figure 4. Distribution of PET values by green space area according to scenarios

Secondly, statistical analysis was performed. The ANOVA-Tukey HSD test results were summarized in Figure 5. The ANOVA-Tukey HSD test was applied to determine statistically significant relationships between PET and 2D/3D characteristics of green spaces. Almost all groups of scenarios are statistically significant ($p>0,05$). It shows that all groups of 100% grass cover vegetated simulations are statistically differentiated from simulations with 50% and 100% tree cover. While the 50% tree cover simulation PET results were approximately 1-2°C cooler than the 100% grass cover simulation, the 100% tree cover simulation PET results were roughly 2- 5°C cooler than the 100% grass cover simulation. When we compare 50% and 100% tree cover simulations.

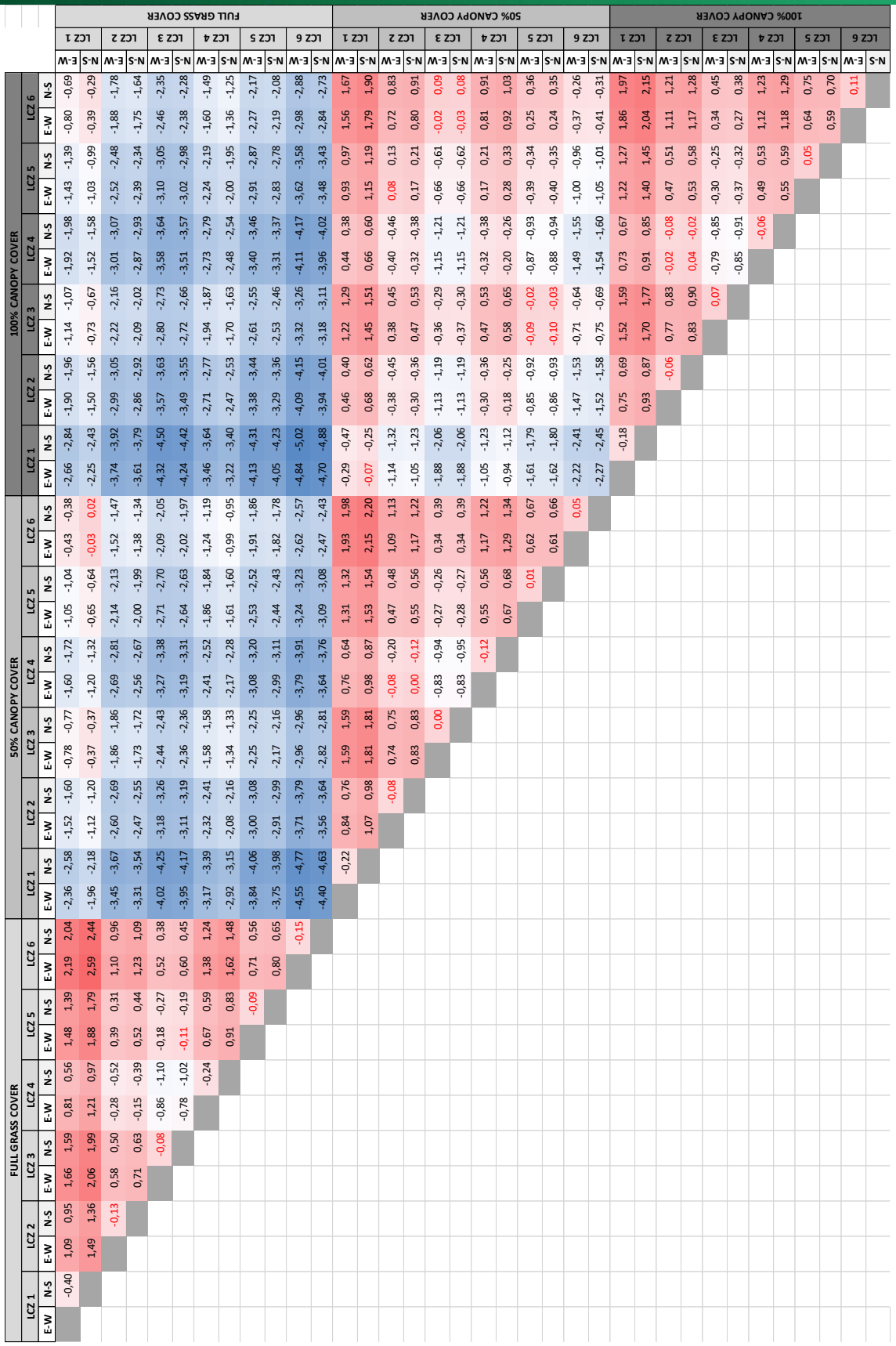

Figure 5: Tukey-HSD comparison matrix for all scenarios, where the blue and red grids show significantly different ($p < 0.05$) mean PETs and red text shows that there are not any significant differences ($p > 0.05$).

4. DISCUSSION AND CONCLUSIONS

The main conclusion of the study was summarized as follows:

- Green spaces with high canopies have lower PET and are the most suitable for thermal comfort due to their high shade. However, it is impossible for all urban green spaces with 100% tree cover in the city.
- The suitable tree cover density can be determined according to the characteristics of each urban green space including area size with more detailed resolution. Before implementing the decisions on the development of green spaces in a city, the optimum tree cover density and tree species for outdoor thermal comfort of different seasons should be determined in the study areas.
- North-South-oriented green spaces have lower PET than East-West-oriented green spaces.
- The climate of green spaces is directly affected by the settlement located nearby. We determined that, especially, small Green spaces surrounded by high-rise buildings have lower PET in any scenario because of the shading effects of these structures.

Future work should include the different green space characteristics such as field size and aspect ratio, as well as LCZ, canopy cover, and orientation. Thus the most suitable 2D and 3D characteristics for green space in different settlements should be determined.

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The authors have no conflicts of interest to declare.

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Management of human resources in the Tourism Industry

Faton Haziraj[1], Faton Sherifi[2]

Abstract: Human resource management in the tourism industry is a critical aspect for the success of tourism organizations. In this abstract, we will examine the role and importance of human resource management in the context of the tourism sector and include some of the main challenges tourism organizations face in their human resource management. Human resource management includes recruitment, selection, training, evaluation and development of employees in the tourism industry. A good human resource management process is essential to ensure the right team of employees who have the necessary skills, knowledge and experience to provide quality services and meet visitors' expectations. One of the main challenges facing tourism organizations is the different sectorization and seasonal nature of the tourism industry. This makes human resource management challenging, as it requires quick and appropriate responses regarding the number and skills of workers in periods of high tourist demand. To address these challenges, tourism organizations must develop sustainable strategies for human resource management. These strategies should include good human resource planning, developing a motivated and committed work culture, providing training and professional development opportunities, as well as creating mechanisms for maintaining and increasing the capacities of their employees.

Key words: management, resources, labor, seasonal, politics, etc

1. INTRODUCTION

The issue of human resource management has been quite complex since the beginning of the existence of relations between employers and employees, with a special emphasis in modern times. However, now we are dealing with a multitude of international acts and principles which create a legal, professional, ethical and technological environment or structure of various enterprises. All these acts consist of two categories of laws:

Laws aimed at protecting workers in the workplace, regulations on wages and working hours, safety at work and equal treatment of employees,
Laws that determine the positions of employers and workers in collective agreements as well as the internal regulation of Unions of employees.

Human resource management is also faced with an environment or economic structure that consists in the fact that every organization is an integral part and is influenced by the general level of development of economic activities. Economic and professional conditions in the industrial branch of the labor market. Managers who in some way ignore either the existing legal or economic environment, are exposed to professional risk and the lack of sufficient adequate workforce which is a key element in the realization of the enterprise's mission. This wide range of laws has created a guide to the operation of human resource management. Knowing this legal environment offers opportunities for increasing the productivity of enterprises and at the same time avoiding legal problems by making a connection between the enterprise on the one hand and what the external environment offers and requires. Managers must be very clear in treating employees fairly by developing ethical procedures and creating opportunities for employees to participate in making decisions that affect their work. The understanding of management is applicable in various organizations, such as private companies, nonprofit organizations, government institutions, and other organizations. The study of management has become part of many university programs and provides the necessary knowledge to develop the skills and competencies needed to be a successful manager. Human resource management is a key aspect in any sector, including the tourism industry. In the tourism industry, personnel play an important role in providing quality services to guests and in managing various operations. Here are some issues that should be considered in the management of human resources in the tourism industry.

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Include the selection of the most qualified personnel appropriate for the respective job. The manager must have at his disposal the entire personnel service, which I can offer help in recording, surveying or testing the potential personnel offered, as well as I can also use the general specialized services outside the company. personnel play an important role in providing quality services to guests and in managing various operations. Here are some issues that should be considered in the management of human resources in the tourism industry. Include the selection of the most qualified personnel appropriate for the respective job. The manager must have at his disposal the entire personnel service, which I can offer help in recording, surveying or testing the potential personnel offered, as well as I can also use the general specialized services outside the company. personnel play an important role in providing quality services to guests and in managing various operations. Here are some issues that should be considered in the management of human resources in the tourism industry. Include the selection of the most qualified personnel appropriate for the respective job. The manager must have at his disposal the entire personnel service, which I can offer help in recording, surveying or testing the potential personnel offered, as well as I can also use the general specialized services outside the company. Include the selection of the most qualified personnel appropriate for the respective job. The manager must have at his disposal the entire personnel service, which I can offer help in recording, surveying or testing the potential personnel offered, as well as I can also use the general specialized services outside the company. Include the selection of the most qualified personnel appropriate for the respective job. The manager must have at his disposal the entire personnel service, which I can offer help in recording, surveying or testing the potential personnel offered, as well as I can also use the general specialized services outside the company.

2. UNDERSTANDING MANAGEMENT

The word management derives from the English word "to manage", which in some other languages such as Albanian, French, Swedish, etc. does not have an adequate meaning, but in most cases the terms governance, leadership, direction, etc. are used. In the general sense of the word management there are these synonyms; setting, arranging, planning, directing, achieving goals, organizing, etc. These synonyms include: regulation, planning, control, organization, direction and realization and have the quotation of the one-way process where the manager tells the "inferior" employees what needs to be done, while the "inferiors" are means to achieve the given goal. The manager is often called "boss", supervisors, while his assistant is called the right hand.

Regarding management, many opinions have been given by different authors: according to Fajoli, governance means forecasting, planning, command, coordination and control.[3]According to Mas and Daglas, management represents the process through which the selected group of people leads and guides all employees in the company according to the common task for common goals.[4]Management represents the process of conscious orientation of human activities towards the realization of the goal, respectively the interconnected third of five functions: planning, organization, framework (personnel), leadership and control.[5]

Managerial functions of planning, organization, framework, leadership and control, management is a relatively universal activity that can be implemented in any type of organization, including the work and activities of managers at all organizational levels, the goal of all managers is relatively the same to create excess, management includes all levels of success productivity, effectiveness and efficiency. Include the selection of the most qualified personnel appropriate for the respective job. The manager must have at his disposal the entire personnel service, which I can offer help in recording, surveying or testing the potential personnel offered, as well as I can also use the general specialized services outside the company.

Today's organizations recognize that people, not money, buildings or equipment, are the key to differentiating business entities and their success. In the new millennium, in the knowledge economy, people become the driving force for making profit and that the entire wealth of the organization (except for people) is inert. Thus, the basic task of contemporary organizations is to try to attract and keep the best people, respectively, it is the qualitative and effective performance of human resource management activities and tasks.

[3]*Fayol, H, General and Industrial Management, Pitman, v. 1949*
[4]*Massic, J, L. And Douglas, J, Managing;Acontemporary Introduction Engelwood Cliffs, NJ Prentace Hall. 1973*
[5]*Ramosaj. B, Enterprise and enterprise management, Rilindja, Pristina*

Figure 1. Shows that even the smallest organizations should carry out the selection of human resources, ie. to choose the people who will work in them, and that based on the assessment of success at work, they should be rewarded for their work or that they should be educated in a complementary way and develop them so that they have the knowledge and skills necessary to perform of their work.

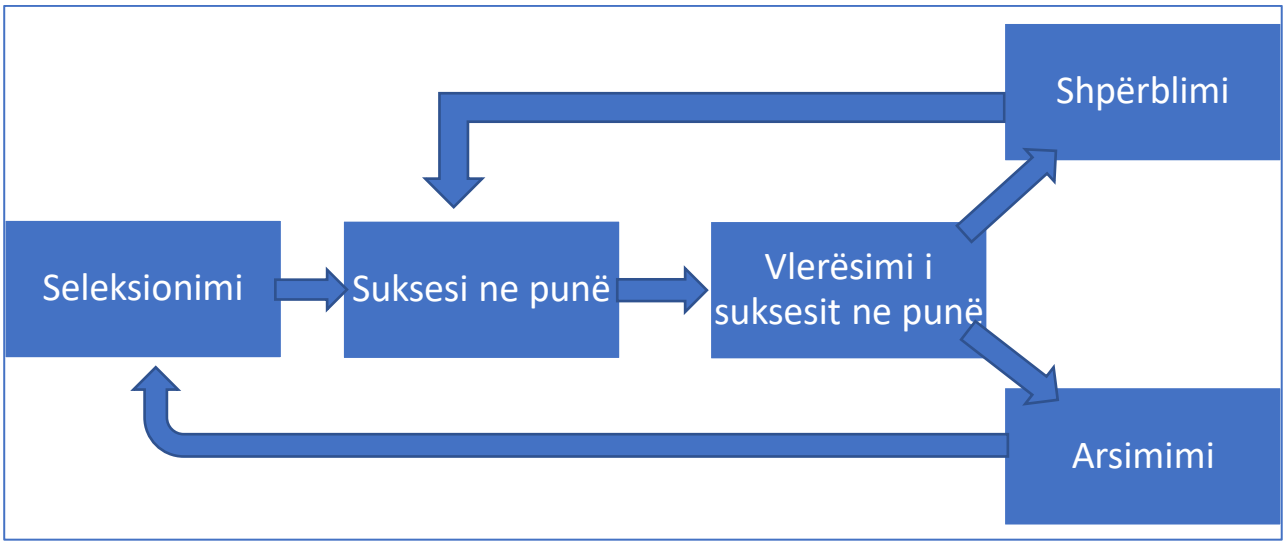

***Figure 1**: Human Resource Management Cycle*[6]

Basic functions Human resource management can also be defined through basic functions, respectively its activities and tasks, each of which includes a range of different and specific tasks and jobs. The basic functions of HRM are:[7]

- Strategic management of human resources,
- Planning the necessary number and structure of employees,
- Analyzing and shaping tasks and jobs,
- Recruitment, selection, induction and systematization of personnel,
- Monitoring and evaluating success,
- Motivation and reward,
- Education and development of employees,
- Creation of adequate organizational climate and culture,
- Social and health protection,
- labor relations,
- Various services to employees.

2.1. Selection of managers

The organization needs managers of different levels and that:
For the lower level of management, at the supervisor level, there are two sources of personnel:

- graduate students,
- advanced workers or promoted from lower levels.

For the first, during the procedure, the available potential must be determined, while for the second, the potential capacity for supervision must be evaluated.
For the middle and high level of management during the selection, the managerial skills and knowledge must be taken into account, which are evaluated by researching the extent to which the candidate has been successful in planning, organization, selection of personnel, leadership or control in the field of communication in relations between human etc.[8]
A special technique for selecting managerial personnel is the use of the evaluation center, which is based on three components:

- Determining relevant behaviors for the successful performance of tasks;

[6] *Rexhepi. H, Human Resources Management, Pristina 2015.*
[7] *Rexhepi. H, Human Resources Management, Pristina 2015.*
[8] *Donald W. MacKinnon. From selecting Spies to Selecting Managers in the book Joseph L. Moses and Willi C. Byham; applying the Asscssment Center Method, New York; Pergamon Press, 1977*

- Method for evaluating such behaviors;
- Qualified people capable of evaluating behaviors.Potential candidates must participate in various exercises and activities such as: spontaneous conversations, written assignments, management games, surveys, interviews, etc.

2.2. Education, training and preparation of workers

Learning, training and preparation of workers are aimed at developing creative experiences and behaviors so that work can be carried out successfully. Their role in the worker is seen in the increase of work experience while in the manager in the increase of managerial experience.

The creation and dynamics of new technology, knowledge of work methods, procedure and practice increases the need for training and education of workers.

The methods they used the most in the field of training and education of workers are:

- Exercises during work;
- Practical exercises.

2.3. Preparation of managers

The purpose of the preparation is to increase the technical, managerial and conceptual skills of the manager for successful work and requires more time than the preparation of workers.

The methods used to prepare managers are:

- Mentor system;
- Rotation system or technique;
- Specialized seminars;
- Courses and programs.

Low and middle managers prepare while working in the organization and are oriented in the technical or managerial field. Senior managers carry out the preparations mainly outside the organization and in the conceptual field by experts and scientific-teaching institutions.

3. SOME OTHER HUMAN RESOURCE PROBLEMS

Protection and health of employees- essential issues within the provision of resources are the existence and issuance of certain laws, rules or norms that regulate the issue of protection at work and the material compensations necessary for the protection and preservation of health.

Human values- the person represents the basic value in the organization for the achievement of the basic goals - profit. Therefore, human values as a factor or dimension in general expenses, general values as a barrier for comparing material values with human and non-material ones in the general spectrum of calculating expenses or goods values.

***Figure 2**: Photo illustration.*

Retirement and replacement of employees- retirees are people who have reached a certain seniority or when they are no longer fit for the organization. The limit of the working cycle of employees is 65 years. Replacement of employees can be provided either from within where the pain is easier and vice versa.

4. EMPLOYEE UNION (Organized labor)

The union of workers is of all organized forms of workers with the aim of ensuring organizational integrity or compactness vis-à-vis management and negotiations with it on wages, working hours, working conditions, etc. They may have the formal organizational character of an organization, association or any other association.
The unionization of employees is done for the following reasons:

- Economic improvements;
- Job security;
- Social status;
- Collective power;
- Expression of dissatisfaction.

Through these forms, it is attempted to reach an agreement with the management at any time, which is an elementary basis for the realization of the common goal in the organization.

4.1. Collective agreements

Collective agreements are a dynamic process of achieving agreement between workers and management on employment conditions, and they acquire the collective attribute only when they are represented as a group. The subject of collective agreements can be broad, but we will highlight three segments:

- Safety at work segment;
- Work segment, work speed and work method;
- Compensation segment.

5. INDIVIDUAL EMPLOYMENT RIGHTS

Individual Rights in Employment are characterized by a more detailed set of rules and procedures that regulate the attitudes and behaviors of employers, managers and employees in workplaces. This set of rules starts from the most basic such as rules on smoking restrictions in the workplace to harassment, Hostile Environment, Family and Medical Leave, Workers' Compensation, Employment Contracts, etc. Harassment (harassment) in Organizations must be legally regulated policies that define the protection of the individual from harassment that may come from workers, supervisors, employees, in workplaces. Therefore, it is the duty of the employer to define preventive policies, especially if such a thing comes from the supervisor appointed by him, and the employer is held liable regardless of whether he was aware of the supervisor's conduct. Usually, harassment can be based on gender, race etc. Derogatory comments directed at a female person can be considered gender-based harassment.

Despite the fact that Hostile Environment (unfavorable) is a subcategory of an unfavorable environment, this does not imply that there are conditioning as the main factors. For the environment to be considered as hostile, it is sufficient that the behavior of one individual towards another is unkind, and this is due to gender, different goals, etc. If the employer has been informed of such a thing and has not taken corrective measures against such an occurrence, then there is not much left to distinguish the hostile environment.[9]

6. STATUS RIGHTS

During the last century, from year to year, there have been qualitative changes in the improvement of working conditions in all types of economic activities. These changes are primarily related to the continuous efforts of employers in maximizing profit and reducing risk and fear for existence.

Such tendencies, among others, are also confronted with various anti-discriminatory laws and legal acts which protect job seekers from discrimination based on race, religion, age, national origin or gender. In spite of them, elements that can and

[9]*Howard Davies & Pun-Lee Lam-"MANAGERIAL ECONOMICS – An Analysis of Business Issues."*

should be taken into account when hiring job seekers are first of all those related to experience, education, behaviors, quantity and quality of work and many other categories related to the performance of work that does not conflict with anti-discrimination laws. In this line, so far many international acts have been issued such as: the Act on Civil Rights, the Act against Discrimination in Employment based on Age, then, the Act against Discrimination based on Disability, the Act against Discrimination based on Pregnancy, etc. .

The Law on Civil Rights equally protects all categories of job seekers, although it is well known that the categories most at risk of employment discrimination in many countries are women, minorities and the elderly. All this is mainly related to the prejudices regarding the possibilities of their employment and promotion in management positions.

The Age Discrimination in Employment Act focuses on prohibiting discrimination against employees over the age of 40. There is a perception among employers that the decline in performance level is directly proportional to age, meaning that after a certain age individuals are no longer as effective in their positions. However, the supposed decline in the level of performance due to age cannot be taken as a reason for harsh measures such as dismissal. On the contrary, the employer must take into account the length of service and the general quality of the work performed by the worker, and these things actually only make it more difficult to come to the conclusion that such a person is no longer effective in his workplace.

In developed countries such as the United States of America, there are also acts such as Americans with Disabilities which protects certain categories of people with disabilities from discrimination in employment. This law protects all those people who suffer from health problems, whether temporary or permanent, problems that affect the change of various vital functions. It is the employer's duty to determine the necessary physical and mental conditions that the job seeker must have upon acceptance in advance, with the announcement of the job vacancy. In case the job seeker or the employee has such health obstacles that are an obstacle to the realization of the work, insurmountable obstacles, then it is the duty of the employer to show that these obstacles are really insurmountable limitations for the specific workplace.

The Pregnancy Discrimination Act requires that, if not favorably, then at least pregnancy be treated like any other medical situation. The employer cannot unilaterally decide when the pregnant worker is unfit for work.

7. CONCLUSION

For Human Resource Management in the Tourism Industry is that a successful intervention in human resource management is essential to achieve success in the tourism industry. As tourism is a service sector, the role of employees and staff is important in providing an excellent experience for tourists. In the management of human resources in the tourism industry, it is important to ensure the proper selection of employees, their continuous training and their motivation to provide excellent services. Competences and skills of employees are key factors to ensure a high quality service and meet the demands of tourists. Also, human resource management in the tourism industry also includes creating a healthy and safe work environment for employees. This may include developing direct policies and procedures for employee safety and well-being, as well as promoting work-life balance.

To improve human resource management in the tourism industry, it is also important to monitor and analyze data and collect feedback from employees and tourists. This can help identify potential issues and develop strategies to improve processes and employee performance. Human resource management in the tourism industry is an important process to create an excellent experience for tourists and to achieve success in this sector. By emphasizing the selection, training, motivation and well-being of employees, tourism organizations can build an engaged and qualified workforce that contributes to the development and growth of tourism.

Human resource management in the Tourism Industry is essential to the success of tourism organizations and to ensure an excellent experience for visitors. By including selecting, developing and retaining the right staff, as well as creating a supportive and motivating environment, tourism organizations can build a prepared, motivated and engaged workforce. Human resource managers must have deep knowledge of the tourism market and understand the specific needs of this industry. They must be able to identify and select individuals with the right skills and motivation to work in the tourism industry. Selection of the right personnel is critical to ensure the quality of tourism services and to create a good image

of the organization in front of customers. The development of human resources in the Tourism Industry should be a continuous process. Continuous training and opportunities for career development will help increase the skills and competencies of employees. This will enable the organization to have qualified and prepared employees to meet the ongoing demands of the tourism industry and adapt to new developments in the tourism sector.

Retaining talented employees is also a significant challenge for tourism organizations. By creating a stimulating work environment, offering appropriate and attractive rewards and developing a good work culture, tourism organizations can help increase the level of resilience of their employees. This factor is important to avoid employee turnover and to preserve the capital of qualified people within organizations. In conclusion, the management of human resources in the Tourism Industry is key to the success and sustainability of tourism organizations. By focusing attention on the selection, development and retention of the right personnel, tourism organizations can be created into a truly excellent industry, offering wonderful experiences to visitors and contributing to the economic and sustainable development of tourist destinations.

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Economy of tourism

Neritan Turkeshi[1], Zija Zimeri[2]

Abstract: Today, tourism is one of the most powerful industries in the world and as such, it has a great impact on the economic and social development of many countries, especially in developing countries where it is seen as one of the most important sources of income and opportunities. of employment, diversification of the economy, protection of the environment as well as promotion of intercultural exchanges. In this topic, I will address exactly this impact that tourism has on the economy and the benefits it brings to different countries in the world. Tourism economics is an important field of study that focuses on the impact and contribution of the travel and tourism industry to the economic development of countries and regions. Tourism has evolved into a multi-dimensional industry that includes transportation, accommodation, tourist services and tourism-related activities. The impact of tourism on the economy is significant on many levels. It brings about the creation of jobs, an increase in gross domestic income and contributes to the growth of exports. Also, tourism can have positive effects on the balance of a country's current account, help improve infrastructure and influence the promotion of culture and national identity. The travel market is a major component of the tourism economy. This market has seen significant growth in recent years, becoming a sector of great importance for many national economies.

Key words:management, economic environment, employment, impact, policy, etc

1. INTRODUCTION

The development of technology, the use of the Internet and the increase in living standards have contributed to the increase in demand for travel and tourism services. The travel market includes travel agencies, tour operators, airlines, hospitality and other tourism services. These entities operate in a competitive environment and act according to the laws of the market, offering customized solutions and experiences for tourists. The impact of the travel market on the economy is significant. It encourages investments in tourism infrastructure, such as the construction of hotels, airports and other tourist facilities. This process creates new jobs and brings increased income, as a result of increased income from tourists and their spending in the visited destination. Also, the travel market is an important source of foreign exchange and contributes to the country's current account balance. However, the impact of tourism on the economy is not without challenges. The poor and marginalized groups may not benefit sufficiently from tourism development, and in some cases, it affects the conflict with the protection of the environment and the preservation of cultural heritage. Therefore, sustainable management and policy making informed by knowledge and deep understanding of the tourism economy are essential to ensure sustainable and comprehensive development. This summary aims to illustrate the importance and impact of the tourism economy, emphasizing the role of the travel market. While tourism continues to grow and develop globally.

This work aims to generalize and analyze the economy of tourism and its role in economic development. Tourism has seen steady growth and has made a significant contribution to the economies of many countries around the world. In this work, we will examine some key aspects of the tourism economy. First, we will analyze the impact of tourism on economic growth. Tourism has the ability to create new jobs, increase investment and contribute to the growth of a country's gross domestic product. We will also address the impact of tourism on other economic sectors, such as transport, trade and food. Another key aspect we will consider is the impact of tourism on international trade. Tourists help increase a country's exports, contributing to the increase in income and the arrival of foreign currency. Another benefit of tourism is the transfer of technology and knowledge from tourists coming from different countries, contributing to the development of other economic sectors. In addition to the positive aspect, we will also address the challenges and

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problems that come with the development of tourism. Some of these include the negative impact on the environment, social and cultural problems, and the push for wealth sharing. We will also discuss the ways in which tourism planning and regulation policies can address these challenges and help achieve a sustainable and economically advanced tourism. Finally, we will conclude with a future look at the tourism economy.

2. THE ECONOMY OF TOURISM

The new economy reflects the growing demand, at a global level, for new ways of economic life, increasing care for the preservation of the Earth and its resources, as well as for the empowerment of society to meet its needs, which is intertwined with the concept of carrying capacity. The current troubles of our society are due to reckless actions to help sustainability.

Today, more and more, tourism is becoming the main sector of the economy, generating financial income and creating opportunities for new jobs. However, as one of the sectors where the economic growth of the country is expected to be concentrated in the future, tourism is still not finding itself in real sector development. One of the many problems that the tourism economy faces today is the identification of the real strategy for the development of the tourism product, as well as the use of marketing strategies, which will lead to the sustainable development of tourism. In the time of the market economy, unfavorable fiscal policies often become an obstacle to the development of tourism enterprises, even when they have capacity and development potential. How much tourist operators are able to recognize and understand the principles of sustainable tourism and sectoral strategies and how much they manage to implement in practice, which in most cases are ad‟hoc actions, will be identified through this scientific research. The design and implementation of appropriate strategies will enable the tourism sector to develop sustainable tourism operators in the long term, who will offer tourism products and services that will motivate local and international clientele to stay in Kosovo. The differentiation of the products and their best positioning in the market, not only in the country, but also in a wider area, will influence the tourist operators to completely change the approach to the tourist potentials.

Economic factors are among the most important factors that influence the increase or decrease in the demand for tourism, as they are decisive in the choice or not of a tourist destination. The impact of these factors in supporting the development of tourism is particularly evident in the trips made during leisure time. Published tourism statistics and national economic trends make it possible to find links between changes in income and the volume of trips and expenditures made on them.[3]For most of the population in developed economies, overall growth in real incomes has led to increased travel spending, so it is increasingly likely that travel spending in these developed countries will tend to rise and fall depending on the economic cycle that the countries will go through.

Thinker Stabler says that progress to develop and support the concept of sustainable development has been rapid. After the Brundland Report, its further supporting progress is explained by the fact that the concept of sustainable development is associated with the notion of balancing, a fair balance between the need for development and environmental protection. In this way, the appealing meaning of the concept brings a development perspective to supporters of continued growth and a sustainability perspective to environmentalists and supporters of slow growth or gradual development. Synthesizing these two contradictory attitudes, sustainable development represents attractive opportunities for continuous economic development that does not exceed the economic, social-cultural, environmental carrying capacity of the earth.[4]

2.1. Factors affecting the demand for tourism

Exchange rate. A factor that affects the choice of a destination is also the currency, the volatility of the exchange rate in many cases is decisive for the choice of a destination, since most of the time vacationers tend to go to the cheaper destinations. A destination is cheaper when the host country's currency is weaker compared to the currency used by

[3]*Victor TC Middleton,V.,Fyal,A.& Morgan,M.(2009). Marketing in Travel and Tourism" The dynamic business environment: factors influencing demand for tourism"*
[4]Stabler, Tourism and Sustainability, Principles and Practice 1997 Wallingford, CABI International.

vacationers in their home country.[5]For example, when the US dollar strengthens compared to the euro, many Americans are inclined to take their vacations in Europe, as vacations become cheaper for them. The relationship between the two currencies is in many cases decisive for the choice of the country in which to take the holidays, but there are exceptions.

Travel for business and leisure purposes. The business travel market is very broad and international in scope. Business trips are constantly influenced by economic developments, but for some companies the trips of their representatives are more than essential for the smooth running of the business. It is noticed that in the review periods the companies go from bookings in the first class on the planes to those of the lower classes, and even finding the hotel varies from luxury hotels to less expensive ones. By reducing in the same way and overnight stays and even the number of trips. For a business it is not the same as for leisure travel, as an economic downturn will not be decisive for that type of travel, whereas for businesses it could lead to their bankruptcy.[6]For this reason, even in extremely difficult economic times, businesses continue to travel in order to keep their business afloat.

Prices of tourist packages. There is reliable data, for the short term, that the price of a firm's product or the perceived price of a destination, compared to that of competitors, is one of the main factors that influence and dominate the volume of demand.[7]Of course, setting the price of a product is not simple and it even becomes more difficult when you have to set the price you will offer for tourist packages. This price should best justify the conditions that the vacationer will face. The price is one of the main factors that will influence the increase in the number of vacationers who will visit a certain destination. The increase in tourists will lead to an increase in the income of accommodation units, generally hotels, thus leading to an increase in the income of the tourism sector.[8]Since there are many travel agencies whose subsidiaries are located and spread around the world, vacationers have more options to choose one destination over another. Even this is to some extent starting to regulate the market and make the competition between agencies stronger by offering more attractive prices in order to generate demand for their place.

Demographic factors. Demography is the most important external factor that is changing the way tourism is done and will continue to change it and more in the future. Current demographic trends will change the demand for tourism, which will directly affect the structure of the industry, the way it operates. Demographic factors include age, income level, family size, nationality, employment, population movements both within and outside the country, lifestyle, etc. Demographic market studies should focus on individual desires rather than tourism as a whole, so a segmentation of tourism should be done based on the needs and desires of vacationers. The population is the raw material of tourism, but it is not the number that is important, but the ability of individuals of the population to afford vacations. Tourism is a luxury good, therefore the increase in the income of individuals in a society will increase the demand for this good. On the other hand, the average age of the people also affects the demand for tourism. The increase in the average age increases the demand for tourism as people belonging to this category are more likely to take vacations, as a result of their status in the family.[9] These people have higher incomes and as a result, they will spend more on luxury goods and services.

Promotion. A promotional strategy means designing and implementing integrated communication programs. The objectives are usually to make customers aware, motivate their interest, encourage them to browse the Internet, look for brochures and call directly or go to their nearest agencies to ask for more information about the country. that aroused curiosity.

2.2. Factors influencing tourism supply

Accommodation. The qualitative and quantitative characteristics of the accommodation offer have a direct impact on the overall success of tourist destinations. In this way, in order to have a sustainable and efficient development

[5]*Lickorish, L. & Jenkins, C. (1997). An introduction to Tourism. "Factors influencing demand for tourism".*
[6]*Lickorish, L. & Jenkins, C. (1997) An introduction to Tourism. "Factors influencing demand for tourism".*
[7]*Victor TC Middleton,V.,Fyal,A.& Morgan,M. (2009). Marketing in Travel and Tourism "The dynamic business environment: factors influencing demand for tourism"*
[8]*Hajnu, Sh. , "Monitor" magazine. No. 23. (2006). The Knock of Tourism.*
[9]*Victor TC Middleton,V.,Fyal,A.& Morgan,M. (2009). Marketing in Travel and Tourism "The dynamic business environment: factors influencing demand for tourism"*

of tourism, we must pay a lot of attention to the development of the accommodation sector18. Based on several studies, it has been concluded that different forms of tourism present different requirements in terms of the form of accommodation.[10]As you know, there are a number of accommodation units such as hotels, motels, camps, vacation homes, etc. Accommodation is the best form that connects the vacationer with the destination of his choice. It is of particular importance regarding this and the fact that most of the budget available for vacations is spent only on accommodation20. Accommodation includes all the facilities that serve and are needed by vacationers during their stay in a destination, such as: beds, food, or various activities with entertainment purposes prepared by the managers of the accommodation unit.

Figure 1: accommodation spaces, Hotel Aleksandar Palace, Skopje, North Macedonia

Investments in infrastructure. Infrastructure is fundamental for the development of tourism and vital for its marketing. It increases the efficiency of private production and distribution of tourism services, and in certain cases makes possible the supply of tourism services. The fact that the trips are made by air, land or sea, has caused the need to create railways, airports, seaports, tunnel networks and others, to make the trip as easy and as short as possible in time.[11]Both tourists and residents of these countries require the same services, such as the demand for infrastructure services such as water supply and waste disposal, communication and electricity.

Government. The government and its influence are very important in the development and economic growth of a country. Only the government has the right and the power to ensure political stability and provide the legal and financial framework that tourism needs. It provides essential and essential services for a most profitable tourist season. The government is the only one that can agree and carry out agreements with other governments regarding the free movement of individuals from one territory to another. The Ministry of Tourism together with a number of ministries and municipalities made possible the smooth functioning of tourism and the smooth functioning of the public and private sectors. There are a number of ways in which the government can increase a country's tourism offer, such as lowering entry taxes at borders, reducing VAT, etc.[12]So government intervention through its fiscal policies will reduce costs, thus increasing the supply of tourism.

Employment in the tourism sector. The tourism industry is one of the industries that generates more jobs. This sector creates a number of employment opportunities in both the formal and informal sectors. In addition, tourism can create three types of employment opportunities: direct, indirect and induced.[13]According to K. Sharma, direct employment refers to employment generated by hotels, restaurants, night clubs, etc. Indirect employment refers to workers who are not directly related to tourism but who still receive economic benefits from it, such as doctors, fuel workers, etc. And finally induced employment which refers to employment created to provide equipment and services to people directly employed in this sector. However, we will only deal with direct employment and how the latter affects the increase in tourism supply.

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[10]*Bisht, H. (1994). Tourism in Garhëal Himalaya: with special reference to mountaineering and trekking in Uttarkashi and Chamoli Districts. Accommodation.*
[11]*Done, L. & Forsyth, P. (2006). INTERNATIONAL HANDBOOK ON THE ECONOMICS OF TOURISM. Public sector investment in tourism infrastructure*
[12]*Elliott, J. (1997). Tourism: politics and public sector management.*
[13]Sharma, KK(2004) Tourism and socio-cultural development.

Attractiveness. During their travels, tourists participate in activities, which are a key point in their vacation. In some cases, these activities can be the main reason for tourists' travel. Attractions are divided into several categories by tourism researchers to see the impact they have on tourist activities. Usually attractions are studied in the following aspects:

1. **Natural sources.**These are resources provided by nature and used by tourists. The history of tourism is based on the discovery and recognition of these natural resources as attractions for tourists, most notably the discoveries of SPA centers. In a similar way, in the nineteenth century, development was based on the discovery and recognition of different landscapes (such as seas and coasts) as attractions for tourism.[14]
2. **Man-made resources**. These are attractions that were developed in response to the increased demand for tourism in certain localities. Often these attractions are built on natural resources. In the post-war period, the growth of mass tourism and the increase in demand for attractive environments led to the development of the deliberate construction of resources to increase the spending of tourists, thus increasing the supply of tourism.[15]

3. DEVELOPMENT OF SUSTAINABLE TOURISM

The term tourism is used for trips, mainly for entertainment, it is the totality of human activities carried out in function of these trips, which serves to satisfy the needs of tourists.[16]Tourism, as one of the important sectors of the economy, is an ongoing process and one of the sectors with the fastest economic growth at the global level, which with its developmental expansion, during the last 50 years, has turned into a global industry. During its sectoral development, not infrequently, tourism has been quite underestimated, recently with its contribution to economic development, it has been a central component of economic, social and cultural displacement, which has left its mark on a global scale. in the last two decades. Sustainable tourism includes social responsibility, a strong account of nature and the integration of local people in any tourism operation or development.[17]

Sustainable development, during its development, integrates three factors of sustainability: economic, social and environmental problems. These three very important issues of today's society, which integrate sustainable development, can be described as three circles located in a diagram. Venn, to convey the idea that these aspects of sustainability are mutually interdependent, shows through this model that society and economy are dependent on nature. Tourism can have economic, social, cultural and environmental impacts on local and regional communities. It stimulates and diversifies the economy, when it relies on a relatively limited base, and enables the improvement of infrastructure. Therefore, the challenge is to find means to support the sustainable development of tourism.[18]

3.1. Determining factors of tourism development

Regarding tourism development factors, Vjollca Bakiu says: "A country's available resources for tourism development, or what are otherwise called the tourist potential of a country, constitute the determining factors for ensuring the "production" of the community of products and services tourist, or those that can give the name to several places or different areas as tourist destinations. These factors are:

- Natural resources;
- Historical, artistic and cultural assets,
- Human resource,
- Capital and infrastructure resources.

Depending on the use and good management of these resources of a country, the positioning that takes place in the global tourism market can be explained, in accordance with the best models of their development and management.[19]

[14]Yes there.
[15]Yes there.
[16]*Vjollca Bakiu Economy of Tourism 2011 Tirana*
[17]*Yes there*
[18]*Chapter on tourism in the Green Economy report, prepared jointly by UNEP and UNWTO (2011), available at http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER_11_Tourism.pdf (18/ 01/2013).*
[19]*Vjollca Bakiu, Economy of tourism, Tirana 2011.*

4. THE NUMBER OF TOURISTS IN NORTH MACEDONIA AND ALBANIA

The data is obtained from the relevant statistical agencies of the respective states and we have a comparison of these two states. From which the decrease in the number of tourists during the Covid 19 pandemic, especially the year 2020, where the measures to ban free circulation, can be clearly observed.

Table 1:*The number of tourists in Albania and North Macedonia.*

No.	Country	2019	2020	2021	2022
1.	Albania[20]	6 406 038	2 657 818	5 688 649	7 543 817
2.	North Macedonia[21]	1 184 963	467 514	702 463	969 295

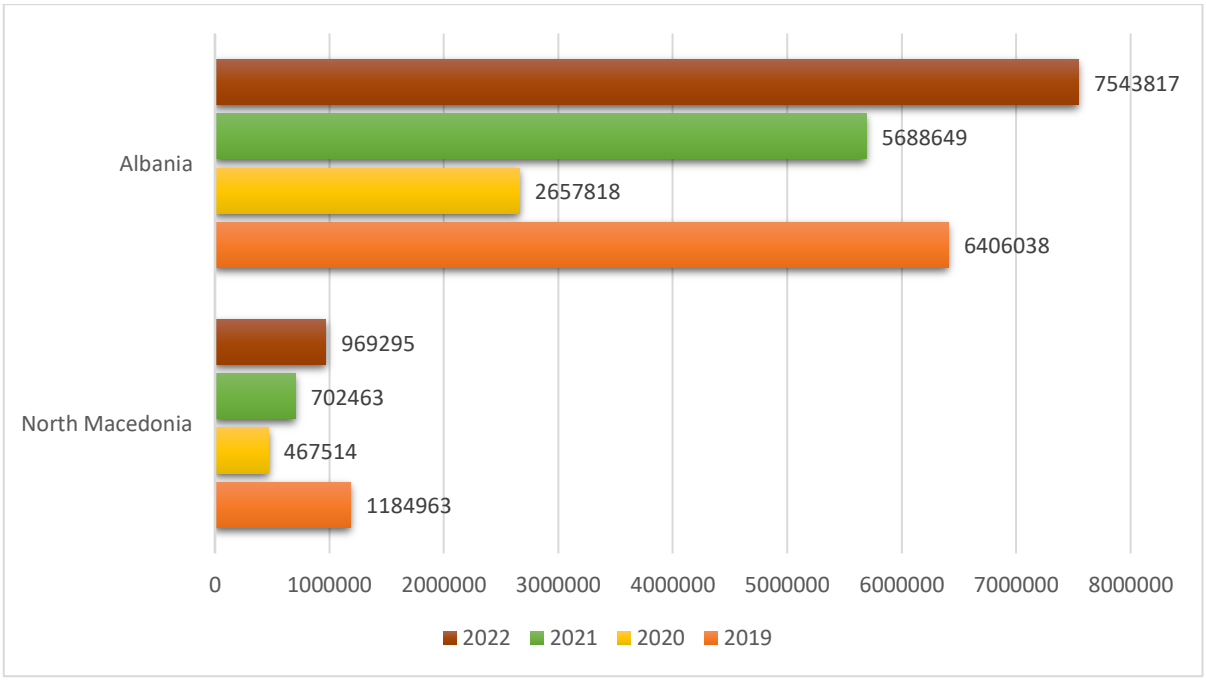

Figure 2*: Number of tourists in Albania and North Macedonia.*

5. CONCLUSION

The tourism economy is dominated by small and medium-sized economic operators, while the large economic operators are still in the process of privatization, therefore, for this reason, it is required to find a favorable sectoral strategy which in the long term will ensure the sustainability of tourist operators, offering a diversified tourist product. Based on the methods and models of sustainable tourism development presented in this paper for the sustainable development of tourism, tourist operators will have an easier time coordinating with the community, the public sector to convey a clear message to the tourist about the tourist product. certain tourist destinations. The analysis shows the possibility for application and the potential for their integration for tourism planning. One of the many problems that the tourism economy faces today is the identification of the real strategy for the development of the tourism product, as well as the use of marketing strategies, which will guide the sustainable development of tourism. In the time of the market economy, unfavorable sectoral policies in Kosovo often become an obstacle to the development of tourism enterprises, even when they have capacity and development potential. The paper has reflected the role and importance of the cooperation of relevant actors (public, private sector, local community and tourist) for orientation towards the development of sustainable tourism. The paper has analyzed four basic groups of actors that will influence the development of tourism and the necessity of their cooperation in order to achieve the goal of the tourism sector for sustainable development. Through the review of the national and international tourism literature, the research carried out through the questionnaire, the strong and soft points which the relevant actors should use and achieve the defined goals have been identified. Although there is an increase in the tourism of our country, it must be said that we still have a long way to go.

[20]*The data has been reclassified based on the categorization by region from the World Tourism Organization (WTO)*
[21]*The State Statistics Agency of North Macedonia.*

A bright future awaits the tourism economy in the coming years. With global incomes rising and travel restrictions gradually easing, the tourism industry has benefited from a strong rebound. The increase in demand for travel, accommodation, restaurants and tourist activities has led to a steady increase in business and employment in the tourism sector. Combined with innovation in technology and the adaptation of the tourism industry to the preferences of modern travelers, the tourism economy can be a positive disruptive force for the economies of developed and developing countries.

A great challenge awaits the tourism economy in the future. The negative impact of the COVID-19 pandemic has severely damaged the tourism sector, bringing a significant drop in income and job losses. Efforts to recover the industry have been challenging, requiring large investments to promote and restructure tourist destinations. However, with good planning, smart policies and international cooperation, the tourism economy can gradually revive and mark a sustainable recovery. Interventions to strengthen travel safety and solve various development problems, such as environmental pollution and benefiting local communities, will be essential to ensure a sustainable and protected future for the tourism industry.

The tourism economy is awaiting a fundamental transformation in the coming years. The impact of climate change, demographic changes and the advancement of technology affect the patterns and preferences of travelers. The tourism industry will have to adapt to these changes and take advantage of the new opportunities they offer. Tourist destinations will have to develop a sustainable strategy to face climate challenges, focusing on sustainable tourism and the use of renewable resources. In addition, the tourism industry can take advantage of new technologies, such as artificial intelligence, virtual reality and advanced communication, to provide the most personalized and convenient experiences for today's travelers.

These are just some of the possible conclusions for the tourism economy. It is important to understand that the conditions of the tourism industry continue to change and that the impact of recent events may have changed the current situation. Fresh information and regular analysis will be essential to understand the future directions and challenges of the tourism economy.

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Tourism performance and the environment in Ohrid

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Abstract: This abstract aims to analyze the tourism performance and environmental impact in the city of Ohrid, an important tourist destination in North Macedonia. The study of this topic aims to highlight the relationship between tourism development and environmental protection in this area. Through a general analysis of tourism in Ohrid, we will examine the development of tourism in this area during the last years. We will take into account the number of foreign visitors, income from tourism, tourist infrastructure and services offered. Also, we will research the factors that have influenced the growth of tourism, such as the promotion of the destination, the easy access of visas and the development of infrastructure. We will present recommendations for tourism management and environmental protection in a sustainable and smart way. These recommendations will be based on the best tourism practices that respect the environment and contribute to the economic and social development of Ohrid. this study aims to raise the awareness of various actors involved in Ohrid tourism, including local authorities, the local community. Through the analysis of statistical data and interviews with key actors of the tourism industry, the impact of environmental factors on Ohrid tourism will be assessed. Some of these factors may include: preservation of the natural landscape, pollution of lake waters, cultural heritage and building infrastructure in a sustainable manner.

Key words: management, environment, pollution, conservation, policy etc

1. INTRODUCTION

Favorable natural conditions along the environmental and landscape values support the sound basis for the affirmation and development of tourism. The improvement of transport facilities and the increase of accommodation capacities together with the enrichment of accommodation links should be a priority task. We can say that lakes are important hydroecological objects, because they give specific features to individual spaces. An integral part of the geographical environment, they are natural and artificial, but we will talk about Lake Ohrid, which is a natural lake. Compensation for tourist demands requires an increase in accommodation capacity, which must be compatible with the natural environment.

At the time of the action and the agents that influenced the creation of the fable, the natural lakes are older and more diverse. They are due to the components and the most popular and sought after in the country's tourist market and the widest is Lake Ohrid. However, man subjugates all nature to his needs, while creating opportunities for benefits for the development of tourism and in areas where the construction of artificial reservoirs is not a lake. And because of this, they are quite different, above all in the step-by-step way, the degree of use and arrangement for tourist visits, they have many common characteristics. This is of great importance for the application of the comparative method during the study, all with the aim of more clearly defining the phenomena and processes that occur in them. Based on the degree of attractiveness, natural lakes are of complex, independent and complementary touristic value. Lakes are important for the development of tourism in the continental parts of the country, especially in those areas or states that do not have access to the seas and coastal tourist areas, and one such is Lake Ohrid in the southwestern part of North Macedonia.

Of the elements, phenomena and processes important for the tourist valorization of the lake, the following are important: geographical position, tourist position, traffic position, type of lake sediments, thermal regime of lakes, fluctuations of lake water, color and transparency of lake water, the chemical composition of lake water, the wealth of lakes with organic matter, lake protection, etc. Geographical position is a determinant of longitude and latitude, altitude and degree of continentality and belonging to the appropriate climatic zone. These indicators are the basis for understanding the phenomena and process elements in the studied lake or group of lakes.

In 1977, the Assembly of the Socialist Republic of Macedonia adopted the Law for the Protection of Lake Ohrid, Prespa and Dojran ("Official Gazette of the Republic of Macedonia" no. 45/77) by which Lake Ohrid was declared a protected area in the "Monument" category natural", with an area of 200km². Due to the exceptional value and first of all due to the concentration of cultural goods with Decree no. 07-57/1 from 28.03.1968 The entity for the protection of cultural monuments - Ohrid protects the old center of the city of Ohrid as a monumental complex with protective measures. The

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Convention for the Protection of the World Cultural and Natural Heritage defines two different types of world heritage: cultural and natural. Combined or mixed goods contain the elements of both types of inheritance.

2. NATURAL AND CULTURAL VALUES OF LAKE OHRID

According to the way of creation, Lake Ohrid is a rarity in the world frame. It was caused by the vertical collapse of the earth, which is also the case with relatively few lakes in the world. Among other things, this is how the deepest Lake Baikal was born in Siberia, in Russia, which is a hundred times larger than Ohrid. The waters of both lakes are inhabited by similar endemic flora and fauna.[3]

***Figure 1**: Landscape from Lake Ohrid.*

Lake Ohrid is one of the largest lakes in the Balkans and is located between Albania and North Macedonia. It is an important natural and cultural value for these two countries. In the following, I will tell about some natural and cultural values of Lake Ohrid.

Lake Ohrid region[4]

- Lake Ohrid is located at an altitude of 683m;
- It is surrounded by high mountain crowns in the east and west which reach an altitude of about 2,250m;
- It has a maximum depth of 288.7 m and an average depth of 155 m;
- This is one of the largest lakes in Europe; has a water surface of 358 km2, of which nearly two-thirds are in Macedonia and one-third in Albania;
- The surface of its direct basin is 1.129 km, while the effective surface of the basin also includes the basin of Lake Prespa due to the underground connection through the karst;
- Over 1,400 autochthonous species have been found, including nearly 300 species which are endemic to Lake Ohrid;
- The city of Ohrid is one of the oldest human settlements in Europe; represents rare architectural and artistic achievements and treasure of architectural, archaeological, material and immaterial values;
- The city of Struga lives on the shore of Lake Ohrid and on the banks of the Black Drini river, which as a natural phenomenon flows from the Lake; there are archaeological findings from the Neolithic period, from the Bronze Age, the Macedonian-Hellenistic period, the Roman period, the early medieval period;
- The coastal neighborhoods (Tërpejce, Peshtan, Radozhdë and Kalishë) bear witness to tradition, rural architecture and present an exceptional cultural place in which the objects are in harmony with the morphology of the terrain, vegetation and water reflection of the lake.

The ecological importance of both lakes has been recognized by the declaration of Lake Ohrid as a UNESCO World Heritage Site in 1980 and the creation of the Prespa National Park in 2000. The high diversity of avifauna, especially among migratory birds, has enabled the Lake of Prespa was designated as a Ramsar site in 1999. Due to all its uniqueness, natural uniqueness and eco-potential, in 2014, the area of both Lake Ohrid and Lake Prespa were declared Transboundary Biosphere Reserves.[5]

Tourist spaces, that is, crystallized points of tourism-oriented global mobility can be interpreted as spiritual resources, both for tourists visiting certain destinations and for locals (Perdue, Long & Kang, 1999). Although the tourist

[3] *http://makedonskibiser.com.mk/index.php?option=com,content&view=category&layout=blog&id=163&Itemid=370&lang=en*
[4] *Natural and Cultural Heritage Management Plan of the Ohrid Region 2019-2028*
[5] *http://ecopotential-project.eu/site-studies/protected-areas/23-ohrid-and-the-prespa-lakes.html*

environment is shaped by a specific interpretation of perceptions and, as such, its existence depends on tourist demand, the appearance of the environment itself is based on the components of the offer of a destination. Within the tourism system (Inskeep, 1991), the tourism environment consists of elements of the country's product, but its evolution is also strongly influenced by some tangible and intangible components of the wider environment of the tourism system.

2.1. St. Naum

2.2. Galichica National Park

Due to the characteristic location, and extremely rich and endemic flora and fauna and specific natural beauty and landscape and aesthetic values, the Macedonian Parliament in October 1958 declared National Park Galichica. The park is named for the preservation of authentic natura, cultural and spiritual heritage and has research, cultural, educational and tourist and recreational purposes. It is located on the same named mountain in the southwestern part of the Republic of Macedonia between Ohrid Lake and Prespa Lake.[8] It covers an area of 22,154 acres (221.54 km2). According to the natural presence of biological diversity it is one of the most important natural places on the Balkan Peninsula. In the park represented are over 1,000 species of higher plants with presence of numerous endemic and relict breeds. Characteristic is the presence of 15 so far discovered local endemics, which are found only in the park and nowhere else. National Park is exceeds with great wealth and representation of animal species. The most important of which are invertebrates of which Galichica has 26 endemic species. The vertebrates have 11 amphibian, 21 reptile , 260 bird species and 51 mammal, of which present are even most attractive lynx, bears and chamois . Protection of natural values and management activities in the park are the responsibility of the Public Institution National Park Galichica established by the Government of Republic of Macedonia. Mountain of the same name that runs the national park is part of the Shara- Pind mountain range. Southern boundary of the park is the border between Macedonia and Greece and Albania, eastern shores of Prespa Lake and west shores of the Ohrid lake. The northern border is in height of the cities of Ohrid and Resen. The boundaries of the National Park includes an island Golem Grad in Prespa Lake.

***Figure 3**: Galicica National Park*

3. LAKE OHRID AMONG THE OLDEST LAKES IN THE WORLD

According to the publication dated 19.08.2022 made by NASA,[9]Lake Ohrid and Lake Prespa, two of the oldest lakes in Europe and the world, lie in a mountainous area along the borders of North Macedonia, Albania and Greece. Lakes have existed for at least 1 million years and possibly longer. Lakes owe their longevity to sustained tectonic activity that causes the land beneath them to sink, creating grabens, or low valleys surrounded by faults. This constant sinking of valleys prevents sediments and plant life from building up and turning lakes into marshes over time, as most lakes do after a few thousand years.

[8] *Analysis of the economy of the Southwest planning region and possibilities for employment, Prilep, 2013*
[9] *https://earthobservatory.nasa.gov*

Most of Ohrid's water comes from underwater sources, but about 20 percent of it flows from the upper Prespa through underground karst channels. While water levels have remained relatively stable in Lake Ohrid in recent decades, Prespa has suffered a significant decrease in both surface area and volume. In a recent study, based on nearly four decades of Landsat observations, scientists reported that Lake Prespa lost 7 percent of its surface area and half of its volume between 1984 and 2020, likely due to increased water withdrawal. for agriculture. Lakes are not the only local features notable for their ages. Ohrid, the largest city on the lake, is one of the oldest human settlements in Europe.

***Figure 4**: Lake Ohrid and Lake Prespa, two of the oldest lakes in Europe*
Source:https://earthobservatory.nasa.gov

The tourism industry is closely related to environmental protection. The rapid development of tourism and travel in modern times has led to the great exploitation of natural resources and the environment. It caused considerable stress on the environment. Tourism has a negative impact on some lakes. Areas that are easily accessible to a large part of the population/metropolitan areas are more susceptible to negative impacts due to the threats of urbanization. Another serious problem that has an impact on the environment from the increase in tourist activities is pollution from traffic on the roads of the cities where the lakes are located. The roads are very narrow. Traffic density is very high during peak tourist season. Leisure walks that should have been a characteristic feature of hill towns and lake resorts become increasingly rare during peak tourist months. The open spaces have turned into parking lots. This leads to the pollution of cities.

4. NUMBER OF TOURISTS

Ohrid is a popular tourist destination in North Macedonia and is truly a beautiful place to visit. The city is located on the shore of Lake Ohrid, which is also declared a World Heritage Site by UNESCO. There are many interesting attractions that can be visited in Ohrid and its surroundings. In the center of the city, you can see the Ohrid Castle, an old fortress that offers amazing views of the city and the lake. Also, Saint Sophia's Church is one of the most visited places in Ohrid. It is an orthodox church built in the 19th century and has very beautiful architecture. There are also beautiful beaches in Ohrid, such as Lagje e Re Beach and Linja Beach. These beaches offer white sand and clear water, and are ideal places to relax and enjoy time at the seaside. The crisis caused by COVID-19, in the world, but also in the countries of the region, has mostly affected the tourism sector. Tourism revenues are among the main sources for the cities that gravitate around Lake Ohrid. In this area, tourism ensures the operation of many businesses but also the existence of many families. Struga is the second most visited destination in North Macedonia, after Ohrid.

Lake Ohrid is the number one tourist spot in the country and for good reason. The list of leisure activities on offer is long: swimming, sailing, nature exploration and photography, hiking, cycling, astrotourism, culinary delights and much more. It's no surprise that more than 200,000 tourists visit the lake every year.

Table 1: *The number of local and foreign tourists, from 2018-2022.*

Year	**2018**		**2019**		**2020**		**2021**		**2022**	
Ohrid	No. Tourists	percent	No. Tourists	percent	No. Tourists	percent	No. Tourists	percent	No. Tourists	percent
Domestic tourists	117 734	40%	130 643	41%	129 054	90%	142 110	69%	149 125	53%
Foreign tourists	178 312	60%	191 930	59%	13 772	10%	62 830	31%	134 145	47%
Total	296 046	100%	322 573	100%	132 826	100%	204 940	100%	2833 270	100%

Source: State Statistics Agency of North Macedonia.

From what can be seen in table 1, the movement of the number of tourists in the city of Ohrid is quite large and dominates the summer months, because Lake Ohrid is used for summer tourism. notedand a decrease in the number of foreign tourists during 2020, 2021 and 2022 as a result of the impact of the Covid 19 pandemic, where even the city and the lake of Ohrid were not left without consequences. This decrease is quite pronounced and it is clearly seen that in 2019 there were 191930 foreign tourists or expressed as a percentage of 59% of the total number of tourists in the city, and this falls to only 13772 tourists in 2020, expressed as a percentage of only 10% of total tourists, a full 49% fewer tourists than a year earlier. A year later it marks an increase of 31%, but not at the level of 2018 or 2019 where it was 59-60% of the total. And the last year we take into consideration, 2022, has more or less returned to normal as far as foreign tourists are concerned.

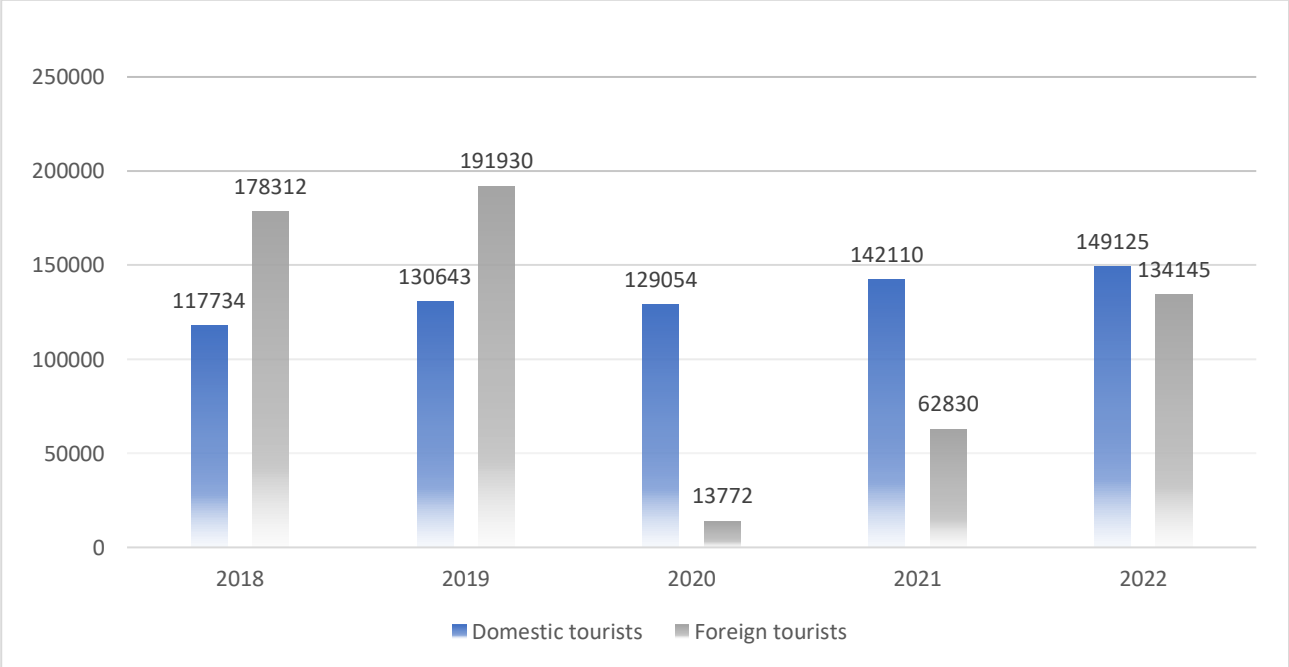

Figure 5*: Number of domestic and foreign tourists, from 2018-2022.*

Table 2*: Number of nights of stay in accommodation facilities of Ohrid during the years 2018-2022*

Year	**2018**		**2019**		**2020**		**2021**		**2022**	
Ohrid	Nights of stay	percent	Nights of stay	percent	Nights of stay	percent	Nights of stay	percent	Nights of stay	percent

Domestic tourists	585 051	57%	621 390	56%	652 644	96%	677 718	80%	690 384	67%
Foreign tourists	449 807	43%	480 173	44%	29 530	4%	173 032	20%	336 033	33%
Total	1 034 858	100%	1 101 563	100%	682 174	100%	850 750	100%	1 026 417	100%

Source: State Statistics Agency of North Macedonia.

Table 2 presents the number of nights of stay in the city's accommodation facilities, where it is also clear from here that the city and Lake Ohrid have a large number of visits both from the country and from abroad (foreign), but different from table 1 where there is a dominance of tourists from abroad, the nights of stay are dominated by domestic tourists, especially in the last three years with a special emphasis on the year 2020, where the dominance is 96% with 4% foreigners. Even here, as in table 1, the years of the Covid 19 pandemic show a drastic drop in the number of arrivals from foreign tourists. For example, in 2020, we had only 29,530 cattle during the year, and compared to the previous year (2019), there is a difference of 450,643 cattle, or a decrease of 47%.

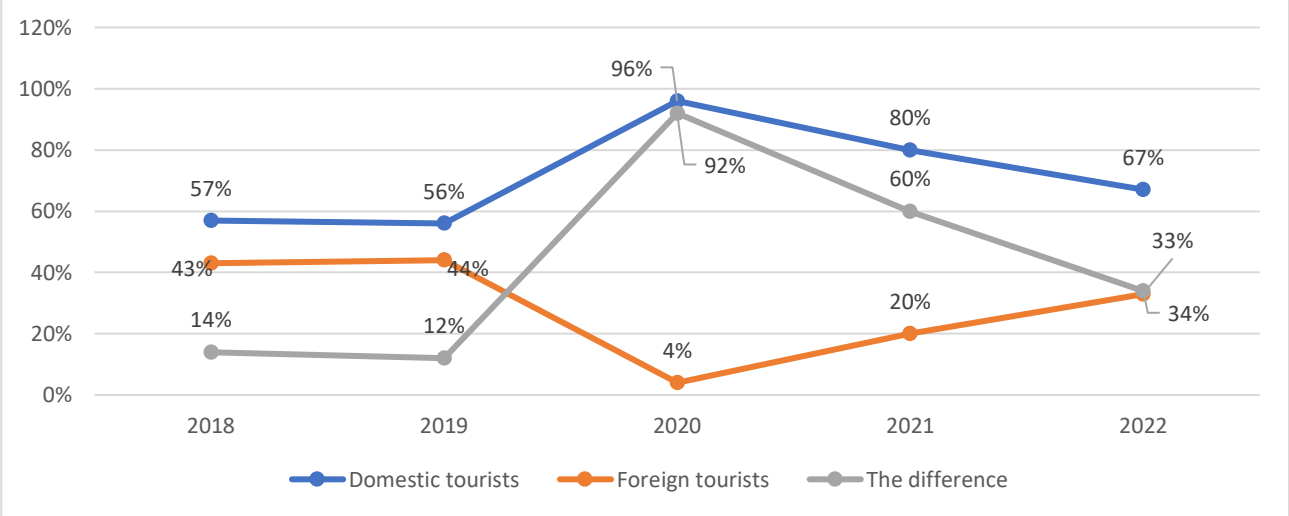

***Figure 6**: The movement of the percentage of nights of stay by local and foreign tourists (2018-2022)*

Overall, the COVID-19 pandemic has had a negative impact on the livelihoods of the city of Ohrid, creating major challenges for the local economy and the standard of living of the residents. It is important to mention that the impact of the pandemic may be different currently, as it is based on 2020 and 2021, which can also be seen from figure 5, where the percentage shows the decrease in the curve of nights of stay in accommodation facilities.

5. CONCLUSION

The performance of tourism and the environment in Ohrid is a success story. The city of Ohrid, known for its natural beauty and cultural wealth, has managed to develop a valuable international tourist industry, while at the same time preserving its precious environment. The performance of tourism and the environment in Ohrid is a complex topic that requires a careful analysis of the impact of the tourism industry on the city's environment. Ohrid is a tourist destination known for the beauty of its lake and rich cultural heritage. In recent times, tourism in Ohrid has experienced a great growth, but this has also brought great challenges for the environment. An important conclusion is that the construction of tourist infrastructure and the increase in the number of visitors have had a significant impact on the natural environment of Ohrid. Due to the increase in construction and the development of tourist activities, changes have been caused to the natural landscape and have affected the habitats of native animals and plants. In addition, the amount of waste and water pollution have increased, creating great challenges for maintaining the quality of lake waters.

However, it is important to note that local authorities and civil society are trying to implement measures and policies to minimize the negative impact of tourism on the environment. For example, steps have been taken to promote sustainable tourism and encourage visitors to be environmentally conscious. Also, efforts have been made to improve the waste management system and to monitor the quality of the lake waters regularly. In the beginning, Ohrid faced great challenges in preserving the environment and implementing sustainable practices in the tourism industry. The increase in the number of visitors may have caused negative impacts on the city's natural resources and culture. However, local leaders and local

government institutions took important measures to protect and promote both aspects - tourism and the environment. In order to achieve a true harmony between tourism and the environment in Ohrid, it is necessary to continue these efforts and establish sustainable tourism development policies. This process should include educating visitors, carefully monitoring new construction, and improving infrastructure for wastewater treatment and waste management.

One of the key factors in the success of Ohrid was the creation of a clear strategic plan for the development of tourism and the environment in cooperation with the local community and environmental organizations. This regulated planning helped protect important natural areas, such as the Ohrid Lake National Park and the Lake Shore, by prohibiting undesirable construction and polluting activities. In Ohrid, programs were also created to educate and raise awareness among visitors about the importance of preserving the city's environment and cultural heritage. The protection and restoration of historical and cultural heritage were at the center of ongoing efforts to preserve Ohrid's unique identity. The performance of tourism and the environment in Ohrid is a success story, where the preservation of natural and cultural wealth was a priority, while the development of tourism took place in a stable manner. This brought economic benefits and pride to the local community, building a good reputation for Ohrid in the international arena.

The COVID-19 pandemic has had a significant impact on the tourism industry in many countries around the world, including in Ohrid, a tourist city in Macedonia. In 2020 and 2021, the number of tourists in Ohrid decreased drastically due to travel restrictions, border closures and other measures taken to combat the spread of the virus. In 2020, when the pandemic began to spread around the world, most countries banned international flights and imposed travel restrictions to control the spread of the virus. This resulted in a steady detachment of tourists in Ohrid. Restaurants, hotels and tourist attractions were closed or limited their services, causing many tourists to cancel or postpone their plans to visit the city. Even in 2021, the pandemic continued to have a negative impact on tourism in Ohrid. Although some countries allowed international travel, restrictions and increased measures remain in place. The lack of complete security and the fear of a second wave of infections caused many tourists to show reservations or cancel their trips. Tourism is a very important sector for the economy of Ohrid, therefore the decrease in the number of tourists has had a great impact on the city and the local community. Local authorities and tourist operators have taken measures to promote local tourism and to adapt their services to the new safety and hygiene conditions. Also, the use of technology and online marketing strategies are used to attract new visitors. Although some countries allowed international travel, restrictions and increased measures remain in place. The lack of complete security and the fear of a second wave of infections caused many tourists to show reservations or cancel their trips. Tourism is a very important sector for the economy of Ohrid, therefore the decrease in the number of tourists has had a great impact on the city and the local community. Local authorities and tourist operators have taken measures to promote local tourism and to adapt their services to the new safety and hygiene conditions. Also, the use of technology and online marketing strategies are used to attract new visitors. Although some countries allowed international travel, restrictions and increased measures remain in place. The lack of complete security and the fear of a second wave of infections caused many tourists to show reservations or cancel their trips. Tourism is a very important sector for the economy of Ohrid, therefore the decrease in the number of tourists has had a great impact on the city and the local community. Local authorities and tourist operators have taken measures to promote local tourism and to adapt their services to the new safety and hygiene conditions. Also, the use of technology and online marketing strategies are used to attract new visitors. The lack of complete security and the fear of a second wave of infections caused many tourists to show reservations or cancel their trips. Tourism is a very important sector for the economy of Ohrid, therefore the decrease in the number of tourists has had a great impact on the city and the local community. Local authorities and tourist operators have taken measures to promote local tourism and to adapt their services to the new safety and hygiene conditions. Also, the use of technology and online marketing strategies are used to attract new visitors. The lack of complete security and the fear of a second wave of infections caused many tourists to show reservations or cancel their trips. Tourism is a very important sector for the economy of Ohrid, therefore the decrease in the number of tourists has had a great impact on the city and the local community. Local authorities and tourist operators have taken measures to promote local tourism and to adapt their services to the new safety and hygiene conditions. Also, the use of technology and online marketing strategies are used to attract new visitors. therefore the reduction in the number of tourists has had a major impact on the town and the local community. Local authorities and tourist operators have taken measures to promote local tourism and to adapt their services to the new safety and hygiene conditions. Also, the use of technology and online marketing strategies are used to attract new visitors. therefore the reduction in the number of tourists has had a major impact on the town and the local community. Local authorities and tourist operators have taken measures to promote local tourism and to adapt their services to the new safety and hygiene conditions. Also, the use of technology and online marketing strategies are used to attract new visitors.

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Comparing of Biochemical and Antioxidant Activities of Silymarin Extraction from Milk Thistle (Silybum marianum Gaert L.) Seeds with Different Solvents

Ümit Erdoğan[1], Şule Sultan Uğur*[2]

Abstract: Milk thistle (*Silybum marianum* Gaert L.) seeds contain the natural compound silymarin, which has pharmaceutical, food, and cosmetic applications. The present study aimed to investigate to what extent the biochemical content and antioxidant capacity are affected by ultrasonic-assisted extraction with different solvents of dried defatted seeds, which are sources of bioactive components and can be used for commercial purposes throughout the year. For this purpose, we determined the total phenolic content (TPC), total flavonoid content (TFC), and antioxidant capacity of different solvent extracts of dried defatted seeds using the folin assay, aluminum chloride colorimetry**,** the copper ion (Cu^{2+}) reducing antioxidant capacity (CUPRAC), and the 1,1-diphenyl-2-picryl-hydrazil (DPPH) method assays. The research findings indicated that the methanol and water (80:20, v/v) mixture might be the most effective of the four solvents applied for the extraction of silymarin from milk thistle seeds. The total phenolic content, total flavonoid content, and total silymarin content in the obtained extracts from methanol-water solvent were 33.64 mg GAE/g-DFS, 17.96 mg CE/g-DFS and 49.79 mg SE/g-DFS, respectively. Moreover, the antioxidant capacity and radical scavenging activities of the obtained extracts from the methanol-water solvent were dominant over the other applied solvents. Considering the antioxidant and radical scavenging activity effect of silymarin, the findings of this study may have benefits for fields such as pharmaceutical, food, and cosmetics.

Keywords: milk thistle seed, silymarin, *Silybum marianum*, CUPRAC, DPPH.

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1. INTRODUCTION

Compounds such as flavonolignans and dihydroflavanol in milk thistle (*Silybum marianum* Gaert L.) seeds have interesting and important therapeutic properties (Wallace *et al.*, 2003). The flavonolignan and dihydroflavanol complex in milk thistle is called silymarin (Wianowska & Wiśniewski, 2015). Silymarin is a natural compound found in species of Silybum marianum, commonly known as milk thistle. Silymarin has been shown to have clinical applications in the treatment of toxic hepatitis, fatty liver, cirrhosis, ischemic injury, radiation toxicity, and viral hepatitis (Mhamdi *et al*., 2016). Moreover, the most important major component of silymarin, silibinin, is a flavonolignan compound derived from Silybum marianum (milk thistle plant), which has strong antioxidant activity and modulates many molecular changes induced by xenobiotics and ultraviolet radiation to protect the skin (Singh, & Agarwal, 2009). Silibinin accounts for 80% of the silymarin extract (Zheng *et al.*, 2009). Recent studies indicate that silibinin has potent cancer chemopreventive properties in various animal models of carcinogenesis, including skin cancer (Singh, & Agarwal, 2002). Considering these skin protective effects of silibinin is expected that it can be utilized for humans through cosmetic preparations.

The production of milk thistle products involves a two-stage extraction process. Before being extracted for their flavonolignan content, milk to extract the 15~25% lipid content, the thistle seeds must first be defatted (Wallace *et al*., 2003). Considering all these, extraction of silymarin from milk thistle seeds with high efficiency has become important Therefore, this study aimed to investigate the batch, two-stage extraction of whole and defatted seeds using ethanol, methanol, ethanol-water (80:20, v/v), and methanol-water (80:20, v/v) as solvents. Another aim of this study was to determine the total silymarin content, total phenolic content, total flavonoid content, total antioxidant capacity, and

radical scavenging activity of extracts obtained from different solvents by ultrasound-assisted extraction of defatted milk thistle seeds.

2. MATERIAL AND METHOD

2.1. Plant material

Milk thistle seeds used in the present study were collected from Çünür (Isparta, Turkey) region in August 2023. Samples were also identified by Prof. Dr. Sabri Erbaş and deposited at the herbarium of the Faculty of Agriculture, Isparta University of Applied Sciences, with voucher specimen numbers DD32-2023.

2.2. Extraction of milk thistle seeds

Due to the high lipid content of thistle fruits, the European Pharmacopoeia recommends a two-step extraction procedure. First, the fruits are defatted with n-hexane for 6 hours; then, the defatted fruits are extracted with methanol for another 5 hours. This procedure has been modified by an ultrasound-assisted method with minor modifications. In the current study, milk thistle seeds were extracted with n-hexane using a Soxhlet apparatus to remove their oils for 4 hours. Next, defatted milk thistle seeds were incubated for 24 hours to remove n-hexane, then, dried defatted seeds were extracted using four different solvents (methanol, ethanol, 80:20(v/v) methanol-water, and 80:20(v/v) ethanol-water) with ultrasonic-assisted extraction for 30 min at 45 ºC. The samples (5 g) were extracted in an ultrasonic bath system (LAB.ULT.4045, interior dimensions: 300 mm ×150 mm × 100 mm) using 50 mL of solvent. The aliquots were then filtered through a 0,45 µm PTFE filter (Isolab, Germany) and filtered aliquots were stored in the dark at +4 °C before further analyses.

2.3. *In vitro* spectrophotometric assays of extracts of milk thistle seeds

We applied DPPH (Bener *et al*, 2022), CUPRAC (Apak *et al*., 2006), Folin–Ciocalteu (Waterhouse, 2002), and aluminum chloride colorimetry (Sakanaka *et al.*, 2005) assays to measure free radical scavenging capacity (FRC), total antioxidant capacity (TAC), total phenolic content (TPC), and total flavonoid content (TFC) of extracts of milk thistle seeds, respectively. In each method, all tests were repeated three times for samples and evaluated with a UV-Vis spectrophotometer (UV-1280, Shimadzu, Japan). A calibration curve was constructed using Trolox and results were expressed as mmol TE /g- dried defatted seed (DFS) for DPPH and CUPRAC method**s.** A calibration curve was constructed using gallic acid equivalents (GAE) and results were expressed as mg GAE /g -DFS for TPC. TFC was expressed as milligram catechin equivalent per gram dried defatted seed (mg CE/ DFS). The content of silibinin in the silymarin of dried defatted seed is more than 80% (v/v); therefore, the total silymarin yield in the sample was calculated to be silibinin equivalents using the standard curve (Zheng *et al*., 2009). The procedures of the applied methods were briefly summarized in Table 1.

Table 1. Procedures of *in vitro* spectrophotometric assays

Assays	Procedures	References
Folin–Ciocalteu assay of TPC	Put 40 µl sample (diluted 10 times) into a glass tube. Added 3.16 ml water, followed by 200 µl FC reagent. Mixed thoroughly by pipetting or inverting and incubated for 1 to 8 min. Added 600 µL sodium carbonate solution, mixed, and incubated 2 hr at room temperature (at 20ºC). Measured sample absorbance at 765 nm against the blank solution. (The blank solution contained distilled water instead of the sample. All other steps were the same.) **TPC = C1 x1000x df xV/M** Where, TPC = Total phenolic content mg g^{-1} of extracts in GAE [Gallic acid equivalent]; C1 = The Concentration of Gallic acid established from the calibration curve µg mL^{-1}; V = The Volume of extract solution [50 mL], and M = The mass of the DFS [5g]	Waterhouse, 2002
Aluminum chloride colorimetry assay of TFC	Briefly, 0.25 ml of the extract solutions ((diluted 10 times) was mixed with 1.25 ml of distilled water in a test tube, followed by the addition of 75 µL of a 5% sodium nitrite solution. After 6 min, 150 µL of a 10% aluminum chloride solution was added and the mixture was allowed to stand for a further 5 min before 0.5 ml of 1 M sodium hydroxide	Sakanaka *et al.*, 2005

	was added. The mixture was brought to 2.5 ml with distilled water and mixed well. After 30 minutes of incubation, the absorbance was measured against the blank, where $AlCl_3$ solution was substituted with water at 510 nm using a spectrophotometer. **TFC = C1 x1000x df xV/M** Where, TFC = Total flavonoid content mg g^{-1} of extracts in CE [catechin equivalent]; C1 = The Concentration of catechin established from the calibration curve µg mL^{-1}; V = The Volume of extract solution [50 mL], and M = The mass of the DFS [5g], df; dilution factor	
DPPH	Added to a glass tube X mL of extract solution (diluted 100 times), "2 – X" mL 99% ethanol, and 2 mL of 0.2 mM of DPPH• solution. Incubated at 25 ˚C in the dark for 30 min. Recorded at 515 nm against ethanol (absorbance values) $\boldsymbol{FRC\ (mmol\ TE/g-DFS)} = \frac{\Delta_A}{\varepsilon_{TR}} x\ \frac{V_m}{V_s}\ x\ D_f\ x\ \frac{V_E}{m}$ where $\mathcal{E}_{TR}$: molar absorption coefficient of TR compound in the DPPH method (2.19×10^4 L $mol^{-1}.cm^{-1}$) , Vs is the sample volume, *Vm* is the total volume of method (4 mL), *Df* is dilution factor (when needed), *VE* is the extract volume and, *m* is the mass of DFS. (Δ_A was calculated by subtracting the absorbance of the sample solution from the absorbance of the control solution. The control solution contained 2 mL of 0.2mM DPPH• solution and 2 mL of ethanol (99%)).	Bener *et al*, 2022
CUPRAC	Added into a glass tube 1 mL of copper (II) solution (Cu(II)), 1 mL neocuproin solution (Nc), 1mL ammonium acetate buffer (NH_4Ac), 0.5 mL sample solution (diluted 100 times), and 0.6 mL distilled water respectively. Reagent blank solution: 1 mL Cu(II) + 1 mL Nc + 1 mL NH_4Ac + 1.1 mL H_2O Sample solution: 1 mL Cu(II) + 1 mL Nc + 1 mL NH_4Ac + 0.5 mL sample + 0.6 mL H_2O. Incubated at 25 ˚C in the dark for 30 min. Absorbance values were recorded at 450 nm against the reagent blank solution. $\boldsymbol{TAC\ (mmolTE/g\ -DFS)} = \frac{A}{\varepsilon_{TR}} x\ \frac{V_m}{V_s}\ x\ D_f\ x\ \frac{V_E}{m}$ where $\mathcal{E}_{TR}$: molar absorption coefficient of Trolox compound (1.67×10^4 L $mol^{-1}.cm^{-1}$), Vs is the sample volume, *Vm* is the total volume of method (4.1 mL), *Df* is dilution factor (when needed), V_E is the extract volume (50 mL) and, *m* is the mass of DFS (5 g)	Apak *et al*., 2006

Statistical analysis

To determine the relationship between the biochemical contents and antioxidant capacities, Pearson's linear correlation analysis (Heatmap correlation) was determined using OriginPro software (version 2021, OriginLab, Northampton, MA). All values were expressed as mean ± standard deviation and the results were based on dried defatted seed of samples.

3. RESULTS AND DISCUSSION

Ethanol, methanol, and their binary aqueous mixtures (ethanol/water; EW and methanol/water; MW) are widely utilized in the extraction of plant antioxidants. The findings of the extractions from defatted seeds with different solvents obtained through ultrasonic-assisted extraction are depicted in Figure 1. In this present work, total phenolic and total flavonoid contents in the ultrasonic-assisted extraction of the defatted seed of milk thistle with methanol, ethanol, methanol/water (80:20, v/v), and ethanol/ water (80:20, v/v) solvents were determined. The highest TPC was measured in the order of MW > EW > M> E (Figure 1a) and the highest TFC in the order of MW > EW > M> E (Figure 1a, b). The highest TPC was obtained from MW (33.64 mg GAE/ g-DFS) and EW (26.14 mg GAE /g-DFS) solvent extracts, and similarly, TFC was obtained from MW (17.96 mg CE/ g-DFS) and EW (13.46 mg CE/ g-DFS) solvent extracts. Among all solvents, E exhibited poor ability for TPC and TFC. Earlier, Aziz *et al.* (2021) reported that the phenolic content of milk thistle seeds of different cultivars ranged from 24.17 to 35.07 mg GAE/g -dw. On the other hand, they

reported that the total flavonoid content varied between 16.01 and 29.09 mg QE/g. The present findings regarding the total phenolic content and total flavonoid content of milk thistle seeds were in harmony with the findings reported in the literature.

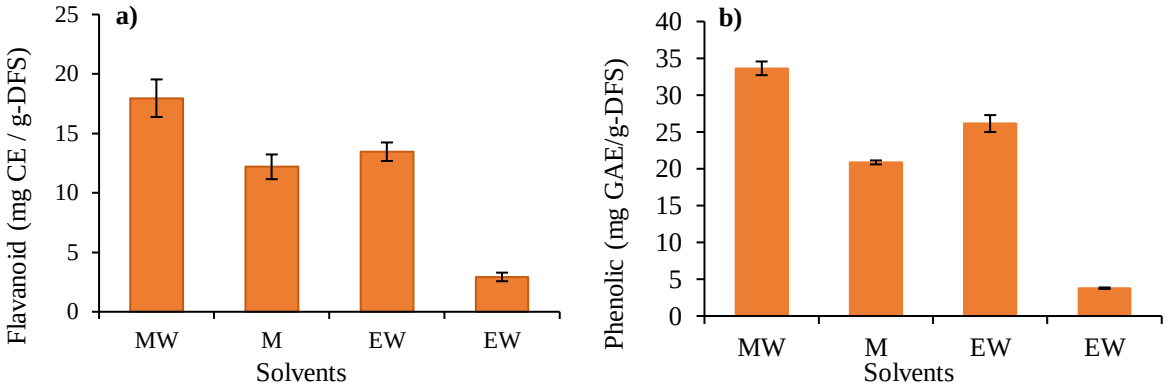

Figure 1. a) Total flavonoid (b) total phenolic in DFS with four different solvents (DFS, dried defatted seed; MW, methanol-water; M, methanol; EW, ethanol-water; E, ethanol

To measure the total antioxidant capacity of dried defatted seed, we performed two different methods (CUPRAC and DPPH), which are frequently preferred, reproducible, and easy to apply. It is recommended to apply at least two methods to determine the total antioxidant capacity in extracts (Önder *et al*., 2023). By using Cu(II)-Neosporin (Nc) reagent, which is a chromogenic oxidant, in the CUPRAC test, the total antioxidant capacity of plasma antioxidants, flavonoids, and food polyphenols can be easily measured (Apak *et al.,* 2004). Appropriately positioned phenolic hydroxyls transform into corresponding quinone structures by the CUPRAC redox reaction, and the Cu(I)-Nc chelate formed because of this redox reaction gives maximum absorbance at 450 nm. Figure 2a depicted that the copper(II) ion-reducing ability changes significantly depending on the extraction with different solvents ($P \leq 0.05$). The CUPRAC value in MW and EW was 0.33 and 0.303 mmol TR /g-DFS, respectively, while the CUPRAC value in M and E extracts was 0.228 and 0.048 mmol TR /g-DFS, respectively. Depending on the polarity of the used solvents, the antioxidant yield of defatted milk thistle seeds differed.

Oxidation processes are essential for the maintenance of cells. However, aerobic cellular respiration organisms supply the energy necessary for cell survival, while simultaneously contributing to the formation of free radicals in metabolism, which cause cellular damage (Gulcin, 2020). It is known that there is a direct relationship between free radicals and oxidative stress (Altay *et al.*,2019). However, oxidative stress occurs when the balance between the body's antioxidant defense systems and pro-oxidants is disrupted (Gulcin & Alwasel, 2023). In addition, many factors contribute to oxidative stress that affects human health daily, including UV radiation and pollutants (Koksal *et al.*, 2011). As a result, free radicals inevitably cause many degenerative diseases such as carcinogenesis, acute inflammation, high blood pressure, diabetes, preeclampsia, acute kidney failure, atherosclerosis, Alzheimer's disease and Parkinson's diseases, mutagenesis, aging, and cardiovascular disorders (Cetinkaya *et al.,* 2012). Today, many bioanalytical methods have been developed to estimate the antioxidant effect. Among these, the 1,1-diphenyl-2-picrylhydrazil (DPPH) scavenging test is the most putative, popular, and commonly used method to measure antioxidant capacity. In this study, the free radical scavenging activity of milk thistle seeds extracted with different solvents was measured by the DPPH test. DPPH radical scavenging activity was calculated to be in the order of MW (0.266 mmol TE/ g-DFS) > EW (0.258 mmol TE/ g-DFS) > M (0.184 mmol TE /g-DFS) > E (0,023 mmol TE/ g-DFS) (Figure 2b). As in the CUPRAC test, the antioxidant activity order of the extracts obtained from different solvents was similar in the DPPH test.

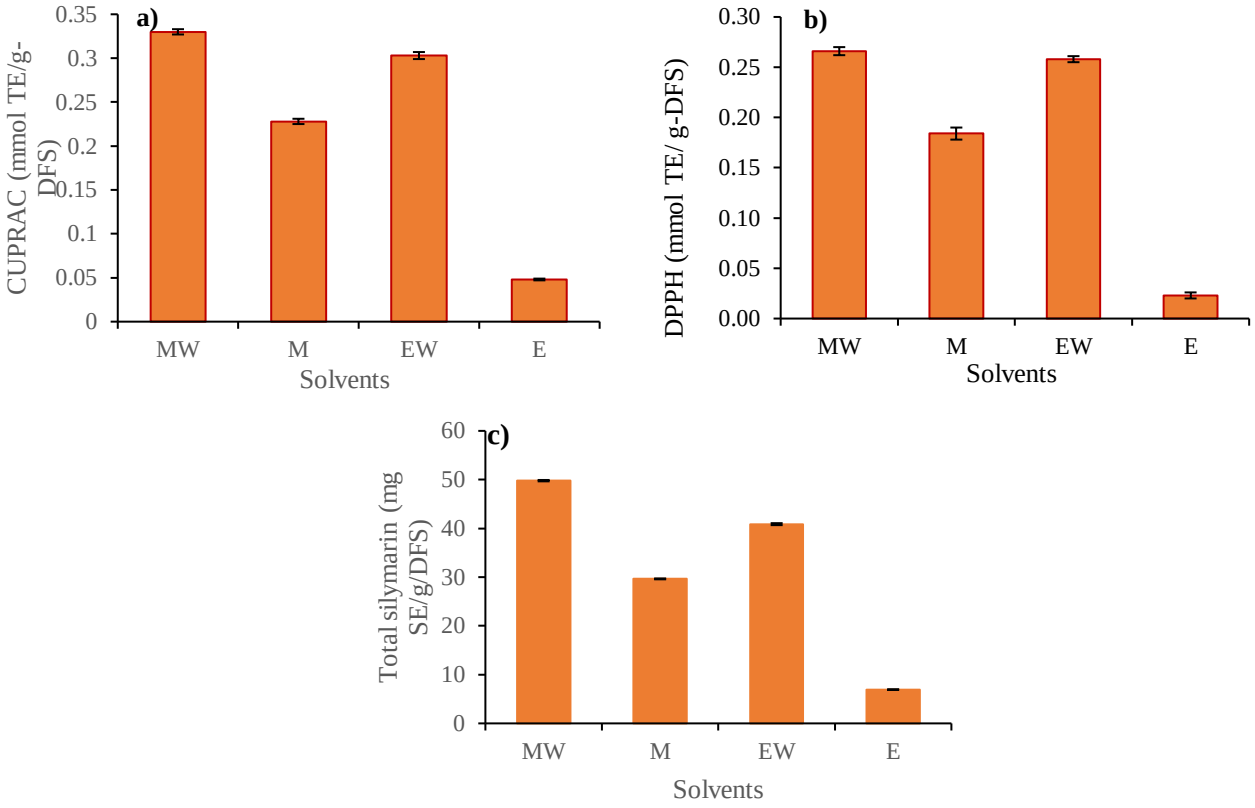

Figure 2. Findings of CUPRAC (a), DPPH (b), and total silymarin (c) from DFS with four different solvents. Results expressed means ± standard deviation.

Silymarin is a natural compound found in milk thistle seeds. The major main components of silymarin are flavonolignans (silibinin, isosilybin, silydianin, and silicrystin), and flavonoids (Škottová *et al*., 2003). Silibinin is the most abundant component in the silymarin complex. Total silymarin content was calculated to be in the order of MW (49.79 mg SE/ g-DFS) > EW (40.87 mg SE/ g-DFS) > M (29.64mg SE /g-DFS) > E (6.93 mg SE/ g-DFS) (Figure 2c). It was observed that the most suitable solvent was a mixture of methanol and water to produce more efficient silymarin from milk thistle seeds.

Heatmap correlation analysis was performed to investigate the relationship between the antioxidant capacity of total silymarin, total phenolic, and total flavonoid contents, depending on the ultrasonic-assisted extraction findings of degreased seeds with different solvents. The findings of the correlation analysis based on the extraction of milk thistle seeds with different solvents were depicted in Figure 3. Of the 10 coefficients, two were very significant at the $P \leq 0.001$ level. The other two were significant at the $P \leq 0.05$ level. Of these four significant correlations, all were positively correlated with each other. Significant positive correlations ($r = 0.95$) between total silymarin content and both CUPRAC and DPPH may indicate that the silymarin complex contributes mainly to CUPRAC and DPPH capacity. In addition, it can be said that there is a strong correlation ($r=1$) between CUPRAC and DPPH methods.

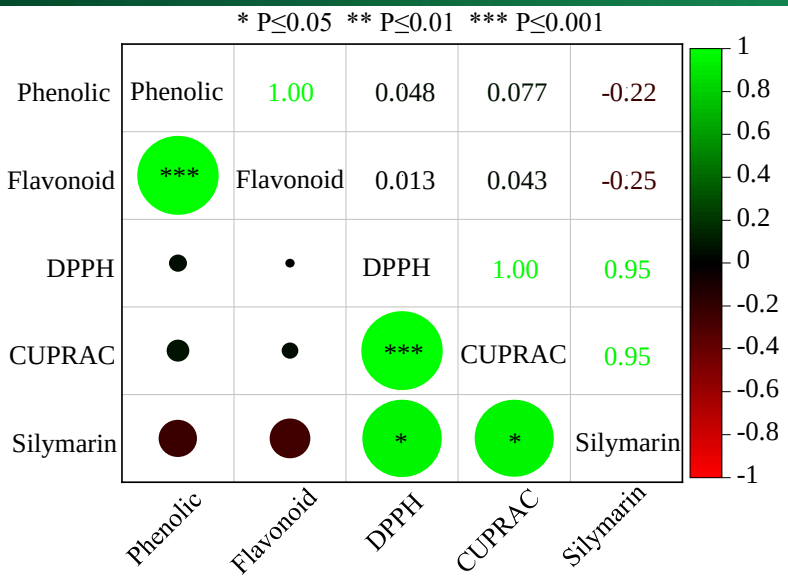

Figure 3. Relationships and correlations between examined parameters generated by a heat map using mean values. The color scale indicates the intensity of the normalized mean values of the different parameters [CUPRAC, cupric reducing antioxidant power; DPPH, DPPH radical scavenging].

4. CONCLUSIONS

In conclusion, the data presented here showed that different solvents will produce different results in milk thistle seeds. The data showed that milk thistle seed is rich in total phenolic content and total flavonoid. Moreover, *in vitro*, spectrophotometric methods revealed that milk thistle seeds have potent antioxidant and radical scavenging activity. Methanol-water mixture was found to be the most effective solvent for ultrasonic-assisted extraction of silymarin from milk thistle seeds. Considering the efficacy of silymarin, the findings of this study may have benefits for pharmaceutical, food, and cosmetic applications. In light of the data obtained in this study, more detailed studies can be carried out for the purification of individual phenolic and flavonoid compounds of milk thistle seed.

Acknowledgments
It should be written as short as possible and express the contribution made without giving the number.

Author Contributions
Conceptualization: Ü.E.; Investigation: ÜE.; Material and Methodology: Ü.E.; Supervision: Ş.S.U., Ü.E.; Visualization: Ş.S.U.; Writing-Original Draft: Ü.E.; Writing-review & Editing: Ş.S.U., Ü.E..; Other: All authors have read and agreed to the published version of the manuscript.

Conflict of Interest
The authors have no conflicts of interest to declare.

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Bibliometric Analysis Between Covid-19 and The Chemical Industry

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Abstract: In late 2019, a new virus that emerged in Wuhan, the capital of China's Hubei region, soon spread around the world, causing a global pandemic to be declared in March 2020. This new virus caused us to change all our habits until that day. So much so that the high contagiousness of the virus required us to abandon our daily habits such as hugging and kissing, and instead use masks and disinfectants. Products such as masks, alcohol-based disinfectants, which were not on the shopping list and priority of many people until that day, became our first consumption priority, while products such as fuel oil were no longer a priority as we stayed at home due to restrictions. For this reason, some of the sectors producing these products could not find products, while crude oil prices saw negative values. In addition, curfews and labor force lost due to illness negatively affected supply chains. Especially the long shutdowns in China, the world's number one raw material supplier, negatively affected the global chemical markets. In parallel to this, scientists started to carry out studies on this subject. In this article, a Bibliometric Analysis on the theme of "Covid19 and the chemical industry" was conducted to analyze the relationship between the industry and the number of scientific articles, the relationship between the incidence of the disease and the number of scientific articles, and the relationship between the number of articles with the elimination of the disease in the current situation. As a result, the number of publications is high in countries with a strong chemical industry, while the number of publications is high in countries that are highly affected by the virus. Interestingly, although Egypt was not much affected by the virus and did not have a strong chemical industry, it received the title of the institution with the most publications, thanks to the Egyptian Knowledge Bank system, which gives scientists access to unlimited and free databases and the right to publish.

Keywords: Covid 19, chemical, industry, bibliometric

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1. INTRODUCTION

Covid-19, a novel type of coronavirus that emerged in late 2019 in the city of Wuhan, China, can cause respiratory infections [1]. The virus can spread from person to person through droplets and contact, and in some cases, it can result in severe lung damage, organ failure and death. On March 11, 2020, the World Health Organization (WHO) declared Covid-19 a global pandemic as more than 270 million cases and over 5.3 million deaths have since been recorded worldwide. At the time of writing, more than 772 million cases and 6.9 million deaths worldwide are reported by the World Health Organization.

The Covid-19 pandemic has not only affected human health but has also had a profound impact on the global economy. Measures implemented to prevent or slow the spread of the pandemic, including border closures, travel limitations, quarantine measures, business shutdowns, and the suspension of social activities, have led to significant disruptions (saglik.gov.tr). As a result, economic indicators such as global trade, production, consumption, employment, and income have experienced substantial declines. According to Kristalina Georgieva, the managing director of the IMF, global economic growth in 2020 will be 0.5% lower than the projected growth of 3.3%. It is worth noting that S&P's estimates are even more pessimistic than IMF's. Their projections predict a mere 0.4% global economic growth, which would be the slowest since the 1982 economic crisis. S&P puts forth that the COVID-19 containment measures have caused global economic recession (Boshkoska and Jankulovski, 2020). Nevertheless, risks and uncertainties remain, depending on the trajectory of the pandemic, inoculation campaigns, and policy measures.

The Covid-19 pandemic's economic ramifications differ amongst industries, with some enduring negative effects while others have seen elevated demand. The chemical industry has experienced both beneficial and adverse impacts during the pandemic. Providing raw materials to numerous other industries with an extensive range of products, the strategic

chemical sector has encountered a plethora of challenges (Bostan and Karadağ 2023). As a result of the pandemic, the chemical industry has witnessed a surge in demand for various products, including disinfectants, pharmaceuticals, medical materials, food additives, packaging, cleaning products, and personal care items (Küçükbay et al 2021). However, diminished demand for products aimed at sectors such as automotive, construction, textiles, and tourism has resulted in reduced sales within the chemical industry. Furthermore, complications in procuring raw materials and exporting due to the pandemic have caused disruptions to the global supply chains of the chemical sector (Yardımcı 2021)..

This study analyses the impact of the Covid-19 pandemic on the chemical industry via bibliometric techniques. Bibliometric analysis allows for quantitative and qualitative evaluation of scientific publications. This methodology employs several parameters such as number of scientific publications, authors, institutions, nations, citation counts, keywords, topics, and year-on-year distribution to reveal the development, structure, and trends of a research field (Seyit 2022). For this research, we sifted through the Web of Science (WoS) database for the years 2020-2024 and plucked out 118 relevant articles that contained both "Covid-19" and "chemistry" keywords. To analyze their bibliometric data, we utilized the VOSviewer and CiteSpace programs. The results of this study indicate the areas where the Covid-19 pandemic has had an impact on the chemical industry, as well as the countries and institutions that have led the way in addressing these effects. The study also highlights the publications that have received the most citations and the frequently used keywords in this context.

2. MATERIAL AND METHODS

This bibliometric analysis examines published academic studies on Covid 19. These studies are indexed in the Web of Science (WOS) core collection database. WOS is a widely recognized global citation database with more than 21,000 peer-reviewed journals and is commonly used to analyze academic papers (Nunen et al 2018). From 2020 to 2024, a total of 3435 documents related to "covid19 and chemical" or "covid 19 and chemical" were extracted. The selection process involved filtering document types by "articles" and "reviews" and restricting language to English. A total of 3304 studies were eventually refined. The collection of data occurred on the same day from the WOSCC to prevent bias resulting from database updates.

The significance of open source programming languages, which are free and have abundant resources, and are extensively used in data science globally, is progressively escalating. One such programming language is the R programming language. For bibliometric analyses, the Biblioshiny algorithm (Cuccurullo et al., 2016) was implemented. Biblioshiny algorithm is an open source code, operating in the R language. Furthermore, the software employed is a free web-based interface (R Team, 2014). The R programming language, an open source programming language geared towards statistical calculations and analysis, is essential in the field. It was created in 1996 by Ross Ihaka and Robert Gentleman at the University of Auckland in New Zealand with its foundations rooted in the S programming language, previously developed by John Chambers and his team at Bell Laboratories in the 1960s. The R programming language is highly developed, incorporating features that facilitate the visual representation of data through graphs. This language is both efficient and straightforward to use (Arslan, 2017). The present study employs bibliometric analysis techniques analyzed using R programming language.

The WOS option was chosen as the database within the Biblioshiny system. A file containing 3304 documents was imported for bibliometric analysis using tabs such as Overview, Sources, Authors, Documents, Conceptual Structure, Intellectual Structure, and Social Structure. The analysis explored the yearly output of the chosen reference topics, then identified the top 10 most commonly used keywords with their corresponding percentages.

3. RESULTS

Figure 1 shows the distribution of corresponding authors by country. Red bars indicate multi-country publications and blue bars indicate publications with authors from only one country. It can be thought that the pandemic has spread from China to the world and for this reason, China has published more on this issue. However, in the Chemical Sector report of the Ministry of Commerce of the Republic of Turkey in Table 1, it is noticeable that there is an overlap between the countries that export the most chemicals in the world and the countries that publish the most on Covid 19. Although India and Brazil are not included in the list of chemical exporters, they are among the top 5 countries in the World Health Organization's list of countries with the highest number of cases and deaths. The only interesting example is Egypt. Although it is not included in either the number of cases or the chemical import and export lists, it is among the countries that publish the most.

Figure 2 shows the collaboration network among article authors. Although there is cooperation between many countries, as can be seen from the figure, the greatest cooperation was between scientists from America, China and India.

Figure 3 shows the country's article production rates on Covid 19 over time. The fact that Brazil and India are among the countries that produce the most and fastest articles can be interpreted as the effects of the pandemic leading the country's scientists to work intensively on the subject.

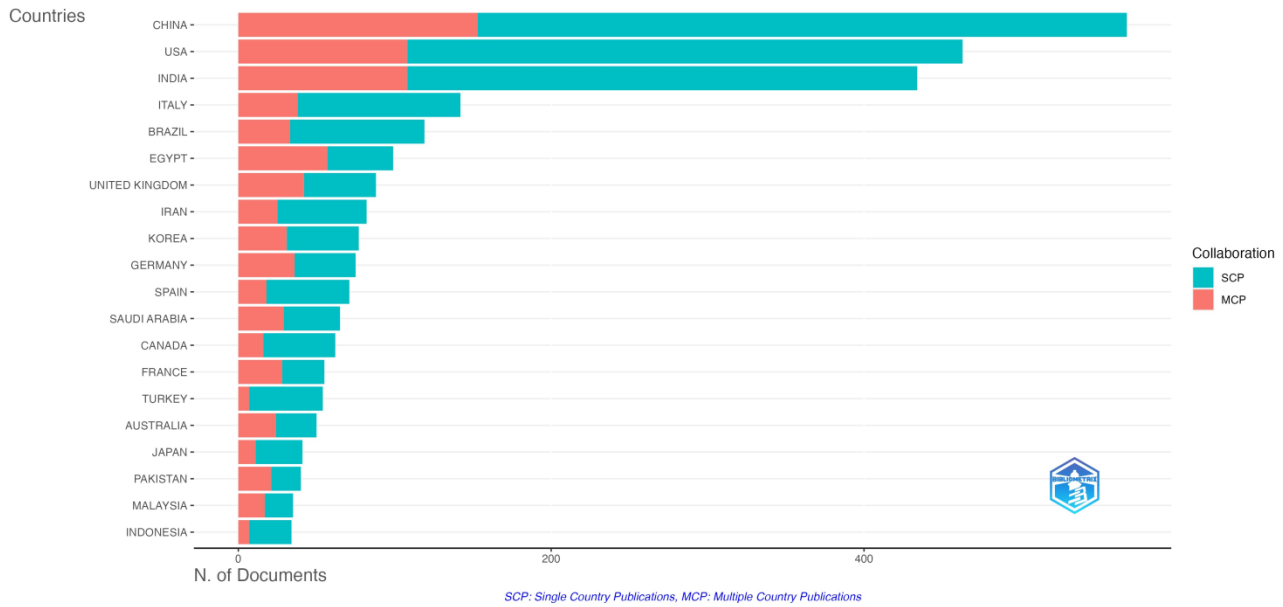


Figure 1. Countries of the corresponding authors

Order	COUNTRY	2020	2021
1	USA	388,166,479	540,630,485
2	Chinese	287,076,519	417,038,422
3	Germany	298,945,838	377,818,721
4	Belgium	172,816,748	257,637,629
7	Saudi Arabia	163,361,504	252,312,228
6	Russia	164,406,974	247,898,285
5	UAE	190,502,802	239,194,506
8	Holland	163,381,077	231,965,113
9	Canada	111,735,034	173,803,418
10	France	125,661,148	155,799,197
11th	South Korea	111,255,876	154,986,922

Table 1. Countries According to World Chemical Sector Export (Thousand USA $) (ticaret.gov.tr)

Figure 4 shows the countries with the most publications on Covid 19 in the world. The article rate according to the time seen in Figure 3 remains constant after 2023. The countries that made publications until this time and their distribution are shown in Figure 4. Figure 4 also shows the ratio of countries in total publications. According to this, China, USA and India, which have made the most publications, have realised 44.34% of the total publications. In other words, almost half of the publications were realised by the scientists of these three countries. This is the main reason why the co-operation network in Figure 2 is very dense between the scientists of these three countries.

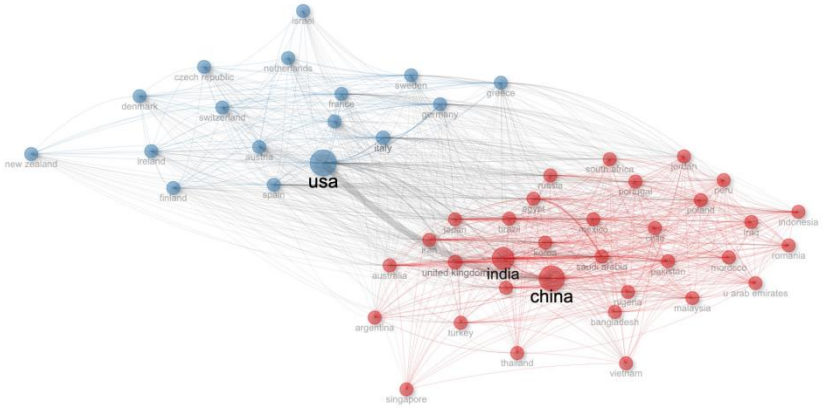


Figure 2. Collaboration network between articles

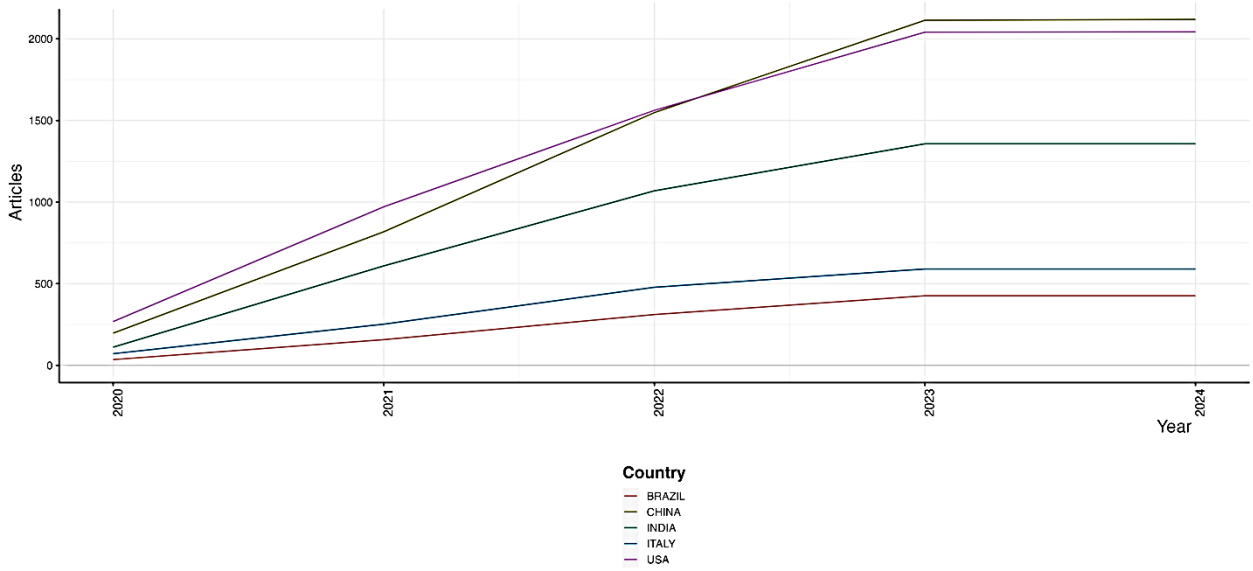
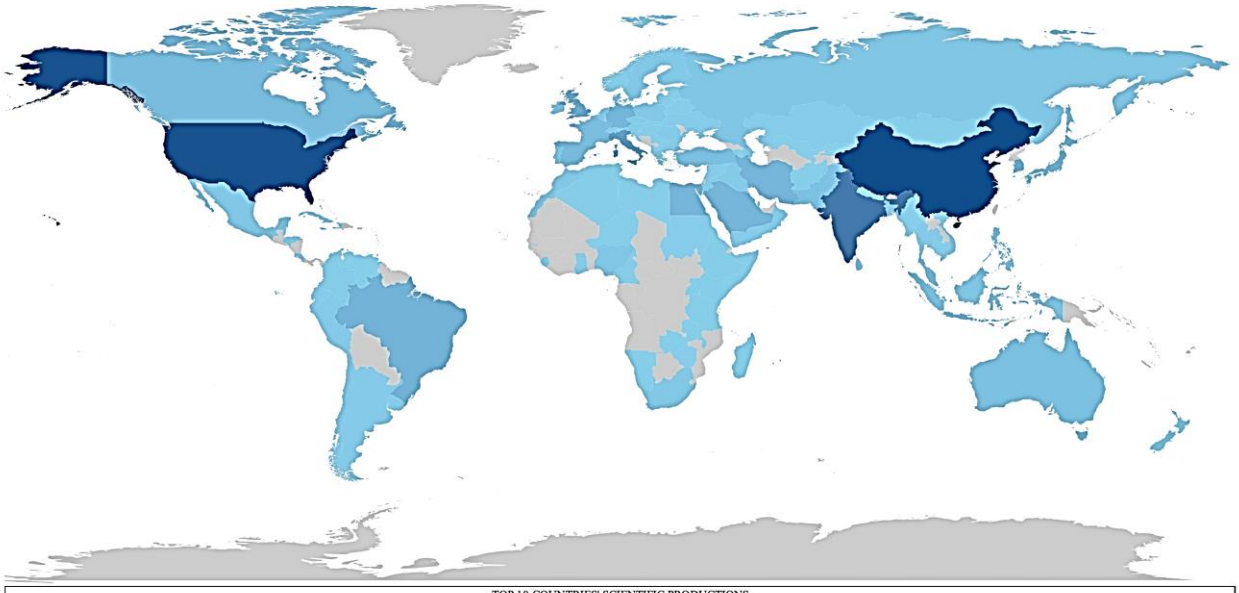


Figure 3 Article productions by countries over the time

Figure 5 shows the institutions publishing the most articles on Covid 19 and the chemical sector and Figure 6 shows the journals publishing the most articles. What is interesting here is the Egyptian Knowledge Bank (EKB). The issue of why Egypt publishes a lot of articles about Covid 19, which we could not make sense of above, becomes clear after a little research on Egyptian Knowledge Bank. Interestingly, Egyptian Knowledge Bank is not a university or a research institute. The "Egyptian Knowledge Bank" (EKB) is a pioneering national project which provides cutting-edge, peer-reviewed and verified digital content for education and scientific research to all Egyptians. It offers global knowledge in digital format, free of cost to every citizen. The EKB is the first platform of its type in terms of scope, excellence and availability. The institution has open access publishing agreements with many of the world's leading scientific publishing houses. Therefore, Egyptian scientists can easily publish their work in reputable journals of the world through EKB. This is a testament to how productivity increases when barriers such as publication fees are removed. Maddi and Sapinho indicated that (2022) there is no discernible difference in impact between publications that authors have paid high costs for and those that have a low article processing charge. Impact may even be lower. They also showed that some publishers are taking advantage of the open access movement to demand high article processin charge, while their academic impact is very low.



TOP 10 COUNTRIES' SCIENTIFIC PRODUCTIONS

Country	Number of Articles	Rate	Country	Number of Articles	Rate	Country	Number of Articles	Rate	Country	Number of Articles	Rate	Country	Number of Articles	Rate
CHINA	568	17.19	INDIA	434	13.14	BRAZIL	119	3.6	UNITED KINGDOM	88	2.66	KOREA	77	2.33
USA	463	14.01	ITALY	142	4.3	EGYPT	99	3	IRAN	82	2.48	GERMANY	75	2.27

Figure 4. Top 10 countries scientific production

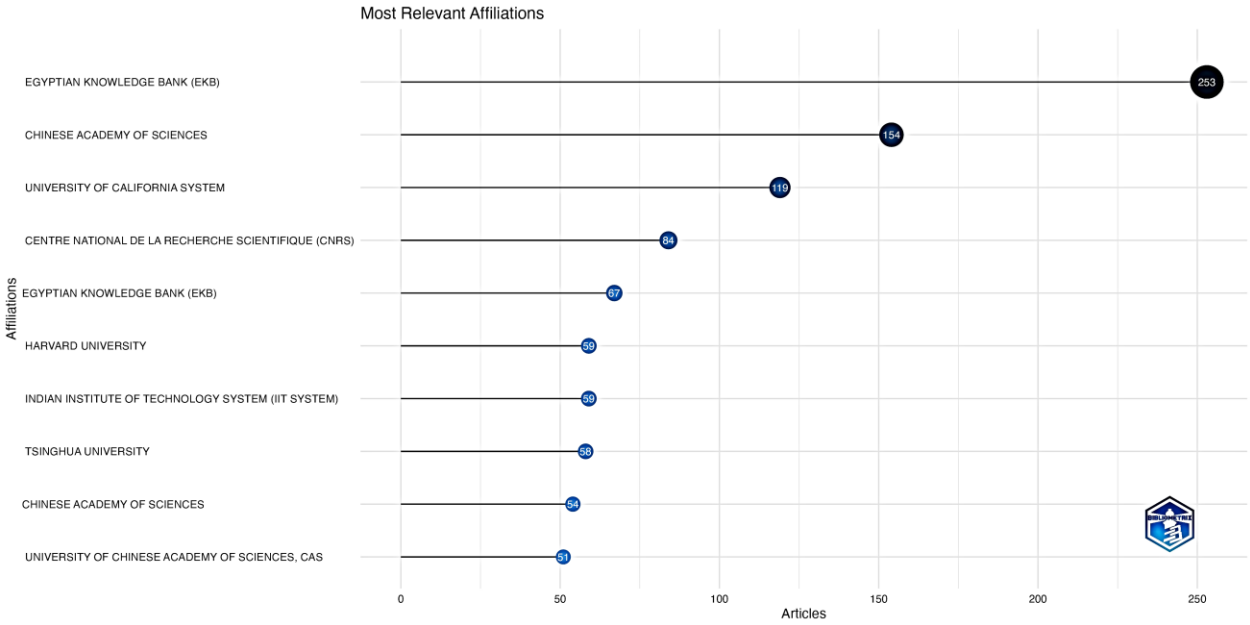


Figure 5. Most relevant affiliations of the articles

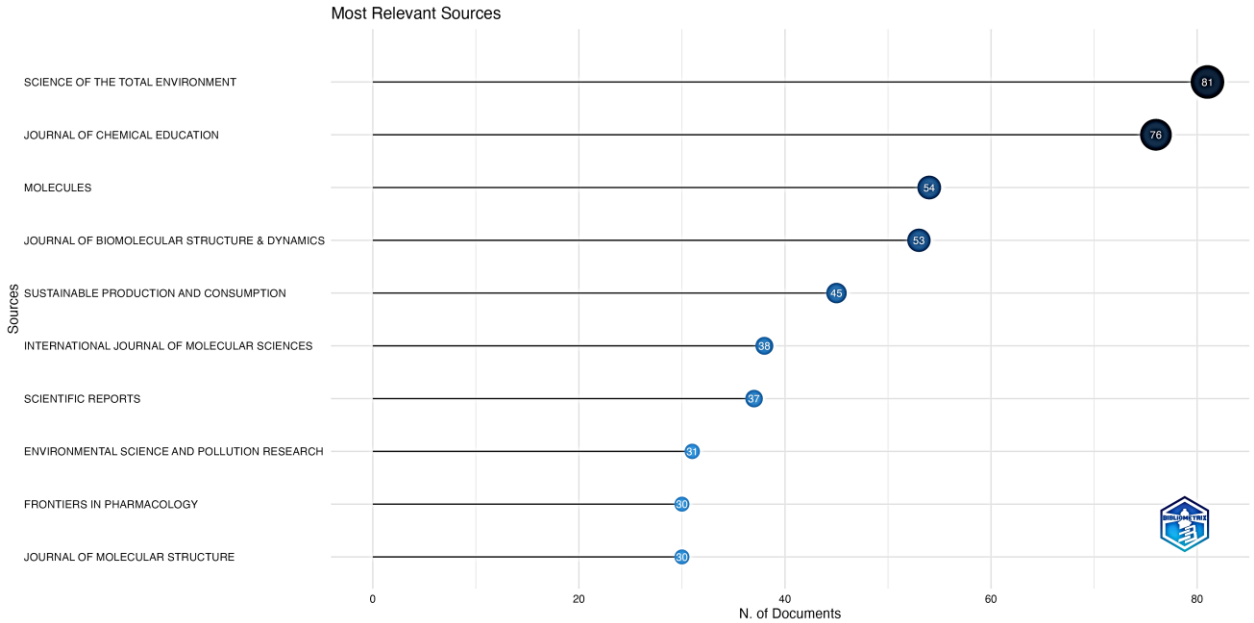


Figure 6. Journals with the highest number of articles published on "Covid 19 and the chemical industry"

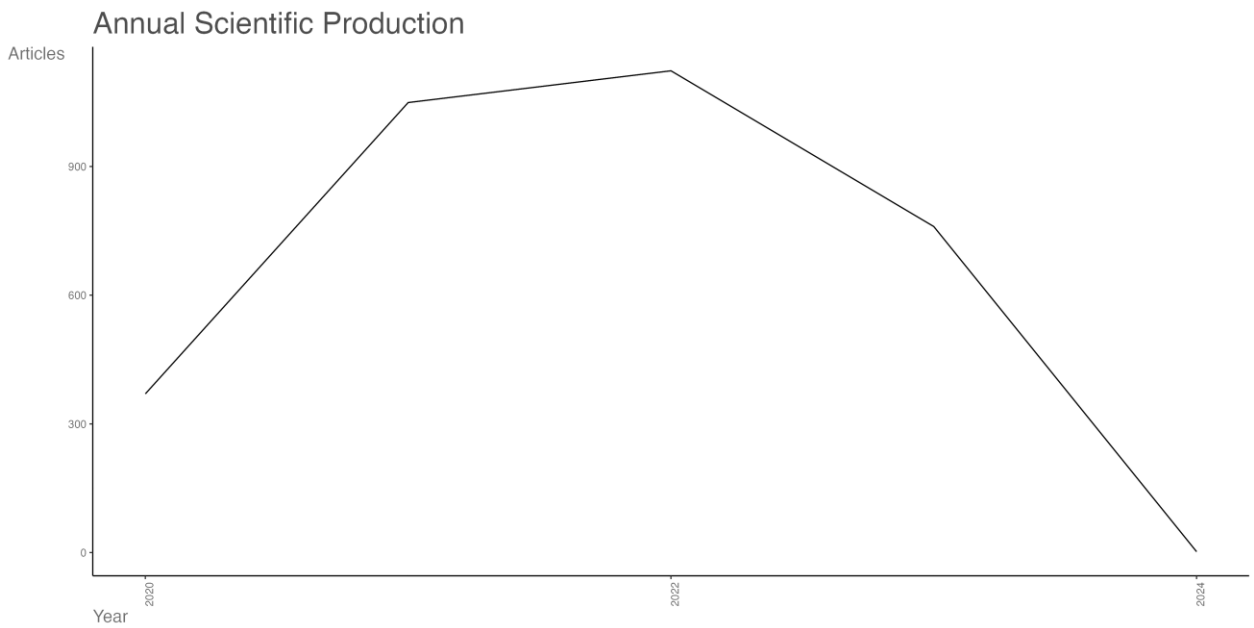


Figure 7. Annual production of articles on Covid 19 and the chemical industry

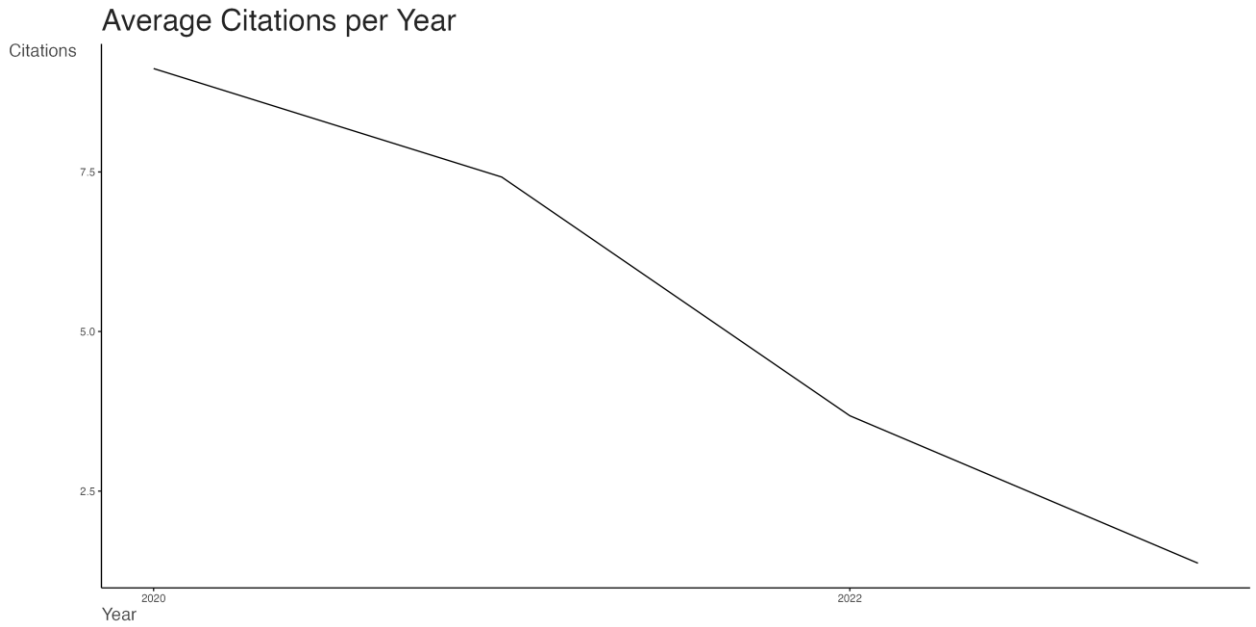


Figure 8. Average annual citations to articles related to "Covid 19 and Chemical industry"

Figure 7 shows the number of articles published between 2020 and 2024 on "Covid 19 and the chemical sector", and Figure 8 shows the average annual number of citations to these articles. Both graphs clearly show us that there is a decrease in both the number of published articles and the number of citations to these articles after 2022. It can be seen as a consequence of the fact that this disease evolved into different variants and lost its former power and fell off the world agenda. The statistics of the World Health Organization show that there was a peak in December 2022 and then the virus continued to exist at a very low level. In other words, the fact that the disease has fallen off the agenda has reduced its effects on the chemical industry and scientists no longer feel the need to produce new studies on this subject. The thesis that the reason for the high number of publications in Brazil and India is that the disease is very common and high on the agenda in these countries is also confirmed here.

4. DISCUSSION AND CONCLUSIONS

In this study, a bibliometric analysis was conducted regarding the relationship of the Covid 19 pandemic with the chemical industry. We can collect the results of the study under four main headings

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Scientists work on sectors in which their country is strong. Because it is strong in those sectors thanks to those scientists. Scientists are working on events that affect societies intensely. The large number of articles produced in countries where pandemic effects are intensely experienced indicate this. The pandemic has lost its impact on the industry and society. Because the number of articles produced and the number of citations received are decreasing significantly. And finally, when scientists are granted open access and free access, their productivity increases.

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Unveiling Wildfire Impact on Forests: Exploring Antalya's Kemer District Through Sentinel-2A Satellite Imagery and Comprehensive Analysis of Environmental and Forestry Parameters

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Abstract: In recent years, global climate change has led to significant temperature increases, adversely affecting numerous ecosystems. The escalation of temperatures has also contributed to a rise in both the frequency and intensity of wildfires, natural disasters that pose a substantial threat. Detecting wildfire areas and identifying key environmental parameters are crucial to minimizing their adverse effects on ecosystems, providing essential guidance for rehabilitation efforts. This study focuses on the detection of a wildfire in Antalya's Kemer district between July 24 and July 29, 2023, utilizing Sentinel-2A satellite imagery. The Normalized Burn Ratio (NBR) index was employed for wildfire detection, resulting in the creation of a wildfire severity class and the determination of the affected area in hectares. Following this detection, parameters such as stand type and site index were assessed based on the Türkiye General Directorate of Forestry's management plan. Additionally, topographic environmental factors like slope and aspect were determined through elevation data. The NBR analysis revealed an approximate wildfire-affected area of 5168 hectares, categorized into ~162 hectares of 'Moderate-high Severity,' ~537 hectares of 'Moderate-low Severity,' and ~4469 hectares of 'Low Severity.' Analysis of the management plan data identified red pine (*Pinus brutia* Ten.) stands with a site index class of 3 as the most severely affected, covering 2954 hectares. Examination of topographic parameters in the wildfire area indicated an average elevation of 41 meters, an average slope of 20^0 degrees, and an Eastward dominant aspect. This study serves as a valuable guide for managers involved in the rehabilitation efforts following the Antalya Kemer wildfire.

Keywords: Wildfire, Türkiye, NBR, Remote Sensing

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1. INTRODUCTION

Fires are considered a natural mechanism playing a significant role in the global ecosystem (De Santis and Chuvieco, 2007; Ireland et al., 2015). This natural phenomenon is a crucial part of the global carbon cycle (Prentice et al., 2001; Karamesouti et al., 2016). Dealing with fires has been an unavoidable aspect throughout history (Bowman et al., 2009). Fires can yield both positive and negative effects on the affected areas. While the destruction of certain vegetation on the forest floor can pave the way for regrowth, it can also inflict significant harm on the ecosystem, necessitating a prolonged rehabilitation process (Wimberly et al., 2009). In the past decade, a significant increase in the frequency and intensity of fires has been observed worldwide. This increase has heightened the need for fire mapping techniques (Keeley and Syphard, 2016).

The increasing frequency of fires has become of greater interest from fields such as atmospheric science, remote sensing, ecology, and forest management (Huang, et al., 2015; Chuvieco, 2012; Ricotta et al., 2001; McRae et al., 2001). Additionally, global climate change is another factor contributing to the increase in fire frequency and intensity. Historical research indicates that global climate change leads to an annual rise in the frequency and intensity of fires (Pechony and Shindell, 2010). Furthermore, temperature increases associated with global climate change are expected to further enhance fire frequency and intensity (Remy et al., 2017). Remote sensing is a crucial tool for identifying areas affected by the increasing global incidence of wildfires, enabling the collection and interpretation pertinent information (Walz et al., 2007). As wildfires often start in remote areas away from human settlements, gaining access to fire-affected areas can be challenging and pose potential risks. Therefore, satellite images, both safe and cost-effective, play a critical role as tools for detecting fire boundaries (Heward et al., 2013).

Satellite images not only help in detecting the boundaries of wildfires but also enable the identification of environmental parameters (Jaiswall et al. 2002; Parisien and Moritz, 2009). The environmental and forestry parameters (i.e. slope, aspect, stand type, site index) associated with wildfires can be interpreted, providing insights into the rehabilitation process (Ghazoul and Chazdon, 2017). On the other hand, through digital maps, information can be provided that facilitates the easier definition of parameters for each location in damaged areas (Chuvieco et al. 2010).

In this study, environmental and forestry parameters in conjuction with the detection of the wildfire area in Antalya's Kemer district spanning from July 24 to July 29, 2023. The detection and identification of the wildfire area, involved the calculation of the Normalized Burn Ratio (NBR) utilizing Sentinel-2A satellite imagery. Based on the calculated NBR, the wildfire boundary was detected, and stand type and site index maps for the wildfire area were generated from the Türkiye General Directorate of Forestry's management plan. Additional parameters related to the wildfire area, such as slope (degrees) and aspect maps, were derived from elevation maps, and generated parameters for the wildfire area were subsequently interpreted.

2. MATERIAL AND METHOD

2.1. Material

2.1.1. Study area

The study area, encompassing the Kemer district in Antalya, is characterized by a Mediterranean climate. The forested areas within this district exhibit a geomorphological composition predominantly comprised of limestone. Notably, the district features the prominently elevated Tahtalı Mountain, reaching an elevation of 2336 meters. The prevalent tree species in the forested areas of the district include Red pine (*Pinus brutia* Ten.), Lebanon cedar (*Cedrus libani* A. Rich), and black pine (*Pinus nigra* Arnold) (Arslan, 2006). The location map of the study area is provided in Figure 1.

Figure 1. The location map of the Antalya Kemer wildfire area

2.1.2 Data Used

As a part of the Copernicus programme, the European Space Agency (ESA) successfully launched a satellite known as Sentinel-2A in 2015. Its primary purpose is high-resolution land observation, and it is equipped with a Multispectral Imaging device (MSI). The MSI comprises thirteen different spectral bands, detailed in Table 1, covering the visible, near-infrared, and shortwave infrared ranges. The satellite has a swath width of 290 kilometers and a revisit period of 5 days at the equator, allowing for frequent coverage.

Table 1. Band information of Sentinel-2A (MSI) satellite images

Bands	**Wave length (µm)**	**Resolution (m)**
Coastal Aerosol	0.443	60
Blue	0.490	10
Green	0.560	10
Red	0.665	10
Vegetation Red Edge	0.705	20
Vegetation Red Edge	0.740	20
Vegetation Red Edge	0.783	20
Near Infrared	0.842	10
Near Infrared	0.865	20
Water Vapour	0.945	60
Cirrus	1.375	60
Short Wave Infrared	1.610	20
Short Wave Infrared	2.190	20

2.2. Method

Using satellite imagery from the Sentinel-2A satellite, the Normalized Burn Ratio (NBR) were calculated to identify area affected by wildfires (Lopez et al. 1991). The formula for calculating this index using the satellite image is provided as follows: (1).

$$NBR = (\rho NIR - \rho SWIR)/(\rho NIR + \rho \text{SWIR}) \quad (1)$$

The NIR and SWIR bands in the satellite image correspond to specific wavelengths, such as B8 and B12 in Sentinel 2A. The NBR was computed using satellite images captured before and after the fire, and the wildfire area was determined by applying equation (2) (Lasaponara et al. 2019).

$$dNBR = (NBRprefire - NBRpostfire) \quad (2)$$

The results of the NBR analysis derived from Sentinel-2A satellite images were classified. The following band values were used to define the categories: values between +660 and +1300 indicate "High Severity," values between +440 and +659 indicate "Moderate-high Severity," values between +270 and +439 indicate "Low Severity," values between +100 and 269 indicate "Unburned," values between -100 and -99 indicate "Enhanced Regrowth, Low," and values between -250 and -101 indicate "Enhanced Regrowth, High" (Key and Benson, 2006).

Following the identification, the wildfire area using NBR, the site index and stand type for the affected area were determined based on the Türkiye General Directorate of Forestry's management plan. Simultaneously, slope and aspect were derived from elevation data, resulting in the determination of environmental parameters for the area.

3. RESULTS

The analysis of the wildfire in Antalya's Kemer district between July 24, 2023, and July 29, 2023, utilized Sentinel-2A satellite imagery. The NBR analysis results and the classification from the Sentinel-2A satellite image are depicted in Figure 2.

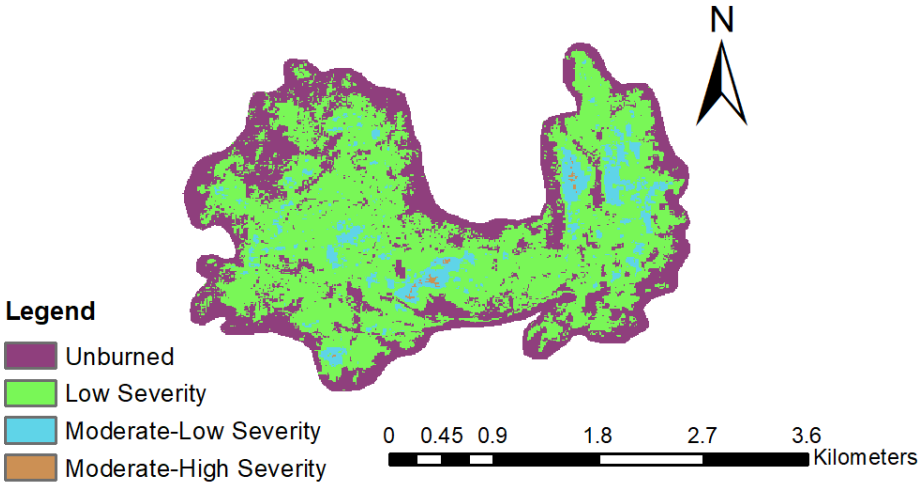

Figure 2. The result of the NBR index analysis

According to the NBR analysis results, a total of ~ 5168 hectares of forest area have been affected by the wildfire. Based on the classification applied to the wildfire area, no area was identified in the 'High severity' class. In the identified classes, ~ 162 hectares were classified as 'Moderate-high Severity', ~ 537 hectares as 'Moderate-low Severity' and ~ 4469 hectares were detected in the 'Low Severity' class.

Subsequent to the wildfire identification through NBR analysis, certain environmental and forestry parameters related to the fire-affected area were determined. The examined environmental and forestry parameters in this study encompass stand type, site index, elevation, slope (degree), and aspect. These parameters for the wildfire area are visually presented in Figure 3.

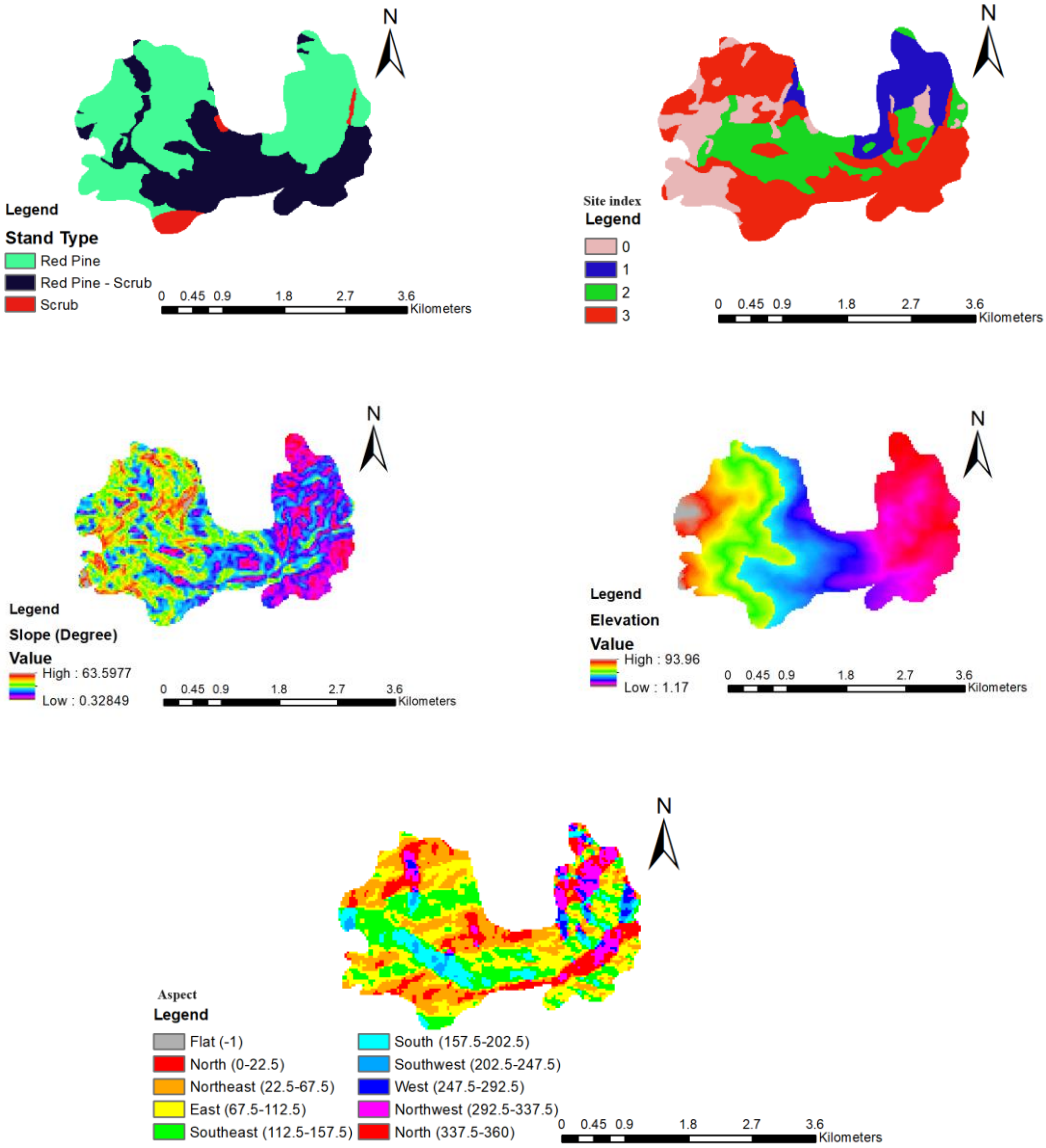

Figure 3. The environmental/forestry parameters of the wildfire area

Upon examining the environmental and forestry parameters of the wildfire area, it is evident that the red pine (*Pinus brutia* Ten.) forest tree species has significantly affected. Additionally, another stand type affected by the wildfire is scrub. The fire has affected approximately 2954 hectares of red pine (*Pinus brutia* Ten.) pure areas and approximately 150 hectares of pure scrub areas.

Furthermore, it has been observed that the site index of the tree species affected in the wildfire area predominantly falls under class 3, covering an extensive area of approximately 2368 hectares. Conversely, the least affected site index class is 1, encompassing around 716 hectares. The average elevation of the affected area is 41 meters, with an average slope of 20^0. The dominant aspect in the wildfire-affected area is oriented towards the East.

4. DISCUSSION AND CONCLUSIONS

In this study, the detection of the forest fire area in Antalya's Kemer district was carried out using NBR (Normalized Burn Ratio), and certain environmental and forestry parameters were subsequently identified. Satellite images, a widely preferred tool in wildfire detection studies, were chosen for their economic and time-saving advantages. This preference for satellite images is underscored by studies conducted by de Carvalho Júnior et al. (2015), Meddens et al. (2016), and Lee et al. (2022), where NBR proved accurate in detecting wildfire areas. Conversely, other studies, such as those by Escuin et al. (2008) utilizing the Normalized Difference Vegetation Index (NDVI), and Wang et al. (2008) employing

Normalized Multi-band Drought Index (NMDI) and Normalized Difference Water Index (NDWI), showcase the application of different indices for wildfire area detection. Although these studies used NDVI, NMDI and NDWI for detection, they did not calculate severity classification based on the indices. In our study, both the severity classes of the fire and the magnitude of these classes were determined in hectares.

Upon examining the stand type in the wildfire-affected area of Kemer district of Antalya red pine (*Pinus brutia* Ten.) emerges as the most impacted forest tree species. Red pine, commonly found in Türkiye's temperate climate-dominated areas (Sarıbaş and Pınar, 2009), is known for its sensitivity to fire and high flammability (Jolly et al. 2016; Drobyshev et al. 2008). Considering the high flammability of red pine, it can be inferred that red pine contributed significantly to the extensive damage observed in the wildfire area. Another parameter identified in the wildfire area is the site index, where areas with a site index of 3 suffered more extensive damage. The site index serves as an indicator of the production capacity of the growing environment (Yue et al., 2016) and, while not directly impacting wildfire size, reflects the productivity of the area. The prevalence of a site index of 3 in the wildfire area contributes to the most damage occurring in this class.

The average slope (degree) in the wildfire area is approximately 20^0, and the dominant aspect is east. While slope does not directly affect the severity of the wildfire, it can lead to changes in water flow post-wildfire, causing landslides and flash flooding (Ebel, 2013; Rengers et al., 2020). This is due to wildfires reducing the soil infiltration capacity and altering evapotranspiration (Abbate et al., 2019). Aspects, along with wildfires, influence soil temperature, leading to surface runoff post- wildfire (Ebel, 2013). While not affecting the growth of the wildfire area, it does impact the soil's infiltration capacity.

The average elevation of the wildfire area is 41 meters. Elevation, while not directly impacting wildfire size, can contribute to changes in frequency (Mansoor et al., 2022) attributed to climate change and increased human activities in higher elevation areas. In this study, the low elevation of the wildfire area, close to the city center with high human activities, suggests an increased risk of wildfires (Westerling et al. 2006).

In the study conducted wildfire that occurred in the Kemer district of Antalya was detected using the NBR (Normalized Burn Ratio) calculated from Sentinel-2A satellite imagery. Some environmental and forestry parameters of the detected wildfire area were identified and interpreted. The obtained parameters were used to determine stand type, site index, elevation, aspect, and slope (degree) in the affected area by the wildfire. This study is expected to provide valuable guidance for understanding the interaction of some environmental and forestry related parameters and wildfires.

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Author Contributions

Methodology: [Tunahan Çınar, Serkan Özdemir, Abdurrahim Aydın], Formal analysis and investigation: [Tunahan Çınar], Writing original draft preparation: [Tunahan Çınar, Serkan Özdemir, Abdurrahim Aydın]; Writing, review and editing: [Tunahan Çınar, Serkan Özdemir, Abdurrahim Aydın]

Conflict of Interest
The authors have no conflicts of interest to declare.

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