1st INTERNATIONAL FORESTRY & NATURE TOURISM E-CONGRESS "New Approaches and Trends in Forestry" November 25-27, 2020

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NOVEMBER 25-27, 2020, KASTAMONU / TURKEY

PROCEEDING BOOK

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FACULTY OF FORESTRY
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2020

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Faculty of Forestry

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PREFACE

As one of the five universities that was declared within the scope of the "**Regional Development Oriented Mission Differentiation and Specialization Programme**" at the beginning of 2019 by the Council of Higher Education of the Republic of Turkey, Kastamonu University has been designated as one of the universities that shall specialize on "**Forestry and Nature Tourism**" across Turkey. As being entrusted with the mission of specializing in forestry across Turkey by the Council of Higher Education among 10 other universities, and as being in a position where it has the most optimal infrastructure in terms of academics, research studies, implementation and industry, Kastamonu University, in order to duly realize the task it was given, held the "**1st International Forestry and Nature Tourism E-Congress**" with the theme of "**New Approaches and Trends in Forestry**" to share and build upon the obtained scientific data, and to serve as a base for future studies.

It was an utmost pleasure and honor to welcome researchers from both home and away (USA, Romania, Philippines, Pakistan, Kyrgyzstan, Libya) to the e-congress during which a total of 64 academic papers were presented in Kastamonu, the city that is acknowledged as the center of Forestry in Turkey thanks to its forests that cover approximately 65% of the province, its 3 national parks, and its status as being host to the Regional Directorate where the most forest assets are produced.

Climate change is one of the biggest environmental, social and economic threats in today's world, and the importance of the role that forests play in the fight against climate change is evident. Furthermore, our forests need to meet the various needs of the society as a result of industrialization and population growth. Within the context of climate change, the recent pandemic and the different needs of society in an ever-changing world, natural resources and especially the forests are required to be handled with different approaches. Thus, we expect the e-congress held at our university with the aim of shedding light on the needs of society and science to make significant contributions to society, science and forestry with regards to developing new approaches in forestry applications.

For this very reason, I would like to extend my most sincere gratitude and appreciation to the organization committee of the **1st International Forestry and Ecotourism E-Congress** held in Kastamonu. I would also like to commend the valuable academic staff and the distinguished scientist from different institutions that participated in the congress for their great support and participation. We would like to thank and congratulate the valuable staff, the administrators and academics of the Faculty of Forestry at Kastamonu University for their efforts. Lastly, I would like to thank all the institutions and participants that supported and showed interest in our congress, with the hopes that it will prove beneficial and successful for both our university and our country.

Prof. Dr. Ahmet Hamdi TOPAL
Kastamonu University
Rector
Honorary Chair of INFONT 2020

PREFACE

Forests, besides their vital role in combating climate change, have to respond to the increasing and diversified needs of the society brought about by industrialization and population growth. Forestry activities carried out in forests, which are extremely important in terms of the continuity of the ecosystem, should be managed with a different perspective and understanding in this direction, and high value-added products obtained from the forest should also be offered to humanity with an effective, efficient and sustainable approach.

Approximately 67% of the surface area of Kastamonu province, which is regarded as the center of Forestry in Turkey, consists of forests. Kastamonu Regional Directorate of Forestry, with its annual production rate of 3.4 million m^3, is the regional directorate where the forest goods are produced by far the most in Turkey. Additionally, within the boundaries of the province where three national parks are located, the factories such as Kronospan, Kastamonu Entegre, Ekol Plywood, Çağ Plywood, and Dortek, there are also approximately 400 enterprises in the form of SMEs where forest products are processed. Kastamonu also has a significant share in the manufacturing of wood-based doors in the total production in Turkey.

Among the main themes addressed in the Ist International Forestry and Nature Tourism E-Congress were erosion, the adverse impacts of mining sites on forest ecosystems, the change of precipitation and temperatures within the scope of climate change, forest fires, possible effects of climate elements and solutions to ecological problems. In addition, the studies on the certification in forestry, on the carbon sequestration capacity of forests, which are the most important terrestrial ecosystems in reducing the negative effects of climate change, on the biomass estimation of different tree species in forests, as well as on the detection of large mammal species and some insect species that damage forest trees in Kastamonu region were presented.

As for the field of Forestry Industry, thermal processes applied to wood raw materials and their usage areas, the physical and mechanical properties of wood-based nanocomposites, and the importance of natural dyes in the paper industry were mentioned. In addition, the use of Industry 4.0, which becomes increasingly important today, in the forest industry and the situation of the forest products industries operating in Kastamonu during the Covid-19 pandemic were evaluated. Kastamonu University, which specializes in the field of Forestry and Nature Tourism, carried out an outstanding scientific activity within the scope of regional development and mission differentiation in the Ist International Forestry and Natural Tourism E-Congress, during which many different issues were covered.

I would like to express my sincere respect to Prof. Dr. Ahmet Hamdi TOPAL, the Rector of Kastamonu University for allowing this Congress to be organized. I would also like to extend my appreciation to my colleagues for their efforts during the organization of the congress, and to the scientists and participants who shared their knowledge by taking part in this special event.

I hope that the conclusions reached throughout the congress will be beneficial for the forestry of Kastamonu, Turkey, and the world in general, and offer an insight into future studies on forestry.

Prof. Dr. Ömer KÜÇÜK
Kastamonu University
Vice Rector
Chairman of INFONT 2020

KEYNOTE SPEAKERS

Sustainable Forest Operations in the United States Dr. Dalia ABBAS, American University, USA
Raw Materials for The Wood Industry Dr. Marius Catalin BARBU, Transilvania University, ROMANIA
Biodegredible Face Mask from Biofibers Dr. Salim HIZIROĞLU, Oklahoma State University, USA
Global Trends and Opportunities in Forestry Dr. Yusuf SERENGİL, İstanbul University-Cerrahpaşa, TURKEY

CONTENTS

Analysis of Forest Fire (2019-Turkey)

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Abstract

Aim of study: This study was conducted with the aim to analyze forest fires occurred in Turkey during 2019. In particular, it is aimed to determine the reasons for forest fires, the amount and number of burning areas according to region.

Area of study: All of Turkey's forest area is designated as an area of research. Forest fires in terms of Turkey's Mediterranean climate zones are also of importance.

Material and methods: The data of the forest fires in 2019 occurred in Turkey constitute the study material. The database program was prepared by data transfer to the computer. Data were analyzed separately according to the general and regional directorates in Turkey. A database program was used in the evaluation of forest fires information. The data are presented as tables, figures and maps.

Main results: Initially, Turkey's forest area and forest wealth distribution, the composition of tree species of the forest areas are is declared. Furthermore, information about the distribution of forest areas according to the province and the regional directorates is shared. Then, the causes of forest fires (intent, neglect-accident, natural, unsolved), the number of forest fires and the amount of burnt area were specified. In addition, the distribution of forest fires according to regional directorates was given as area and number. The distribution of fires that occurred in 2019 according to forest characteristics, the distribution of forest fires by provinces, and the areal and numerical distribution of the regional directorates according to the causes of fires are shown in tables and figures. Finally, the silvicultural evaluation of the burning areas (the area exposed to the cover fire but not damaged, the area where natural regeneration was prepared, the area included in the artificial regeneration program, the rehabilitation area, the area included in the afforestation program, the area protected because there is no technical operation to be done) were discussed.

Highlights: Suggestions have been made for the protection and renewal of the forests in Turkey and for the acquisition of new forest areas.

Keywords: Forests, Forest Fires, Fire Reason, Turkey.

Introduction

Combustion; It is a chemical reaction that occurs as a result of the ignition of the flammable substance and caustic substance under suitable conditions. (URL-1, 2020). Combustion triangle is the combination of flammable material, caustic material and ignition source under suitable conditions. Fire; It is the uncontrolled combustion of flammable materials by spreading heat and light at different rates to its surroundings. Fire may be caused by ignorance, imprudence, negligence, accident, intent, natural events, etc. (URL-2, 2020). Combustible material properties, land structure and meteorological values are the three most important factors affecting the movement, shape, speed and size of the fire (TOD, 2020).

Forest fire; It is the burning of forests partially or completely by natural or anthropogenic fires. There are natural fires such as lightning strikes, volcano eruptions and high temperatures, and man-made forest fires caused by smoking, agricultural products etc. Fires are seen in almost all ecosystems in the world except for glaciers and water surfaces and extremely arid deserts and cause many ecological damages (Altın et al., 2005; Pausas & Ribeiro, 2013; Tavşanoğlu, 2017). Fires that tend to spread freely that burn and destroy all living and non-living things that can burn; are examined in three different types: cover fire, hill fire and ground fire (URL-3, 2020; TOD, 2020). Cover fire : It emerges when the needle, branch, cutting residues, grass, shrub and living cover burns on the forest soil. It rarely harms the main tree species of the stand. It hardly turns into hill

fires when the weather is humid and in the winter months. Many woody plant species in ecosystems where cover fires occur have a thick shell that will protect them from low-intensity fires (Akman et al., 1996; Tavşanoğlu & Gürkan 2004; Pausas, 2015; Tavşanoğlu, 2014). Hill fire : It damages the entire stand, especially the main tree species in the stand. It is a type of fire that progresses by burning the tops of trees, and when the hill fire is mentioned, it should be understood that all elements in the stand, including flammable substances on the soil surface, burn. Land fires, on the other hand, are fires consisting of peat on and under forest soil such as reeds and swamps (URL-4, 2020). After these fires, secondary succession development might be observed in the area, and over time, the vegetation may reach climax vegetation (Akman et al., 2001).

2019 Turkey's forest wealth forest preserves 1.660.618.742 m^3 (98.9%) and coppice forests m^3 (1.1%) to a total of 1.679.356.210 and 22.740.297 m^3 ha. shows spread in the area. Forest fires cause the loss of this wealth every year.

This research was carried out with the aim to analyze forest fires occurred in Turkey during 2019. In particular, it is aimed to determine the reasons of forest fires, the amount and number of burning areas according to region.

Material and Methods

Material

Information regarding forest fires which have occurred in Turkey in 2019 is the study material. The data were obtained from the Ministry of Agriculture and Forestry, General Directorate of Forestry (URL-5, 2020). The database program named FG-Forest ver. 0.1 was prepared by data transfer to the computer.

Method

Data were analyzed separately according to the general and regional directorates in Turkey. Database program was used to evaluate the information about forest fires. The data are presented as tables, figures and maps.

Results and Discussion

Initially, the distribution of Turkey's forest area (Table 1), forest wealth distribution (Table 2) The distribution of forest tree species (Table 3) is explained. In addition, information was given on the distribution of forest areas by province (Figure 1) and forest regional directorates (Figure 2).

Table 1. Distribution of forest areas

Forest form	Total (ha.)	Productive	Degraded
2019	22.740.297	13.083.510	965.678
High forest	21.540.131	12.733.660	880.647
Coppice fores	1.200.166	349.850	850.316

Table 2. Forest wealth distribution

Forest form	Total (ha.)	Productive	Degraded
2019	1.679.356.210	1.609.841.860	69.514.350
High forest	1.660.618.742	1.595.828.101	64.790.641
Coppice fores	18.737.468	1.401.3759	4.723.709

Table 3. Distribution of important tree areas

Tree species groups	Total (ha.)
Kızılçam (*Pinus brutia*)	5.736.371
Meşe (*Quercus* sp)	5.956.527
Karaçam (*Pinus nigra*)	4.354.821
Kayın (*Fagus orientalis*)	1.935.730
Sarıçam (*Pinus sylvestris*)	1.538.304
Ardıç (*Juniperus* sp.)	963.217
Göknar (*Abies* sp.)	593.201
Sedir (*Cedrus* sp.)	487.819

Figure 1. Distribution of forest areas by provinces

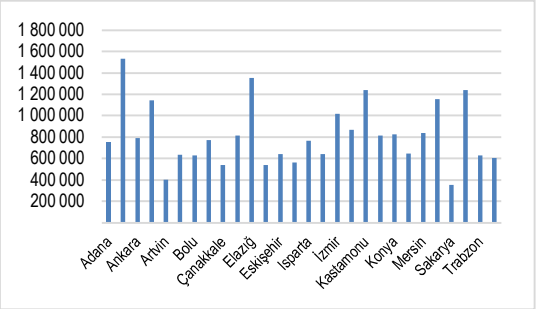

Figure 2. Distribution of forest areas by forest regional directorates

The causes of forest fires (intent, negligence-accident, natural, unsolved) are given in figure 3. The number of forest fires was determined as 2.688 and the amount of burning area was determined as 11.332 hectares. In addition, the distribution of forest fires by regional directorates is given as number (Figure 4) and area (Figure 5).

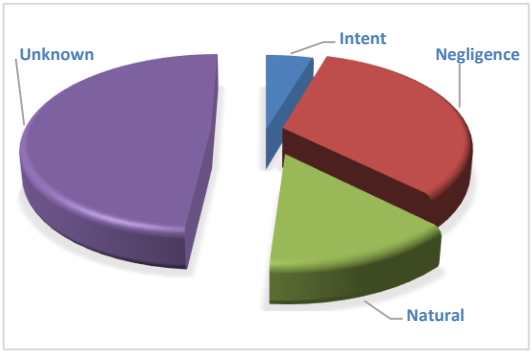

Figure 3. The causes of forest fires

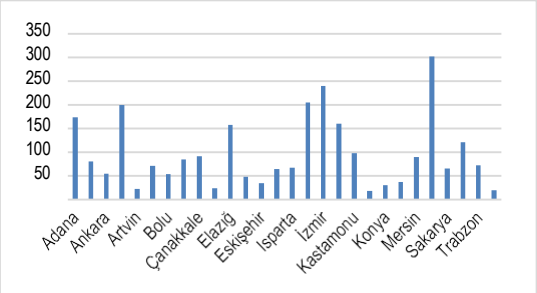

Figure 4. Numerical distribution of forest fires to regional offices

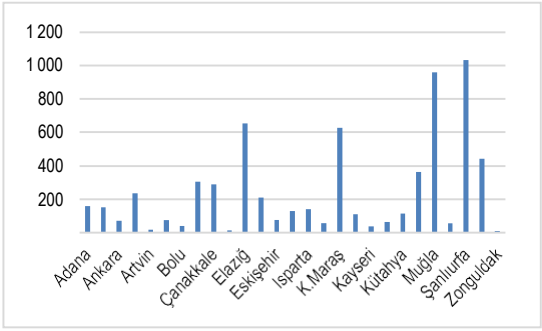

Figure 5. The spatial distribution of forest fires to regional directorates (The highest area has been determined as 4.904 hectares in İzmir.)

The distribution of fires that occurred in 2019 is given according to forest characteristics (Figure 6). Depending on the causes of forest fires, the areal (Figure 7) and numerical distribution (Figure 8) of forest fires by provinces are shown on the map.

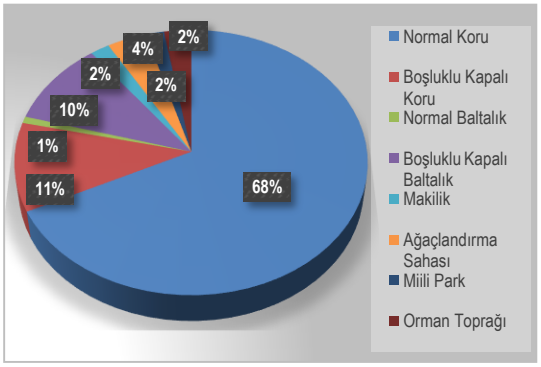

Figure 6. Distribution of forest fires according to their characteristics

Figure 7. Area distribution of forest fires by provinces

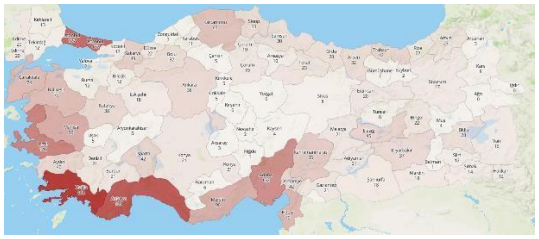

Figure 8. Numerical distribution of forest fires by provinces

According to the causes of fires; the spatial distribution and numerical distribution in the regional offices are shown (Figure 9, Figure 10). The total number is 2.688.

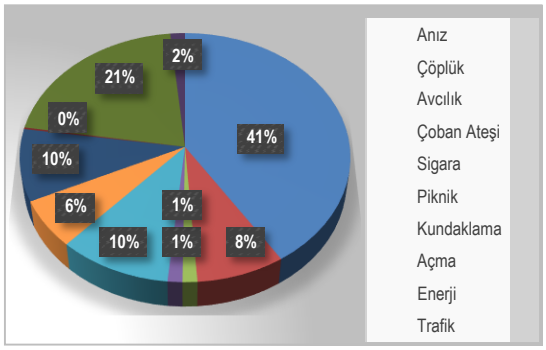

Figure 9. Reasons of forest fires according to regional directorates

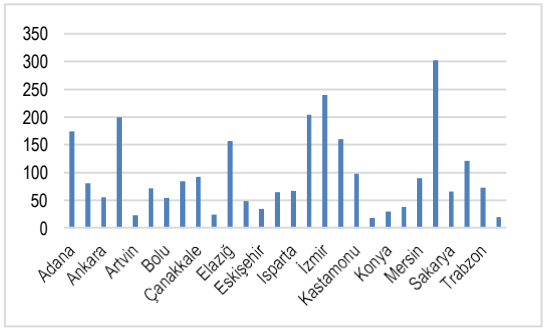

Figure 10. Number of forest fires by regional directorates

Finally, by evaluating the burning areas from a silvicultural point of view; undamaged area (34.547.379 ha.), area of natural regeneration (3.730.595 ha.), artificial rejuvenation area (200.241 ha.), rehabilitation area (15.104 ha.), area included in afforestation program (140.244 ha.), the protected areas (5.912.196 ha.) are shown in figure 11.

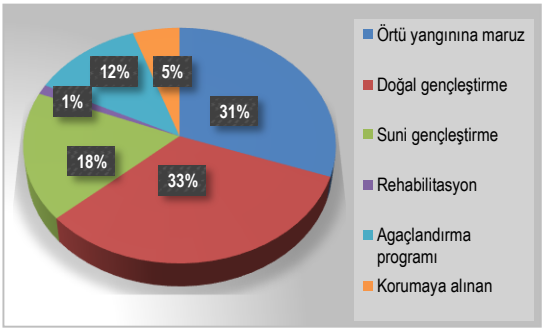

Figure 11. Evaluation in terms of silvicultural aspects

The search page (Figure 12) and the main menu page of the computer program where data analysis is performed are given in Figure 13.

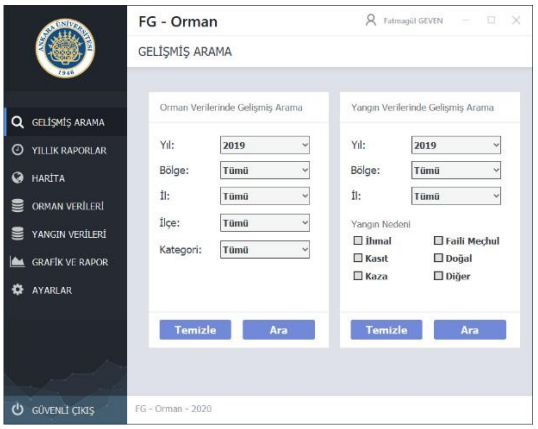

Figure 12. Search page of the database program.

Figure 13. The main menu page of the database program.

Conclusion

In the last decade, forest fires burned area amount to 71.300 hectares and the number of burned areas was 24.773 hectares. It

corresponds to an area of 2.87 hectares per fire number. Today, these fires cause a significant loss of national wealth. In addition, forest fires have negative effects on global warming, which is the main environmental problem. Burning forests cause an increase in carbon emissions and greenhouse gas effects and adversely affect environmental health. It is estimated that the effects of global warming will be felt more intensely by the countries in the Mediterranean basin and forest fires will increase gradually. For these reasons; The source of forest fires should be determined, solutions should be produced in this regard and the number of fires should be reduced. In addition, individuals should be trained on prevention and response to forest fires and directed to afforestation activities.

With this study, forest fire data of 2019 were transferred to digital environment, making the data more accessible and usable. We think that the results of the study will shed light on future research.

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Dynamic Erosion Model and Monitoring System (DEMIS) Produces Updated Erosion Statistics by Land Use Types at the Province Scale in Kastamonu

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Abstract

Aim of study: To provide erosion severity distribution maps on which detailed action plans in province scale for combating soil erosion.

Area of study: All available data sets of climate, soil, topography and land use and land cover across Kastamonu were tapped into for computing model parameters exclusive to the RUSLE technology which performed in General Directorate Combating Desertification and Erosion in Ankara.

Material and methods: DEMIS uses an existing map of R-factor of Turkey, which is layered by using 357 minute-data of the Automatic Meteorological Observation Station and calculated as a result of the annual total energy of rainstorm (E, MJ $ha^{-1}y^{-1}$) and the maximum 30-min intensity (I_{30}, mm h^{-1}) ($E \times I_{30}$). DEMIS computes soil erodibility factor from 138 geo-referenced soil samples distributed over Kastamonu. Dependent upon presence of germane soil parameters required to estimate erodibility, the equations of nomogragh were utilized to assess K factor after regression analyses to express best possible relations among three different K values. The topographic factor of DEMIS is interactively calculated by slope length factor (L) and steepness factor (S) along with flow accumulation. Where χ is the flow accumulation and is obtained from DEM using a GIS accumulation algorithm, which employs the watershed delineation tool of Arc view 10.2. DEMIS consumes 44 classes of CORINE land cover (CORINE 2012) as a base map for the RUSLE-C together with correspondent values determined by Panagos et al. (2015). Furthermore, additional adaptive corrections were performed combinatorially using the National Forest Map of Turkey given semi-arid specificities of forest types and vegetative covers. As well, DEMIS could be run to predict soil losses and to assess water erosion risk at the micro-catchment level considering support practice factors along with effects of existent dams and lakes on the erosional transport processes, and has a sufficient capability to be integrated with the Sediment Delivery Ratio to compute sediment amounts reaching outlet of each micro-catchments. Its calibration and validation works have been in progress by comparing with the suspended sediment loads directly measured at 10 monitoring stations of the province scale in Kastamonu.

Main results: Relying upon the DEMIS generated statistics and predictions, the calculated soil loss is nearly eight-million ton ha^{-1} y^{-1}in Kastamonu. Erosion severity also revealed 84.19% of Kastamonu is under the influence of either very low or low erosion although 15.81% of its whole land area is prone to the moderate, severe and very severe erosion. Once sorted by land use types, severe and very severe erosion rates obviously alarm for agricultural lands. When the weight of each model parameter on total loss to determine their effect and contribution was further partitioned, the topographic factor (LS), which represents the combined influence of slope length and slope steepness on overland flow and erosion processes took a lead with rational efficiency of 47.55%, and crop management (C), erosivity (R), and erodibility (K) followed this by the percentages of 34.82, 14.26 and 3.36, respectively.

Highlights: DEMIS has performed successfully to spatially and hierarchically delineate soil erosion risk areas by the severity classes so that the SLM/SSM approaches and technologies to avoid, reverse and restore land degradation by the soil erosion at the Kastamonu province scale.

Keywords: DEMIS, Soil Erosion Risk Assessment, SLM/SSM Practices.

Introduction

Soil erosion is one of the most important means that threatens the sustainable use of soil resources in the catchments of Turkey (FAO & ITPS, 2015). Also, varying with climate, soil, topography and land cover and management, sediment amounts transported into water reservoirs by different erosion processes cause harmful consequences for energy and agricultural water use in the semi-arid ecosystems of Anatolia in Turkey. Therefore, a nationwide evaluation of erosion risk became a pressing priority for natural resource managers and soil erosion scientists to have to contain this threat, and a RUSLE model based project was initiated by the General Directorate of Combating Desertification and Erosion (ÇEM) under the Ministry of Agriculture and Forestry (MAF).

Indeed, studies of assessing erosion risk by USLE/RUSLE technology have been for a long time used at the scale of small watersheds in Turkey (Erdogan et al., 2007; Tunc and Schröder 2010a, b; Hacisalihoglu 2010; Ozcan et al., 2015; Saygin Deviren et al., 2014; Efe et al. 2008; Yüksel et al. 2008; Karaburun et al., 2009; Demirci & Karaburun, 2012). Saygın et al. (2014) used the sediment delivery ratio (SDR) in combination with the (R)USLE model to quantify both potential and actual soil erosion risks, estimating the amount of sediments to be delivered from the hillslope of the catchment to the reservoir of the dam. Bayramin et al. (2008) reported that soil properties and (R)USLE-K, evaluated by the nomograph (Wischmeier & Smith 1978; Renard et al. 1997), statistically changed with land use changes in a semi-arid watershed. At the scale of 1:25.000 Erdogan et al. (2007) used the soil database of Turkey (GDPS, 1986) to predict the (R)USLE-K values from the soil units formed by the combinations of texture and erosion classes to predict soil loss in a semiarid agricultural watershed of Kazan, Ankara.

Another comprehensive study reported the erosive power of rainfalls based on long-term data and high-temporal resolution records by the state meteorological stations distributed all over the country (Erpul et al., 2016), findings of which have been later successfully integrated with the global rainfall erosivity assessment (Panagos et al., 2017).

Some researchers have made of the RUSLE-based erosion assessments in order to design rehabilitative practices of Sustainable Land Management (SLM) at small dam watersheds, using the product of crop management and support practice factors as decision criterion (Madenoğlu et. al., 2018; Pınar, et al., 2018). Most recently, a Water Erosion Atlas has been published to give statistical data on soil erosion in 25 river-basins of Turkey along with their maps (Erpul et al., 2018). Also, sediment delivery ratios (SDRs) of the watersheds were calculated, and for having SDR of the Kastamonu province, the spatial data of both western black sea and Kızılırmak basins were made use of.

This paper introduces "Dynamic Erosion Model and Monitoring System (DEMIS)" developed by the Ministry of Agriculture and Forestry, General Directorate of Combating Desertification and Erosion to document erosion statistics by land use types in Kastamonu in order to support decision and policy making in Turkey given close intertwinement of soil ecosystem functions and services with climate change, land degradation and desertification and significance of conserving soil resources to ensure food security at the province scale.

Material and Methods

The "Dynamic Erosion Model and Monitoring System (DEMIS)" estimates potential and actual erosion rates for river basins involving Kastamonu borders using the RUSLE erosion model (Wischmeier & Smith, 1978; Renard et al., 1997). Model parameters are calculated by Remote Sensing (RS) and GIS techniques along with spatial statistical methodologies, and the digital databases (raster and vector) with which the model systematically associate are; Topographical maps (1:25.000), Digital elevation models (1:25.000), Soil maps (1:25.000) (Anonymous, 1982), Land use data (CORINE, 2012), Catchment and river network data (General Directorate of State Hydraulic Works), River sediment data (General Directorate of Electrical Power Resources Survey and Development Administration (E.İ.E.İ), 2006-2012), Erosivity map (General Directorate of

Combating Desertification and Erosion) (Erpul et al., 2016) and Automatic Meteorological Observation Stations Data (General Directorate of Meteorology), National Water Erosion Atlas (Erpul et. al., 2018).

As listed above, all available data sets of climate, soil, topography and land use and land cover across the country were tapped into for computing model parameters exclusive to the RUSLE technology, further adapted to larger catchment scales by methodologically relevant RS and GIS tools.

Operation Method

General workflow scheme of DEMIS is given in Figure 1, which depicts it is based upon the Revised Universal Soil Loss Equation (RUSLE) (Wishcmeier & Smith, 1978; Renard *et al.* 1997), distinctively given by (Eq.1):

$$A = R \times K \times LS \times C \times P \quad (1)$$

Here:
A = Average Annual Soil Loss (t ha^{-1} y^{-1});
R = Rainfall-Runoff Erosivity Factor (MJ mm ha^{-1} $hour^{-1}y^{-1}$);
LS = Slope Length and Steepness Factor (t ha hour ha^{-1} MJ^{-1} mm^{-1});
K = Soil Erodibility Factor;
C = Cover Management Factor;
P = Support Practice Factor.

DEMIS uses an existing map of R-factor of Turkey, which is layered by using 357 minute-data of the Automatic Meteorological Observation Station and calculated as a result of the annual total energy of rainstorm (E, MJ $ha^{-1}y^{-1}$) and the maximum 30-min intensity (I_{30}, mm h^{-1}) ($E \times I_{30}$) (Wischmeier & Smith 1978; Foster et al. 1981; Renard et al. 1997; Erpul et. al., 2016; Panagos et. al., 2017)

DEMIS computes soil erodibility factor from 138 geo-referenced soil samples distributed over Kastamonu. Dependent upon presence of germane soil parameters required to estimate erodibility, the equations of nomogragh (Wischmeier et al., 1971), Torri et al. ((1997, 2002) and Römkens et al. (1986, 1997) were utilized to assess K factor after regression analyses to express best possible relations among three different K values.

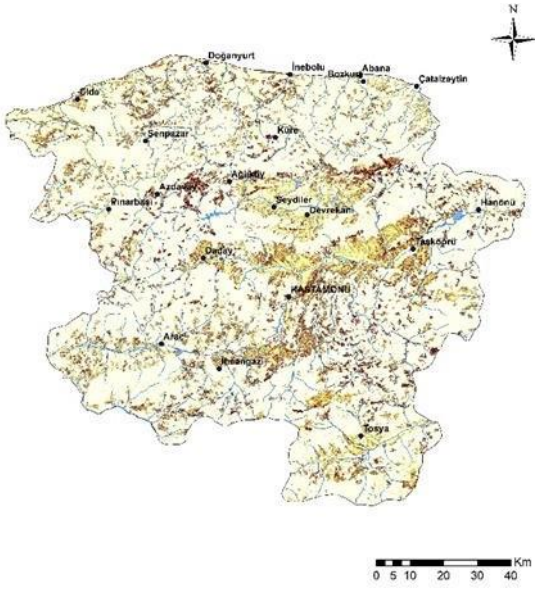

Figure 1. Soil erosion map for Kastamonu province

The topographic factor of DEMIS is interactively calculated by slope length factor (L) and steepness factor (S) along with flow accumulation (Moore & Bruch 1986a, b; Ogawa et al. 1997) (Eq. 2).

$$LS = \left(\frac{x\eta}{22{,}13}\right)^{0,4} \left(\frac{\sin\theta}{0{,}0896}\right)^{1,3} \quad (2)$$

Where χ is the flow accumulation and is obtained from DEM using a GIS accumulation algorithm, which employs the watershed delineation tool of Arc view 10.2 (Lee, 2004), η is the cell size, and θ is the slope steepness in degrees.

DEMIS consumes 44 classes of CORINE land cover (CORINE 2012) as a base map for the RUSLE-C together with correspondent values determined by Panagos et al. (2015). Furthermore, additional adaptive corrections were performed combinatorially using the National Forest Map of Turkey given semi-arid specificities of forest types and vegetative covers.

As well, DEMIS could be run to predict soil losses and to assess water erosion risk at the micro-catchment level considering support practice factors along with effects of existent dams and lakes on the erosional

transport processes, and has a sufficient capability to be integrated with the Sediment Delivery Ratio (Eq. 3 and 4) to compute sediment amounts reaching outlet of each micro-catchments. Its calibration and validation works have been in progress by comparing with the suspended sediment loads directly measured at 10 monitoring stations of the province scale in Kastamonu.

$$Q_T = \{\sum_{i=1}^{n} ECA_i \times A_i\} \times SDR \quad (3)$$

$$Q_T = \{\sum_{i=1}^{n} ECA_i \times (R.K.L.S.C.P)_i\} \times SDR \quad (4)$$

Q_T, Total sediment arriving to the dam reservoir (ton y^{-1}); *ECA*, Erosion Class Area (ha); A_i [$(R.K.L.S.C.P)_i$], Soil loss (ton ha^{-1} y^{-1}), *SDR*, sediment delivery ratio (%).

Results and Discussion

One - minute detailed rainfall data regularly recorded by the regional weather stations were used by distributing those over whole city regions, and then exhaustive calculations for both rainfall intensities and energy fluxes portrayed climatic severity for soil erosion in the Kastamonu province.

Moreover, tapped into were soil data as extensive as possible for whole Kastamonu for having a map for soil susceptibility to water erosion.

In this study, the RUSLE technology was methodologically reinforced by RS and GIS for more effectively using model parameters at the province scale in Kastamonu, and RS and GIS are readily compatible with further possible scale-ups for watersheds, regional, and national purposes in DEMIS. Additionally, statistical soil erosion data in 25 river-basins of Turkey provided detailed maps for severity assessment and resulted in a Water Erosion Atlas through DEMIS (Erpul et al., 2018).

The total soil loss per unit area predicted by the DEMIS in Kastamonu is 5.96-million-ton ha^{-1} y^{-1}, and magnitude of the predicted annual soil losses showed that 84.19 % of Kastamonu is under the influence of either very low (76.08%) or low erosion (8.11%) although 15.81% under the influence of either moderate erosion (5.8%) or severe (5.4%) and very severe erosion (5.34%). Also, these amounts were calculated for the province areas that fall in both river basins including Western Black Sea and Kızılırmak (Table 1).

Table 1. Soil erosion severity classes for Kastamonu.

Soil Erosion Severity Classes (ton ha^{-1} $year^{-1}$)	Percentage (%)
Very Low (0 - 1 ton ha^{-1} $year^{-1}$)	76.08
Low (1,01 - 5 ton ha^{-1} $year^{-1}$)	8.11
Moderate (5,01 - 10 ton ha^{-1} $year^{-1}$)	5.08
Severe (10,01 - 20 ton ha^{-1} $year^{-1}$)	5.40
Very Severe (> 20,01 ton ha^{-1} $year^{-1}$)	5.34

Once sorted out over different land use types, severe and very severe erosion rates are alarming for agriculture land, being approximately 68.2%, but in the forest and pasture areas percentages is as low as one fourth of agriculture areas, 13.61% in forest and 16.58% in pasture areas (Table 2).

Table 2. Soil erosion amount based on landuse types

Landuse Type	Area (ha)	Erosion Amount (ton $year^{-1}$)	Unit Erosion Amount (ton ha^{-1} $year^{-1}$)	Percentage Total Erosion (%)
Forest	921,8	1,06	1.15	13.6
Agriculture	289,6	5,31	18.34	68.2
Pasture	88,2	1,30	14.65	16.6
Other	9,2	128	13.92	1.6
Total	1,31	7,79	5.96	100

When we further partitioned the weight of each model parameter on total soil loss, the crop management (C) effect took the lead with the rational efficiency of 96.34%, (C) followed by topography (LS), rainfall erosivity (R), and erodibility (K) with the percentages of 2.5, 0.88 and 0.28, respectively (Table 3).

Table 3. Effect of parameters percentage on soil erosion in Western Black Sea

Parameter	%
Crop Management (C)	96.34
Topography (LS)	2.5
Rainfall (R)	0.88
Erodibility (K)	0.28

Conclusion

DEMIS was run at the state scale and have produced maps of the predicted soil losses and soil erosion risk classes at different scales ranging from small watersheds up to big river basins including Kastamonu province in Turkey by using the RUSLE methodology. It continuously generates temporal and spatial statistics on when and where human-induced erosion rates alarmingly threaten soil resources.

The spatial statistics showed that soil erosion is a threat causing significant loss of agricultural lands and critical indicator for land degradation under the changing sub humid climate in the Kastamonu province. Hence, DEMIS as a supportive prediction tool and system would have a high potentiality and would provide opportunities for decision makers and policy developers not only to minimize soil erosion aimed at for Sustainable Soil Management (SSM) but also to ensure sustainability of land resources by hierarchically avoiding, reducing and reversing land degradation.

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Considerations on Forest Management Certification in Turkey as to FSC® (Forest Stewardship Council) Scheme

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Abstract

Aim of study: The aim of this study is to examine the Forest Management Certification projects which have been carried out in Turkey since 2010 as to the FSC system. Presently, 6.673.308 ha of forests certified in Turkey according to this system.

Area of study: This study based on the Forest Management Certification projects of Turkey as to the FSC system.

Material and methods: In the study, FSC projects currently carried out were evaluated as material. In this study, certification projects in Turkey are examined, problems and their solutions are listed.

Main results: Not only the positive price contribution of the certification process to the wood producer General Forestry Directorate (GFD), but also the country-based contribution to the forest industry should be evaluated. It is not possible to return from the FSC certification process, and it is necessary to establish permanent quality systems in all centre and local forestry organizations. Instead of delegating the management and monitoring of the management of the process only to the Business Marketing Branch directorate, all branches should be involved in this process, management and monitoring should only be controlled by a chief engineer or branch whose job is the certification process. In the certification process, it is important for the top management to own the process and this process must be included in the scope of internal control. The decision on which certification process to use should definitely be agreed with the wood products buyers.

Highlights: In Turkish forestry, Forest Management Certification process must be accepted as an irreversible process, and more efficient system should be established accordingly.

Keywords: FSC, Forest Management Certification, Turkey

Introduction

The local public and other NGO's about forest and forestry reached sufficient strength to cause national and global concern in 1980s. Thus, some of the multilateral organizations like World Bank and FAO as well as national bilateral agencies, funded or managed numerous projects to improve forest management and protection. Also, some of initiatives such as the Tropical Forest Action Plan and the International Tropical Timber Organization were established to help improve the forestry sector in the tropics (Synott 2005). Throughout the 1980s and in the 1990s, forests became an increasingly important issue for the NGOs. Friends of the Earth started in the mid1980s with research linking UK timber companies with tropical deforestation (Dudley et al. 1995). Facing public concerns, manufacturers put labels on the products, claiming sustainability of their forest resources. For some of them, the situation became urgent in the late 1980s when journalists, the media and environmental NGOs started targeting retailers and their purchasing policies. In this case, many organizations and people contributed to the search for solutions. In a sense, all of them contributed to the eventual emergence of certification. Even the vigorous early criticisms of the certification idea contributed to success by identifying the key interests and needs of different groups. Up to the late 1980s, most national efforts to promote better forest management had concentrated on pressuring their own governments, foresters and loggers. Most of the bilateral and multilateral efforts in the tropics targeted the same groups. In contrast, three initiatives in northern countries developed the idea of using market forces to promote good forest management. They

focused on the traders and retailers in timber products, and proposed to encourage the preferential imports of tropical timber from identifiable well managed forests. These three early initiatives (Friends of the Earth-UK, The Ecological Trading Company- ETC, The Woodworkers Alliance for Rainforest Protection-WARP) led in a direct line to the launch of global accreditation and certification in their present form (Synott 2005). Besides, other initiatives like WWF-International developed its plans for a campaign to promote sustainable forest management, and to concentrate the international trade in the products of sustainably managed forests worldwide (Elliott 1991). By July 1991, WWF- UK had identified the potential role of an International Forest Monitoring Agency in helping to achieve this target. By May 1992, the target had "been broadened to cover the entire trade in wood and wood products worldwide" The 1995 Group, other Buyers Groups and the Global Forest & Trade Network were emerging (WWF-UK 1992). In mid-1990, The Nature Conservancy (TNC) made a study of the need for certification, and the potential for TNC itself to become involved as a certifier. They consulted organizations involved in certification, trade and forest conservation. Most of them were highly sceptical about the need for certification, and whether any credible form of tropical forest certification was possible. Shortly afterwards, The Homeland Foundation commissioned a study of the requirements for a credible certification system for forest products (Simeone 1990). The first group to launch itself into forest certification was Rainforest Alliance, a New York NGO with four years of experience in rainforest areas. During 1990, a program was developed for identifying "well-managed tropical woods", and evaluated logging concessions in Indonesia. In October, the launch of the Smart Wood certification program was announced. It was recognized the lack of "broadly accepted standards for particular tropical forest regions", and developed a simplified system based on 1) watershed stabilization, 2) sustained yield production, and 3) positive impact on wellbeing of local people. Operations that demonstrated a "strong operational commitment to these criteria will be classified as well-managed (Ussach 1990a). This was the first third-party certification of forest management. In November 1990, Ussach (1990b) circulated a draft Rainforest Alliance "Criteria for Evaluating the Sustainability of Tropical Logging Operations", which followed closely the recent ITTO Guidelines (ITTO 1990). These eventually evolved into the Smartwood standards. Rainforest Alliance confirmed that certification needed "independent third-party field evaluation" and, in due course, a broad agreement on the definition of "sustainable logging". Thus, the concepts of third party assessments and widely agreed standards formed part of the original concept. Meanwhile, this early version of certification concentrated attention and encouraged the attention of other certification initiatives. Green Cross Certification Co (1991), (later SCS) and the Institute of Sustainable Forestry (ISF 1991), both of California, drafted their forestry certification systems in March 1991; Soil Association entered certification discussions with WWF in May 1991, and SGS was started making its interest in the same period (Synott 2005). From January 1991, the Certification Working Group (CWG) took the initiative. Over the next year, most of the activities that led to the founding of FSC were associated with this group or its members. However, it remained quite informal, as a gradually expanding circulation list or forum, rather than a fixed membership. The first key event organized by the CWG was a Certification Meeting in San Francisco in April 1991 (Synott 2005) Rainforest Alliance and Scientific Certification Systems, and an explanation of the proposed International Forest Monitoring Agency. Much of the meeting was devoted to wide-ranging discussion of the concerns, expectations and questions about forest and wood certification, and to the contents of a Forest Stewardship Charter to which all certification groups could subscribe and adhere. The meeting also discussed the structure and governance of the organization that would monitor the certifiers for compliance. By now, it was clear that the new organization under consideration would not itself certify forests, but would be responsible for developing some sort of

standard. A report of the meeting referred to the birth of "an umbrella certification watchdog/standards organization, tentatively called the Forest Stewardship Council (FSC) (Simeone 1991).

Concerned about accelerating deforestation, environmental degradation and social exclusion, a group of timber users, traders and representatives of environmental and human rights organizations met in California in 1990. The timeline of FSC started with this meeting. This diverse group highlighted the need for a system that could credibly identify well-managed forests as the sources of responsibly produced wood products. The concept of FSC and the name were coined at this meeting. Some of the purposes of FSC had defined as; to promote an adequate management of forests, providing the assistance required to achieve an environmentally appropriate and economically viable exploitation of natural resources, avoiding deterioration or affectation of such resources, of the ecosystems, or of the surrounding communities; to promote a viable management of the forest resources and a forestry production that preserves the environment; to promote the Principles and Criteria of responsible management of the world's forests through the development of the forest management standards and a voluntary accreditation program. The FSC Principles and Criteria were first published in 1994. They were amended in 1996, 1999 and 2001. A comprehensive review commenced in 2009, which resulted in major revisions to the wording – although not the substance – of the Principles and Criteria being proposed in 2011 (URL 1; FSC, 2007). All ten principles and criteria must be applied in any forest management unit before it can receive FSC certification. The Principles & Criteria apply to all forest types and to all areas within the management unit included in the scope of the certificate. The P&C are applicable worldwide and relevant to forest areas and different ecosystems, as well as cultural, political and legal systems. This means that they are not specific to any particular country or region (FSC, 2009). The FSC Principles and Criteria for Forest Stewardship provide an internationally recognized standard for responsible forest management. However, any international standard for forest management needs to be adapted at the national or sub-national level in order to reflect the diverse legal, social and geographical conditions of forests in different parts of the world. The FSC Principles and Criteria therefore require the addition of indicators that are adapted to national or subnational conditions in order to be implemented at the forest management unit (FMU) level. The FSC Principles and Criteria together with a set of such indicators accredited by FSC constitute an FSC Forest Stewardship Standard. In areas in which there is not yet an FSC accredited Forest Stewardship Standard certification bodies may therefore carry out certification according to their own 'generic' standards, adapted to account for the local conditions in the country or region in which they are to be used with input from local stakeholders. The process of local adaptation of the certification body's generic standard is not designed to be a substitute for the process for developing an FSC regional, national or subnational Forest Stewardship Standard. Nevertheless it allows examples of forest certification in a country. Such examples can be useful tools for explaining and demonstrating the potential benefits as well as the limits of forest certification. Finally, the discussion and consultation surrounding the development and implementation of a locally adapted standard can act as a catalyst for the longer and more complex process of developing an FSC Forest Stewardship Standard based on national debate and support (FSC, 2009).

It is the most important goal of forestry to benefit from the wood products offered by forests and other services whose importance is increasing day by day, by ensuring that future generations will benefit from it in a sustainable way. This goal is briefly expressed as sustainability in forestry. Today, it becomes important to examine and certify sustainability in terms of internationally accepted standards (Sıvacıoğlu, 2013).

Material and Methods

As the material of the study, FSC Forest Management certification projects, carried out in Turkey, are used. According to the raised

non-compliances and field observations in these project works, opinions on forest certification were expressed.

Results and Discussion

In Turkey, the forest certification started in 2010, together with pre-assessment of Aladağ FMU (Forest Management Unit) on 25-26 May 2010, based on FSC system. Presently, 6.673.308 ha of forest area certified under 13 projects (URL-2). In these projects, 79 FDD (Forest District Directorate) and 690 FMU have been certified under 12 FRDs (Forest Regional Directorate). The certified area (app. 6.7 million ha) constitutes 30% of the total forest area (22.3 million ha), 53% of the productive forest area (12.7 million ha) of Turkey. In other words, this means that 30% of total FDDs and 34% of total FMUs are certified. 7 of the existing projects are in the 2nd period and 6 of them are in the 1st period of the certification (Table 1).

Table 1. Ongoing FSC Forest Management Certification projects in Turkey.

FRD	FDD	Total Forest (ha)	First Issue	Second Issue
Bolu	Aladağ (1 FMU)	8.991	4.10.2011	8.11.2016
Bolu	Aladağ, Bolu, Gerede, Seben (4 FDDs, 41 FMUs)	287.394	17.04.2014	17.04.2019
Muğla	Overall (12 FDDs, 104 FMUs)	1.152.360	12.12.2012	21.11.2018
Kastamonu	Daday, Araç, Ayancık, Tosya,Taşköprü (5 FDDs, 54 FMUs)	374.039	5.04.2013	5.04.2018
Zonguldak	Karabük, Yenice (2 FDDs, 25 FMUs)	173.897	21.03.2013	16.04.2018
Bursa	İnegöl, Keles, Yalova (3 FDDs, 27 FMUs)	149.323	7.03.2014	7.03.2019
İstanbul	Kırklareli, Demirköy, Vize (3 FDDs, 35 FMUs)	257.744	18.03.2014	18.03.2019
Balıkesir	Overall (9 FDDs, 88 FMUs)	676.210	29.01.2020	
Çanakkale	Overall (9 FDDs, 74 FMUs)	572.992	13.05.2020	
Antalya	Overall (13 FDDs, 73 FMUs)	1.174.414	8.11.2019	
Adana	Overall (9 FDDs, 88 FMUs)	734.710	29.03.2019	
Mersin	Overall (8 FDDs, 66 FMUs)	833.261	6.02.2020	
Konya	Karaman, Ermenek (2 FDDs, 14 FMUs)	277.973		
Total	79 FDDs, 690 FMUs	6.673.308		

First of all, at the beginning of the FSC forest management certification process, there was a perception that, as in some other historical forestry projects, it will be tried for a certain period of time and the certification process will be stopped later. However, this process differs from other historical forestry processes. The only wood producer in Turkey is the General Directorate of Forestry (GFD). Private forest rate in Turkey is less than a degree to be taken into account in the share of raw wood producing. Therefore, imported wood is the only competitor to wood raw material produced by GFD.

The current situation in Turkey, there are 747 institutions and organizations certified as to FSC-CoC (Chain of Custody) standards. In order for these organizations to sell their products as certified, the used raw material must be FSC certified. Also, it is not possible to process the raw wood certified in terms of other certification systems by the FSC-CoC certified organization and to market the product as FSC certified. For this reason, GFD, the leading wood raw material producer, must continuously supply FSC certified raw wood, which is the demand of these organizations. Otherwise, these organizations will have to meet their raw material needs with imports, which will have a negative effect on the current account deficit of country economy.

Since the certification process is considered as a temporary process, there are difficulties in internalizing it by the local foresters. The fact that this is an irreversible system must first be accepted by the forestry system. This will only be possible with a top management approach. Top management's ownership of the process contributes to its permanence. However, it is extremely important to establish a structure responsible

for the management and monitoring of the certification process.

The management of the FSC certification process is planned to be carried out under the responsibility of the Business and Marketing Branch Directorate (BMBD) in the local organization, since the Certification Branch Directorate in GFD is affiliated with the Business and Marketing Department. However, the FSC process is not just a business and marketing process, it is a quality management system where the management system is audited. Another reason why the process is considered together with business marketing is a completely erroneous perception, such as the high expectation of positive contribution to the pricing of the raw wood products. This misperception of the FSC process has led to the result that other branch offices do not attach sufficient importance to the process. The fact that other branches do not have enough ownership of the process creates an obstacle to the full formation of the system.

Giving the management of the process to only one branch office is an obstacle to an efficient system. For this reason, it would be beneficial to authorize a chief engineer under the command of the Regional Directorate in the management of the process, or to establish a branch management responsible only for this process. Thus, the process will be better managed and the problems faced by the local organization in creating a process system will be solved easily. In addition, an effective monitoring will be possible only through the unit / person dealing with this process.

The FSC certification process must be included in the scope of internal audit. Branch directorates within the scope of FRD in accordance with the circular numbered 4919, check the FDDs twice a year regarding their work and responsibility areas, and request the correction of deficiencies. Performing these internal controls regarding the FSC process will make a positive contribution to the formation of the system.

Turkey is located in efforts towards use other certification systems. Currently, 221,089,214 ha area is certified according to the FSC system and there are 44,518 CoC certified organizations (URL-2). Which certification system to use depends entirely on the marketing portfolio of wood products buyers. For this reason, the certification system to be used should be revealed by surveys to be made to wood buyers, and the road map should be determined accordingly. In this way, directing the certification systems by the wood producer institution without receiving the demands of the wood products buyers will cause problems in the future. Because the system with which the raw wood is certified can only be passed through the CoC certification system of that system and marketed. Wood material certified according to FSC and other systems cannot be changed and used by the other system. Organizations that will use the raw wood of other certificate system must have the CoC certificate of this system. Since these changes will be shaped according to the marketing portfolio of the buyers and will cause changes, it is absolutely necessary to ask the buyers of wood products.

The importance of NWFP certification is increasing day by day in terms of entering new markets. Currently, the FSC certificate covers wood products produced in the region. In case of NWFP certification, standards regarding these should be established. It is therefore beneficial to initiate certification processes for potential NWFPs.

Conclusion

Not only the positive price contribution of the certification process to the wood producer GFD, but also the country-based contribution to the forest industry should be evaluated.

It is not possible to return from the FSC certification process, and it is necessary to establish permanent quality systems in all centre and local forestry organizations.

Instead of delegating the management and monitoring of the management of the process only to the Business Marketing Branch directorate, all branches should be involved in this process, management and monitoring should only be controlled by a chief engineer or branch whose job is the certification process.

In the certification process, it is important for the top management to own the process and this process must be included in the scope of internal control. The decision on which certification process to use should definitely be agreed with the wood products buyers.

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Examination of Certification Systems in terms of Sustainable Ecotourism

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Abstract

Aim of study: It is aimed to investigate the application of the main certification systems applied at national and international level in terms of ecotourism activities in protected areas.

Area of study: Green Star, Blue Flag, White Star, Greening Hotels, Halal Tourism Certificate, Safe Tourism Certificate etc. national certification systems with Green Globe 21, Costa Rica Certification Program, National Ecotourism Accreditation Program, New Zealand Certification Program, Europark, PanParks, Green Key, Travelife, Breeam and Leed, ISO 14001etc. international certification systems.

Material and methods: National and internationally published articles, papers, etc. academic studies, as well as various plans, reports, etc. were used as materials in this research. All materials obtained are discussed separately under the title of national and international studies for research purposes.

Main results: Green Star, Blue Flag, Halal Tourism Certificate and Safe Tourism Certificate from national certification systems in our country and Green Globe 21, Travelife, Breeam and Leed, NEAP, Costa Rika certification system, New Zealand certification system and ISO 14001 certification systems from international certification systems were found to be not suitable for protected areas. However, Europark and Panparks and Global Sustainable Tourism Criteria from international certification systems have been found to be suitable for certification of ecotourism activities in protected areas.

Highlights: Sustainable ecotourism criteria and indicators should be established at the national level and an internationally protected certification system should be emphasized in our country.

Keywords: Certification, Protected Areas, Sustainable Ecotourism, Turkey

Introduction

The process of extensive industrialization, which started with the Industrial Revolution, and urbanization and demographic problems triggered by this process have led to the fast deterioration of the balance in nature and destruction of nature. Therefore, approaches based on the use of natural areas with rich ecosystems and biodiversity for a longer term have emerged, and sustainability consciousness has developed (Tıraş, 2012; Karaçor, 2020).

Furthermore, protection and sustainability studies have become more important due to the change in the needs of visitors in the tourism sector, which is one of the sectors where the relationship between nature and cultural environment is experienced the most intensively (Karaçor, 2020).

Accordingly, in line with the principle of sustainability in tourism, management practices attaching importance to ecologic, cultural, social and economic development and adopting the operability of a national or international environmental management system in the subjects of transportation, institutional reliability, visitor capacity of the destination, waste management, efficiency in energy and water use, biodiversity and activity diversity have started to be considered. This consideration has resulted in the concept of certification (Mensah, 2006; Mair & Jago, 2010).

Certification is a system that approaches the environmental problems of a touristic facility, which applies on the basis of voluntariness, or service in general, and follows these problems and evaluates success according to pre-defined environmental principles and guidelines. A certified touristic facility or service has a logo, symbol, or slogan (Morgan, 1999; Honey & Rome, 2001; Bien, 2007). Certification functions as a significant instrument in terms of both the development and sustainability of the natural

environment and increasing the motivation of the touristic facility or service in tourism.

Moreover, certification enables offering more quality services to visitors, can decrease the operational costs of facilities and provide businesses with the advantage of marketing. Certification can enable businesses to support the certification studies of the government and the public so that they can protect their market niches and helps with reducing poverty in rural areas (Bien, 2007; Haaland & Ass, 2010).

Worldwide, certification systems are needed in order to get rid of the damage caused by mass tourism on natural resources and support, promote and apply the sustainability of tourism; these systems reach the relevant segments and receive more demand over time.

Ecotourism is a type of tourism, and nowadays, ecotourism activities and the certification of the protected areas, where these activities are carried out extensively, have also started to appear in the agenda as much as the sustainability and certification of tourism activities in general. Protected areas are the areas under different management statuses such as national parks and natural parks, which are allocated for the production of non-materialistic services and benefits in order to ensure the sustainable protection of biological diversity and natural and cultural resources. Thanks to the certification of protected areas, both the benefits from the certification of tourism will be achieved, and contribution and support will be provided to the sustainability of the management of natural resources, especially forests.

In this study, by focusing on primary national and international tourism certification systems and global sustainable tourism criteria, the status of implementation of these systems and criteria for ecotourism activities in the protected areas will be investigated.

Certification Practices in Protected Areas

Certification systems in tourism activities in protected areas are used as instruments to inspect and improve the negative aspects of tourism in protected areas. In the certifications of the protected areas, there are five different approaches, which are as follows (Dudley, 2004):

- Certification of all the protected areas in a region or country,
- Certification of the certain management types of the protected areas (for example, private protected areas or protected areas managed by the society),
- Certification of the areas protected for a special purpose (like tourism),
- Certification of the procedures carried out in predominantly protected areas (like the certificate of ecotourism operators),
- Certification of the procedures which can be carried out in protected areas but also outside them (like good management of forests and organic agriculture).

There are many certification systems developed at the national and international levels regarding the protected areas. However, it is possible to examine these certification systems under three headings: mass tourism certification systems, sustainable tourism certification systems, and ecotourism certification systems (Honey & Rome, 2001).

Mass Tourism Certification Systems

Mass tourism certification systems generally include the certification of largescale businesses or hotel chains and take precautions to meet the needs of these businesses. Thanks to mass tourism certification systems, related businesses provide advantages in cost-saving, technical assistance and continuous improvements. However, encountering problems such as the inability to give an adequate response to the interests and expectations of visitors since misleading and incomplete information is given to visitors or visitors are ignored in these certification systems, and following policies deprived of environmental sensitivity have caused mass certification systems to lose their importance and led to a search for new certification systems (Honey & Rome, 2001).

Sustainable Tourism Certification Systems

Sustainable tourism certification systems include the certification of small and medium-scale businesses in natural areas or nearby areas, and they aim at fulfilling the needs of these businesses as well as visitors and local

communities. Sustainable tourism certification systems are relatively more expensive and may experience incompetency in funding and the practice of marketing activities; sometimes, local communities and NGOs feel excluded and do not support the relevant activities. Thus, in sustainable tourism certification systems, businesses that deal with certification could not be recognized adequately. Accordingly, in sustainable tourism certification systems, there is structuring that brings sustainability to the forefront on the basis of the experiences from mass tourism certification systems. However, it has been observed that no sufficient response could be given to the interests and expectations of all the segments with respect to the field, and policies with environmental sensitivity are inadequate and could not be developed completely (Honey & Rome, 2001).

Ecotourism Certification Systems

As in sustainable tourism certification systems, ecotourism certification systems generally include the certification of small and medium-scale businesses nearby natural areas and in protected areas. Businesses in ecotourism certification systems are based on certification for enabling the sustainability of tourism activities in the relevant area, the protection of the area, and local people in these areas to obtain income from ecotourism activities. With ecotourism certification systems, policies supporting environmental protection and sustainable development can easily be developed. In this respect, ecotourism certification systems can easily be recognized by all the countries (Honey & Rome, 2001). Hence, thanks to ecotourism certification systems, a separation can be made about which type of tourism is considered to carry out tourism activities in a protected area, and it is enabled to protect the conceptual integrity of these activities.

However, deficiencies may be faced in the sources of funding, audits and reward systems. Accordingly, problems may be experienced in the fulfillment of some of the needs of the business in ecotourism certification systems (Honey & Rome, 2001).

A Perspective on Certification Systems in Terms of Protected Areas in Turkey

In the special commission reports for tourism of the eighth, ninth, and tenth development plans in Turkey, there are some actions regarding the need for switching to the certification system to increase the service quality in tourism, turning the certification system into a key topic, and the popularization of the certification system in the objectives of increasing the efficiency in the existing capital stock for the realization of the approach based on improvement in the tourism sector and sectoral growth (DPT, 2001; DPT, 2007; Ministry of Development, 2014).

It has even been observed that the first example of the certification system in Turkey was a practice initiated by the Ministry of Culture and Tourism in 1993, aiming at creating environmental consciousness in businesses and contributing to the protection of the environment. In this practice, successful businesses were awarded an "Environmentally Friendly Organization Certificate and Plaque" (Official Gazette, 2020).

Considering mass tourism, sustainable tourism and ecotourism activities and certification systems for these activities, it can be said that the most appropriate tourism activity for the protected areas in Turkey is ecotourism, and the most appropriate certification system for the protected areas is ecotourism certification systems (Daşdemir & Güngör, 2005).

National Certification Programs

There are various documents given to tourism businesses by the Ministry of Culture and Tourism in Turkey. These documents are particularly important in respect of creating a positive image in the perception of visitors who support the sustainable practices of businesses and creating a positive effect on the purchasing behavior of visitors (Şanlıöz Özgen et al., 2016).

The criteria of the national documents are prepared in compliance with the criteria given on an international scale. In this respect, studies are carried out for the integration of the national and international ones. Thus, it is possible for a business that has obtained a national certificate to obtain an international

certificate with some additions and arrangements (Şanlıöz Özgen et al., 2016).

There are many national certification systems implemented in Turkey. Under this heading, the main systems, the Green Star, Blue Flag, White Star, Greening Hotels, Halal Tourism, and Safe Tourism certification systems will be introduced.

Green Star

Green Star is a certification system applied for accommodation facilities in order to protect the environment, develop environmental consciousness, encourage and promote positive contributions to the environment by touristic facilities within the scope of sustainable tourism (URL-1, 2020). This system entered into force with the notice numbered 2008/3 published in the Official Gazette, dated 22.09.2008 and numbered 27005. The Ministry of Culture and Tourism is the executive of the Green Star certification system. With the Green Star certification system, a type of "Environmental Label" is given to environmentally sensitive accommodation facilities within the scope of sustainable tourism (Official Gazette, 2020). In the Green Star certification system, a scoring system was developed by considering international criteria and developments. In this scoring system, there are scores regarding the determination of an environmental policy and action plan of touristic facilities, a special authority to implement the action plan at the facility, training the personnel for environmental consciousness to be increased by the facility and to formulate the environmental measures and action plan, the existence of an environmentally sensitive wastewater plan, protective maintenance and periodic repair of all the installments, equipment, and fittings, and recording them, collection of data on water and energy consumption of facilities, and monitoring of chemical substances and waste amounts (Şanlıöz Özgen et al., 2016).

Blue Flag

Blue Flag is an international eco-labeling program given to qualified beaches and marinas within the context of sustainable tourism (URL-2, 2020). This program was developed in France in 1985 and started to be implemented by the Turkey Environment Education Foundation in 1993. Although Blue Flag is essentially described as an environmental award for sustainable tourism, it is extremely important for sustainable tourism since it signifies an international standard, and its implementation area is coasts and marinas (Şanlıöz Özgen et al., 2016).

White Star

White Star is a certification system, which started to be implemented by the Turkish Hoteliers Federation (TUROFED) in 2008, for controlling the amount of the consumed water, electricity, energy, chemicals and solid wastes in businesses, minimizing the possible damage to the environment and natural resources, and enabling visitors to take part in this environmental sensitivity without compromising the comfort of visitors so that environmental disasters faced by the world can be prevented, and accommodation businesses can have a better, sustainable structure, within the scope of sustainable tourism (Yıldız, 2012).

Greening Hotels

The Greening Hotels project is a social responsibility campaign just like "White Star," and it is a certification system that was initiated by the cooperation of TUROB and Bureau Veritas for the participants of the 5th World Water Forum in 2009. It aims and promotes increasing the awareness of businesses in the tourism sector of sustainability and the sensitivity of accommodation facilities to the environment (Hüseyinli & Esen, 2018). In this certification system, the energy management of hotels, water-saving, increasing indoor air quality, and waste reduction/recycling issues are addressed (URL-3, 2020).

Halal Tourism Certificate

The Halal Tourism Certificate is a certification system that appeared with the change of Islamic hotels, which emerged in 1996, and responds to the requests and demands of visitors in Turkey. The Halal Tourism Certificate involves not only the compliance of food and beverages with Islam but also all the efforts required for a comfortable and reliable holiday, beginning

from the arrival of visitors to the business until they leave the business (Pamukçu, 2017).

Safe Tourism Certificate

The Safe Tourism Certificate is a health certificate prepared with the contributions of the Ministries of Tourism, Health, Transport and Internal Affairs due to the COVID-19 pandemic. It includes the arrival of both domestic and international visitors, who will have a holiday in Turkey, and welcoming them, and all the measures to be taken during and after the journey (URL-4, 2020).

International Certification Systems

There are various documents given in tourism by international certification systems like the documents in national certification systems. Under this heading, the Green Globe 21, Australian Nature and Ecotourism Accreditation Program and Eco Guide Program (NEAP), Costa Rica Certification System, New Zealand Certification System, Europark (PAN European Protected Areas Network), PanParks, Green Key, Travelife, Breeam and Leed and ISO 14001 (Environmental Management System) certification systems, which are the primary documents, will be introduced.

Green Globe 21

Green Globe 21 is an internationally valid independent auditing organization that was developed in line with the decisions made at the UN Rio Summit in 1992 and provides certification, education, training, marketing and consultancy services on mass tourism and sustainable tourism in 83 countries worldwide (URL-5, 2020).

Green Globe 21 provides certificates on sustainable tourism for airports, caravan parks, car rental, golf courses, meeting, congress and ceremony centers, exhibition halls, hotels, marinas, railways and protected areas across the world (Honey and Rome, 2001).

Furthermore, the Green Globe 21 certification subjects include energy, water, electricity-saving, solid waste management, employee rights, local workforce and contribution to the regional economy, etc. (Green Globe, 2020).

With the Green Globe 21 certificate, successful businesses can monitor whether their activities are carried out in a sustainable manner and detect situations that cause problems in their businesses beforehand. Thus, Green Globe 21 helps with the elimination of problems in the region through the adoption of improved standards while contributing to the protection of the relevant region (Buckley, 2002; Şişik, 2012).

The standards related to Green Globe 21 are based on the Global Sustainable Tourism criteria defined by GSTC, Basic Criteria of the Sustainable Tourism Certification Network of the Americas, Agenda 21 sustainable development principles, and ISO 9001/14001/19011 (International Standardization Organization) studies. In this document, criteria are gathered under four main headings: sustainable management, social/economic, cultural heritage, and environment (Green Globe, 2020).

Costa Rica Certification System

The Costa Rica Certification System was developed by Rodolfo Lizano in 1996 and granted its first certificate in 1998. The Costa Rica Certification System is geographically limited to Costa Rica, together with 6 Central American countries. In the Costa Rica certification system, there are criteria gathered in 4 groups in total as physical and biological environment, infrastructure and services, visitors, and socio-economic environment (Honey and Rome, 2001).

This certification system was initially respected a lot, but it was significantly criticized since it exhibited behaviors in support of mass tourism and led to environmental disasters in the geographical areas it covered in years when global tourism escalated (Honey & Rome, 2001).

Australian Nature and Ecotourism Accreditation Program and EcoGuide Program

The Australian Nature and Ecotourism Accreditation Program and EcoGuide Program (NEAP) is a foundation that gives certificates for ecotourism and sustainable tourism covering the geography of Australia, and it started to be planned in 1993 and granted its first certificate in 1997. The audits

in this program are held by the Australian Ecotourism Union. In this certification system, accommodation places, tours and tour actions are controlled. In its sub-program, the EcoGuide program, tour guides are audited (Honey & Rome, 2001).

New Zealand Certification System

The New Zealand Certification System grants certificates in mass tourism, sustainable tourism, and ecotourism and renders services in education, training, marketing, and consultancy. The New Zealand Certification System is geographically limited to New Zealand. This certification system grants certificates in mass tourism and sustainable tourism, and especially ecotourism for establishments such as hotels, holiday parks, shopping malls, tour operators, etc. in the geographical area it covers. In this certification system, training is given on focusing on the natural area, safety and legality, environmental sustainability, contribution to protecting nature, working with local communities, cultural element, customer satisfaction, and environmentally responsible marketing (Honey & Rome, 2001).

Europark (PAN Europe's Protected Areas Network)

Europark grants certificates in sustainable tourism and renders education, training, marketing, and consultancy services. The geographic area of the Europark certification system is limited to the protected areas of the countries in Europe. This certification system is an international certification system providing training on having a vision for the sustainable development of the relevant park, ensuring collaboration in park management, creation of a joint work program, collaboration in the management of protected areas, observation of natural values and changes of parks, communication between protected areas, and joint projects and funding (Daşdemir & Güngör, 2005).

PanParks

PanParks is a non-profit making independent foundation established by the Worldwide Fund for Nature (WWF) and the Netherlands Tourism Association (Molecaten) in 1997 to protect and develop natural areas (URL-6, 2020). PanParks grants certificates in ecotourism in the protected areas of the countries in Europe. In this certification system, training is given on sustaining the natural values in protected areas,creating the habitat management, visitor management, development of sustainable tourism, park management, and collaboration between sponsors and NGOs. The audit of the businesses that have been granted a PanParks certificate is performed by independent auditors. This certification system has a self-sufficient fund and funds its businesses via licensing (Honey & Rome, 2001).

Green Key

Green Key is a non-profit making, nongovernmental and independent eco-labeling system prepared by the International Foundation for Environmental Education (FEE), which is an independent organization. Green Key started in Denmark in 1994, combined with the French Green Key Program in 1998, and has spread over 20 countries nowadays. It has been applied in Turkey since 2011, and its activities are carried on by the Turkish Foundation for Environmental Education (Greenkey, 2020a). The Green Key certificate is an international system applied to camping areas, holiday houses, and restaurants, mainly including accommodation businesses, and supports the activities for the protection of the natural environment with a rewarding system with basic objectives such as protecting the environment by recording energy and water consumption and ensuring saving, economic management, obtaining advantages in marketing, strengthening tourism, education raising consciousness on consumption and increasing recognizability. The Green Key certificate is of great significance in terms of not only management but also marketing (Gökdeniz, 2017; Greenkey, 2020b).

Travelife

Travelife is an initiative, which was founded in 2007 with the support of ECEAT Projects, a non-profit making Dutch organization, to promote sustainability in tourism in cooperation with the Travel Organization of the UK, Travel Organization

of the Netherlands, Leeds Metropolitan University, and Lund University, to promote sustainable practices in tourism. Travelife covers travel companies and accommodation businesses based on the central role of tour operators and travel agencies in the tourism supply chain (URL-7, 2020).

Travelife is a certification system that measures both the environmentally sensitive arrangements in accommodation facilities and the social security rights, working hours and salary scales of employees, education they have received on the environment, whether the products used in the service have been bought from domestic manufacturers, and how much benefit is provided to the domestic economy (Travelife, 2020).

Breeam and Leed

It is an environmental evaluation method developed by the Structural Research Institute in the UK and put into effect in 1990. The Breeam method is one of the principles of the green building evaluation system. The Breeam method consists of 10 criteria such as environmental evaluation system, management-water, transportation energy, waste-health and comfort-materials pollution, land use and ecology-innovation, and it grades buildings according to its own scoring system (Erdede et al., 2014).

Leed is an environmentally friendly building system that was developed by the American Green Building Council in 1998, is based on voluntariness, promotes green competition, suggests a completely environmentally friendly building design, tries to raise the awareness of people and determines the performance frame of sustainable buildings. Briefly, it is expressed as the system of rewarding new and existing buildings. The aim of the Leed system, which is the most preferred environmentally friendly building certificate in the world and Turkey, is to reveal structures that will minimize the environmental damage during the construction and utilization of the building design (Baştanoğlu, 2017).

ISO 14001 (Environmental Management System)

The first preparation of the ISO 14001 Environmental Management System is based on the principles and decisions in the Rio Agreement realized in Rio in 1992. Then, a technical committee consisting of the representatives of approximately 50 countries was established by ISO in 1993 to prepare the international environmental management standards, and this system was published and entered into force in September 1996. The application of the ISO 14001 standard is still based on voluntariness (URL-8, 2020).

ISO 14001 is one of the environmental management system certification systems created to reduce the direct or indirect damage of businesses to the environment in a controlled way and even prevent them completely (URL-9, 2020). ISO 14001 determines the environmental factors from the manufacturing process of products until customers' access to them and tries to ensure that these factors constitute a protective system for the natural environment (Başaran, 2009). To sum up, ISO 14001 should be considered as the determination of the standards that could bring operational, managerial and competitional superiority to businesses to improve the satisfaction of shareholders and relationships in businesses on the basis of sustainable development, value addition and quality (Küçük, 2009).

ISO 14001, which is represented by TSE in Turkey, pays attention to all the environmental topics regarding air pollution, water and sewage problems, efficient use of resources, waste management, soil pollution, climate change, and adaptation (ISO, 2020).

The Relationship Between Global Sustainable Tourism Criteria and Certification

Sustainable tourism is of extremely critical importance in terms of answering how the trust of the visitor in the sustainable system applied, effects of the practices on marketing and incorrect implementations can be measured and evaluated. The Global Sustainable Tourism Criteria, on the other hand, provide an opportunity for everyone to understand sustainable tourism in a clearer way (Şanlıöz Özgen et al., 2016).

The Global Sustainable Tourism Criteria were developed in 2007 with the engagement of many tourism organizations, including the Global Sustainable Tourism Council (GSTC) and the United Nations World Tourism

Organization (UNWTO). By presenting the criteria defined here to businesses as guidelines, it is aimed to increase the sustainability of businesses, to enable travel agencies and tour operators to participate in sustainable tourism certification systems and to select their suppliers accordingly, to inform the press about sustainable tourism, to prepare a general ground for the certification system criteria in the tourism industry, and to create a common starting point for governments, private sector, and NGOs (URL-10, 2020).

The Global Sustainable Tourism Criteria are used nowadays by businesses and organizations across the world for the purpose of understanding the complicated aspects of sustainable tourism in a better way and turning sustainability into a basic methodology in the forms of traveling, learning, and working. Meanwhile, these criteria are also used to have a common understanding of sustainable tourism and to establish the minimum conditions that every tourism organization should try to meet (URL-10, 2020).

The criteria created for the aforementioned purposes in the activities of GSTC have been defined (Gebhard et al., 2009):

- Social welfare,
- Protection of the natural and cultural environment,
- Product quality and visitor satisfaction,
- Management/observation.

Furthermore, these criteria have the potential of being the main starting point to establish the necessary criteria for grounding the tourism and ecotourism activities performed in protected areas on sustainability. It should be remembered that it is important but difficult to measure sustainability for ecotourism activities in protected areas.

In the literature studies, numerous criteria and indicator sets have been developed to serve the purpose of sustainable ecotourism management in protected areas worldwide (Abidin, 1999; Choi & Sırakaya, 2006; Bender, 2008; Gebhard et al., 2009; Gallaher, 2010; Barzekar et al., 2011; Miller, 2001; Tali et al., 2012; Medina et al, 2013). However, it is striking that criteria and indicator sets to serve this purpose in Turkey could not be developed. In Turkey, there is a limited number of studies revealing the current status in the related field only by making use of sustainable criteria and indicator sets (Gürer, 2009; Çalık, 2014; Varnacı Uzun, 2012; Aydın et al., 2017).

Conclusion and Evaluations

When the certification systems implemented at the national and international levels are reviewed, it is understood that the possibility of their implementation is relatively limited in terms of the ecotourism activities performed in the protected areas of Turkey, and some of them have a higher potential of implementation.

The national certification systems with relatively limited possibilities of implementation are the Green Star, Blue Flag, Halal Tourism, and Safe Tourism Certificate, whereas the international certification systems are the Green Globe 21, NEAP, Costa Rica Certification System, New Zealand Certification System, and ISO 14001 certification systems. The fact that these systems are specific to certain areas and subjects has an effect on the limited possibility of their implementation.

For example, Green Star addresses large-scale hotels, Blue Flag is applied to beaches and marinas, the Safe Tourism Certificate is related to the COVID pandemic, the Halal Tourism Certificate targets a certain group, Green Globe 21 aims at meeting halls and congress centers, Travelife focuses on tour operators and travel agencies, Breeam and Leed deal with buildings, the Costa Rica Certification System concentrates on mass tourism and sustainable tourism and is limited to Central American countries, and the ISO 14001 certification system is related to sustainable tourism.

On the other hand, the NEAP and New Zealand certification systems make decisions on ecotourism. However, NEAP is limited to Australia and the New Zealand certification system to New Zealand, which makes it difficult to adapt the criteria in these certification systems to the conditions in Turkey.

Additionally, among the national certification systems in Turkey, the White Star and Greening Hotels certification systems involve decisions on sustainable tourism. Therefore, it is thought that they can

be an infrastructure for ecotourism with some additions and arrangements.

International certification systems such as Europark, PanParks, and the Global Sustainable Tourism Criteria can be said to be suitable for the certification of ecotourism activities in protected areas.

Europark, PanParks, and the Global Sustainable Tourism Criteria include activities related to protected areas, sustainable tourism, and ecotourism, mostly cover the European countries, and similar to the protected area statuses of Turkey, it is more possible to adapt the criteria and objectives in these certification systems to the conditions of Turkey.

Nowadays, certification activities in tourism are carried out at the level of accommodation businesses, travel agencies, and tour operators in general. Certification is actually mandatory for the sustainable management of protected areas. In other words, certification should be used as an instrument to improve and accelerate the development of sustainable tourism and ecotourism rather than being an objective. Moreover, the certification of the protected areas in Turkey is important, but the determination of criteria and indicators for sustainable ecotourism activities in protected areas is quite a new topic. In this context, studies that would enable creating, improving, and monitoring criteria and indicators for sustainable ecotourism on a national scale should be focused on.

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FSC® (Forest Stewardship Council) Pesticide Regulations and Considerations in Forestry System of Turkey

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Abstract

Aim of study: The aim of this study is to examine the use of chemical pesticides in Turkey's forestry. There is no use of chemicals in natural forest areas, but pesticides are used especially in forest nurseries. The subject of this study is to examine the issues to be considered in the case of chemical pesticides use in nurseries.

Area of study: This study use documentation of existing FSC Forest Management Certification projects in Turkey. FSC Forest Management Certification process has started in Turkey in 2010, and 6.673.308 ha of forest area has already been certified.

Material and methods: In this study, FSC Forest Management Certification studies conducted in Turkey were evaluated as material. Pesticides may be used in forest nurseries within the scope of these certification projects. In this case, how the chemicals used will be treated is examined in this study.

Main results: In Turkish forestry, any chemical pesticide use in natural forests is not in question. However, chemical pesticides are used against various factors in forest nurseries. These chemicals must not be in prohibited status. If the use of the prohibited chemical is compulsory, derogations are required from the FSC. In case of using chemical pesticides in forest nurseries, occupational health and safety rules and ILO codes must be fully complied with. Environmental and social impact analysis regarding the use of chemicals should be taken into consideration. The effects of chemicals should be revealed through monitoring. In addition, alternative methods to reduce the use of chemicals must be studied.

Highlights: In Turkish forestry, chemical pesticides are used in forest nurseries. In this application, it is necessary to show compliance with FSC Pesticide Policy and the ILO codes.

Keywords: FSC®, Pesticide, Forest Nursery, Forestry

Introduction

It may be necessary to use chemicals against pests in various fields in the forestry sector. However, in the case of pesticide use in certified organizations, FSC rules should be considered. In this context, FSC requires certified Organizations to use integrated pest management (IPM) to avoid, or aim to eliminate, the use of chemical pesticides in forest management units (FMU), and minimize risks to human health and the environment while maintaining economically viable management (FSC, 2019a).

Integrated pest management (IPM) defined as "careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations, encourage beneficial populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human and animal health and/or the environment. IPM emphasizes the growth of a healthy forest with the least possible disruption to ecosystems and encourages natural pest control mechanisms" (FSC, 2019a).

Also, this issue indicated in FSC-STD-01-001 V5-2 FSC Principles and Criteria, Criterion 10.7 as "The Organization shall use integrated pest management and silviculture systems which avoid, or aim at eliminating, the use of chemical pesticides. The Organization shall not use any chemical pesticides prohibited by FSC policy. When pesticides are used, The Organization shall prevent, mitigate, and/or repair damage to environmental values and human health" (FSC, 2015). This means, FSC-STD-01-001 V5-2 FSC Principles and Criteria Criterion

10.7 requires the use of integrated pest management and silviculture systems which avoid, or aim to eliminate, the use of chemical pesticides. Moreover, FSC recognizes that in certain circumstances, and after having considered other available pest management strategies and practices, the use of chemical pesticides may be the only feasible way of controlling a pest, weed or disease problem (FSC, 2019a).

The steps to reduce and eliminate the use of chemical pesticides, and to minimize associated risks to human health and the environment, are to:

1) Identify highly hazardous pesticides (HHPs) according to their short and long-term toxicity characteristics.

2) Prioritize these characteristics and categorize the HHPs into three hazard based lists: Prohibited HHPs, Highly Restricted HHPs and Restricted HHPs.

3) Regulate the use of HHPs in each list according to the risk they pose to human health and the environment.

4) Repair and compensate for damage to environmental values and human health caused by inadequate development or implementation of environmental and social risk assessment.

5) Monitor the use of pesticides and the impact of the FSC Pesticides Policy (FSC, 2019a)

FSC will update the HHP lists considering the set of criteria, indicators and thresholds at least every 3 years. And, FSC shall annually review whether changes have occurred to the relevant international agreements or conventions, or recommendations for listing new chemical pesticides have been made (FSC, 2019a, 2019b, 2019c).

Material and Methods

In this study, FSC Forest Management Certification studies conducted in Turkey were evaluated as material. Pesticides may be used in forest nurseries within the scope of these certification projects. In this case, how the chemicals used will be treated is examined in this study.

Results and Discussion

Pesticide use, except in cases of force majeure, is not in question in the natural forest land of Turkey. When it comes to the use of pesticides, forest nurseries come to mind. If the use of chemicals is mandatory, the FSC Pesticide Policy should be considered.

The short-term objectives of the FSC Pesticides Policy are to:

- Promote best practices to minimize associated risks to human health and the environment when using chemical pesticides;
- Reduce the overall volume and number of chemical pesticides in use; and
- Eliminate the use of the most hazardous chemical pesticides.

The long-term aim of this Policy is to eliminate the use of chemical pesticides in the management unit (FSC, 2019a).

The FSC Pesticide Policy does not apply to:

- Third party nurseries;
- Area excised from the management unit;
- Biological control;
- Chemical pesticides used for other purposes than pest control in the management unit (e.g., as fertilizer);
- Impurities in fertilizer; and
- The use of chemical pesticides once the forest products have left the management unit (FSC, 2019a).

The prioritization of criteria and categorization of HHPs results in the prohibition or restriction of their use according to the risk they pose to human health and the environment, with risk being a function of the toxicity, which is a global constant, and the local exposure. In certain instances, a more hazardous alternative may present lower social and environmental risks than a less hazardous option. An environmental and social risk assessment (ESRA) shall be undertaken by different stakeholders at international, national and management unit levels to identify:

- Lower risk alternatives,
- Conditions for chemical pesticide use,
- Adequate mitigation and monitoring measures.

As risk increases, the efforts undertaken to reduce and mitigate the risk shall also increase.

Under the same conditions of effectiveness and risk, the less hazardous pest management alternative available shall be selected.

FSC considers the risk associated with using FSC prohibited HHPs to be unacceptable due to their high toxicity, even at low exposure.

The fact that a chemical pesticide is not included in the FSC lists of HHPs, does not mean that it is safe. Before using a chemical pesticide not listed in the FSC lists of HHPs, the Organization shall undertake environmental and social risk assessment (ESRA) (FSC, 2019a).

Regarding the ESRA framework; The Organization shall give preference, as a matter of principle, to:

a) Non-chemical methods over chemical pesticides,

b) Chemical pesticides not listed in the FSC lists of HHPs over those listed in the FSC lists of HHPs, and

c) FSC restricted HHPs over FSC highly restricted HHPs.

Also, the certified organization undertake a comparative ESRA according to scale, intensity and risk (SIR) as part of its integrated pest management to identify the lowest risk option to control a pest, weed or disease, the conditions for its use and the generic mitigation and monitoring measures to minimize the risks. The certified organization consider in their ESRA the minimum list of types of hazards, exposure elements and exposure variables described and select the option that demonstrates least social and environmental damages, more effectiveness and equal or greater social and environmental benefits. The organization conform with the applicable international and national indicators and thresholds for the use of HHPs. Before applying any chemical pesticide, incorporate the results of their ESRA to site operational plans, to identify site-specific risks and adapt the generic mitigation and monitoring measures previously identified in the IPM ESRA. Moreover, the organization make the ESRAs and incorporation to the operational plans available to affected stakeholders upon request and consult the online FSC database for information exchange on alternatives and monitoring procedures. The organization have programmes in place, according to SIR, to research, identify and test alternatives to replace FSC highly restricted HHPs and restricted HHPs with less hazardous alternatives. Programmes shall have clear actions, timelines, targets and resources allocated (FSC, 2019a).

The organization engage with stakeholders in conformance with the requirements in the applicable Interim National Standard when conducting ESRA. Not use any FSC Prohibited HHPs except in the case of an emergency situation or by governmental order. Also, the organization inform third-party processing plants located in the spatial area of the MU and third-party nursery suppliers of the list of FSC prohibited chemical pesticides, encouraging them to avoid these pesticides in their processes and in the production of seedlings and other materials entering the management unit. Moreover, the organization request the list of FSC prohibited chemical pesticides used by processing plants and nurseries suppliers described (FSC, 2019a).

The Organization may collaborate with other Organizations with similar pest problems and forest conditions to conduct ESRA and also collaborate with research institutions and other Organizations on research programs for the identification of less hazardous alternatives (FSC, 2019a).

Repairing damages to environmental values and human health from the use of chemical pesticides; The Organization shall:

a) Prioritize risk prevention and mitigation over damage repair and compensation.

b) Repair damages according to their magnitude, in consistency with Criterion 6.3 of FSC-STD-01-001 FSC Principles and Criteria V5-2, regarding environmental damage and Criterion 2.6 regarding occupational injuries.

c) Provide fair compensation when reparation is not possible; and

d) Develop mechanisms for resolving grievances and for providing fair compensation to workers and local communities, consistent with Criterion 2.6 and Criterion 4.6 of FSC-STD-01-001 FSC Principles and Criteria V5-2.

Monitoring of the use of chemical pesticides and the impact of the FSC Pesticides Policy. The Organization shall maintain records of chemical pesticide usage, including:

- Trade name and active ingredient,
- Quantity of active ingredient used,
- Period of use,
- Number and frequency of applications,
- Location and area of use and
- Reason for use (FSC,2019a).

Conclusion

In Turkish forestry, any chemical pesticide use in natural forests is not in question. However, chemical pesticides are used against various factors in forest nurseries.

These chemicals should not be in prohibited status. The prohibited status is updated by the FSC according to WHO (World Health Organization) records.

If the use of the prohibited chemical is compulsory, derogations are required from the FSC.

In case of using chemical pesticides in forest nurseries, occupational health and safety rules and ILO codes must be fully complied with.

The worker / workers responsible for pesticide application should be trained, and awareness should be raised especially about the toxic effect of the pesticide.

PPE suitable for the chemical applied to the worker should be provided.

Chemical containers and chemicals to be disposed of should be delivered to authorized companies.

Environmental and social impact analysis regarding the use of chemicals should be taken into consideration.

The effects of chemicals should be revealed through monitoring.In addition, alternative methods to reduce the use of chemicals should be studied.

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Environmental Movements Focused on the Solution of Ecological Problems and its Reflections in Turkey

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Abstract

Aim of study: The ecosystem operates in an orderly manner, and it is actualized by external factors or intervention in the deterioration of this order. In this study, the reflections of environmentalist movements focused on the solution of ecological problems in our country in the 20th century and environmentalist movements in terms of forestry were investigated.

Area of study: Environmentalism is a universal issue; It is a movement arising from environmental problems, environmental pollution and consequences of global warming. In this study the environmental movements in Turkey have been examined in a holistic approach.

Material and methods: Literature studies on the environmental movement in general in the world and Turkey is discussed in this study. The results of the research have been evaluated in this context.

Main results: Current studies show the contribution of the ministry of forestry and universities to environmentalist movements. Environmental Problems Research and Application Centers have been established in universities. In addition, foundations and associations engaged in environmentalist movements were opened. However, in the 19th century environmentalist movements, while considering the approaches for the protection of natural habitats, wildlife, primarily birds, wild animals, old forests, In the 20th century environmentalist movements, issues such as anti-war and nuclear armament, protection of nature, prevention of industrial pollution, and preventing excessive consumption of natural resources were adopted.

Highlights: Environmental organizations have been established to find solutions to ecological problems, reduce environmental damage, and become the voice of the people, and environmental movements have begun.

Keywords: Environmental Movements, Ecological Problem, Ecology, Ecosystem, Environmental Pollution, Global Warming.

Introduction

Environmentalism has gained a widespread support as a worldview, lifestyle or individual identity. Environment movements are used in a very broad sense, covering a wide range of thought and activities such as being sensitive and conscious about the environment, social movements growing against harmful activities to the natural environment and human health, groups of political ecology, green parties (Bozkurt & Bayansar, 2016).

Nitrate (artificial nitrogen fertilizer) which increased using on agricultural areas at first years of 20th century, had a negative effect on the agricultural lands along 20th century and destroyed agricultural lands of the cultivated. On the one hand Seeds whose organic structure were altered, have enhanced seriously productivity, on the other hand have given rise to losing of mineral richness of the soil. Besides, it is precise and clear that the destruction it will bring about on the genetic structure and the environmental damage it will cause by the nutrition chain (Horuş, 2009).

It can be said that environmentalist movements have been created to answer many problems such as the increase in population density, deterioration of the environmental cycle, suffering of fauna and flora, inaccuracies in order of utilization from existing natural resources (Bozkurt & Bayansar, 2016). Moreover, it includes important topics such as global heat increasing and greenhouse effect, acid rains, deforestation, environmental pollution, unconscious water consumption, increased population, conservation of natural resources (Uğurlar, 2017).

The random using of natural resources by developing countries, rapid industrialization processes and the harm to nature while aiming to increase the level of development have led to the emergence of environmentalist movements. The fact that human communities are directly intertwined with some problems have made inevitable the emergence of environmental movements. These problems include unevenly increasing population, decrease in biodiversity, pollution of air and water, destruction of forests, soil destruction, and inequalities in the distribution of existing natural resources (Ceritli, 1998).

Material and Methods

Material

Environmental movements prioritize social benefit. Awareness of environmental and demands of environmental which first started in the axis of non-governmental organizations became an active element of politics gradually. Literature studies were examined within the framework of these issues. This study has been focused on the results of the mentioned studies.

When looked to the development of environmental movements in the world, America, France and Germany take place in the first queue. Socialist-minded parties in Germany, Italy, France and England investigated the issue and attempted some initiatives. While there were being developments regarding environmental movements in undeveloped countries towards the end of the 20th century, this situation wasn't keep up with the initiatives in developed countries (Aygün & Şakacı, 2007; Erdoğan & Ejder, 1997).

Method

Environmentalism has become a world view in some societies. This view which concerns the whole world and our country is becoming more and more common. In this study, it has been researched written sources with regard to environmentalist movements occurring in the world. It has been investigated what kind of reflection it has in our country. This study was prepared by compilating literature studies.

Environmental movements give priority social benefit. Environmental awareness and environmental demands which first started around non-governmental organizations became slowly an active element of politics. Greenpeace, FoE, WWF and similar organizations are the leading organizations that mobilize and support environmental movements in the world (Staggenborg, 2012; Eryılmaz, 2018).

Results and Discussion

Environmental movements in our country and in the world are as follows: Greenpeace which is an environmentally friendly non-governmental organization (NGO) has branches in more than forty countries and has an international center in Amsterdam, the Netherlands. WWF (World Wildlife Fund for Nature) is an international non-governmental organization that aims to prevent harm to nature and to restore damage given and was established in 1961 (URL-3).

In the 70s, women living in an area where the Himalayan Mountains are intertwined with India have been made an extraordinary action to prevent cutting down of trees. This movement is called the "Chipko Movement" and here women try to prevent cutting of trees by forming a circle around trees to be cut. Over time, its prevalence increased, received the support of men and led to arising of the new ideas on forestry (yesilgazete.org).

Those who handle the issue in terms of environmental ethics emphasize that protecting the environment and its components is not only an environmental and economic problem, but also a moral issue on functioning (Dural, 2008).

The cutting of the Kaz mountain forests, which has been on the agenda recently in our country, has ensured the unity of environmental organizations in our country and has succeeded to prevent further damage to the trees. Many regulations were done that some of them contain to planting a tree to the different points as much as number of trees felled for mining activity and to restore by reforesting the same area with the end of the mining activity.

Another issue on the agenda is that 'Dipsiz Lake', dried out as a result of

excavation working done to find treasure which thought belonging to Roman Empire. Dipsiz Lake is located in Taşköprü Plateau within the borders of Dumanlı village in the city center of Gümüşhane. Ministry of Environment and Urbanization stipulated EIA (Environmental Impact Assessment) report to projects of treasure exploration depending on the drying out of the lake.

Conclusion

In Turkey, for the period containing between 1973-1977 years through the development plans took steps activities intended for environment.

The United Nation Conference on Human Environment, held in the capital city of Sweden, Stockholm in 1972, awakened the Union of European, and the Environment Action Program, held on 22 November 1973, was approved by the council and representatives of member state. Action programs continue in the ongoing process, The Union of European aims to reach a globally integrated program on the way of protection of natural resources in action programs of third and fourth. The goal has continued to be preventing of pollution (Dural, 2008).

In the 1970s, the Association for Combating with Air Pollution was established in Ankara, and in 1978, the Prime Ministry Undersecretariat of Environment was established. The Undersecretariat was attached to the Ministry of Forestry by following some differentiation. Nowadays, it continues as the Ministry of Environment and Urbanization. The Ministry of Environment and Urbanization works on issues such as infrastructure and urban transformation services, geographic information systems, environmental impact assessment, environmental management (URL-4). In addition, an attempt was made to establish a green party that volunteered to be environmentally sensitive. In 1987, both associations called as Green Peace Environment and War with Turkey Air Pollution have been in an effort to form a party, it was remembered ultimately as "the Green Party" (Aygün & Şakacı, 2007; Keleş, 1992).

There was little interest to ecology in the mid-20th century. Some important areas in Turkey was at risk. One of these areas is Sultansazlığı located within the borders of Kayseri province. Sultansazlığı hosts hundreds of bird species and covers an area of 39 thousand hectares. With the initiatives of the Ministry of Forestry and the relevant unit of DHKD, the region has been protected against negative external factors since 1976. In addition, with a project initiated, it has been evaluated as an important place in terms of protecting and maintaining natural life and species diversity (URL-1).

TEMA foundation was established on September 11, 1992 and constitutes the biggest leg of civil society of environmentalist movements in matters of Combating Erosion, Afforestation and Protection of Natural Heritage (URL-2).

According to the last action plan in January 2001, some targets were listed in the meeting with themed "Environment 2010: 'Our future is our choice'. These include environment, health, climate change, biodiversity, natural resources and waste (Dural, 2008).

There was a tradition of playing of bears in captivity in past time in Turkey. This application ended in cooperation with the relevant ministry (Ministry of Environment), WSPA (World Society for the Protection of Animals), DHKD (Society for the Protection of Nature) and TTKD (Turkey Society for the Protection of Nature). Bears in captivity seized at operations carried out by the relevant units and taken under protection (wwf.org.tr).

In the ends of 20th century, it was carried out a research to obtain detailed datas about turtles in Turkey's southern coastline (from Aydın to Hatay / approximately 2500 kilometers distance). As a result of the research, it was determined that 17 regions on this line are suitable places for *Caretta caretta* and *Chelonia mydas* sea turtles (URL-1).

There are many associations dealing with environmental protection and environmental activities in our country. These include the Nature Protection Society in Turkey, Green Steps Environmental Education Association, the Forest Environmental Education

Volunteers Association, Kure Mountains National Park Ecotourism Association, the Black Sea Environmentalists Natural Environment Protection Association, Nature and Wildlife Conservation Society, Wheat Ecological Life Support Association, hunting animals for Protection and Survival Association (Aygün & Şakacı, 2007).

There are also foundations dealing with environmental movements in our country. Some of those; Turkey Combating Soil Erosion, Reforestation and Natural Heritage Protection (TEMA), the World Wildlife Foundation, Environmental Protection and Research, Environment and Cultural Heritage Development and Protection Foundation, Black Sea Education, Culture and Environment Protection Foundation, Environmental Protection and Packaging Waste (Aygün & Şakacı, 2007).

Environmental Problems Research and Application Centers were established at universities. Environmental Protection Courses started to be given at universities. Another environmentalist movement in our country is the development and use of environmentally friendly technologies.

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Investigation of the Usability of Collect Earth Method in Monitoring and Evaluation of River Edge Ecosystem Areas (Riparian)

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Abstract

Aim of study: Riparian areas, defined as river edge areas, have an important place in ensuring ecological balance and are natural bio filter areas in terms of ecosystem. In this study, the importance of riparian areas in terms of land use and land cover (LULC) is stated. The methodological approach of Collect Earth, the software tool of the United Nations Food and Agriculture Organization (FAO), will been introduced on Land Degradation Neutrality (LDN) of Riparian areas and land cover / use classes and land productivity (net primary productivity). How the Collect Earth method should be evaluated for riparian areas, information extraction results from global satellite data sets will be discussed, and recommendations will be presented in national and international context.

Area of study: In this study, Riparian areas will been examined.

Material and methods: The usability of Collect Earth software for land monitoring and evaluation regarding LDN, land cover / usage classes and land productivity in Riparian areas will be investigated.

Main results: By determining the riparian areas regionally, the area containing riparian environmental indicators such as the plant protection layer, continuity and structural parameters is defined. Studies on land cover and land use carried out in areas adjacent to streams constitute an important basis for planning studies within the framework of sustainability. It is extremely important for the LDN caused by land use in the ecosystem within the Riparian areas and for the sustainability of the riverside areas. "Preserving or improving ecosystem services in their current state" for LDN targets is one of the first goals determined for riparian areas as well. Land cover / use classes (changes and trends), land productivity (net primary productivity) and carbon stocks (soil organic carbon) are the leading bio-physical indicators to be monitored for LDN in Riparian regions

Highlights: The selection and applicability of the ways and methods to be followed during the planning of LDN in Riparian regions is extremely important. Today, with the effect of software and hardware developing in the information sector, integrated applications of Geographic Information Systems (GIS) and Remote Sensing (RS) come to the fore in data acquisition and mapping.

Keywords: Collect Earth, Riparian, Land Cover / Use Classes, Land Degradation Neutrality

Introduction

Climate conditions, which have changed as a result of the increase in the global temperature, are one of the most important problems of mankind today (Vural, 2018). In the parts of the atmosphere close to the earth's surface, as a result of natural events or anthropogenic effect, the temperature of the air above normal is defined as global

warming. Today, global warming caused by rapid population growth and industrialization, unplanned urbanization, improper use of land, degradation of the natural environment, excessive energy production and consumption, destruction of the ozone layer, deforestation, and the increase in greenhouse gases released from different sources affect the climate (Hekimoğlu and Altın Değer, 2008). Climate change defined as "long-term and slowly developing changes in climate conditions with global and local effects"; It covers significant changes in factors such as humidity, temperature, precipitation and glacier amount, sea level rise, drought, and how this affect life on Earth (Vural, 2018; Türkeş, Sümer & Çetiner, 2000).

The change in land cover / use in a particular area over time is an effective variable that is evaluated in the definition of

the degradation of that area and also provides important information about the future of the area. The temporal follow-up and results will be based on the effects and results of different variables in the field (Bektas & Goksel, 2005). Changes in surface characteristics as a result of land use by humans are the main drivers of long-term global climate change.

Determining the current spatial distributions of land cover/use classes and examining the changes occurring in the process constitutes an important basis for studies carried out in many economic and socio-cultural areas. (Di Gregorio & Jansen, 2000, Karnieli & Rozenstein, 2011; Kaya, Turan, Dengiz & Saygin, 2020).

Riparian areas are defined as natural wetlands located on the banks of lakes and rivers with plants that need high humidity or free water. These regions are areas where a large number of species live and food transition between aquatic and continental climate along streams and rivers. In addition, it is most important features of riparian areas that it hosts unique plant species adjacent to sensitive ecosystems, helps to feed aquatic plants and animals with the microclimate formed here, regulates the water economy, prevents harmful substances (nitrate) from entering the water, and prevents erosion. Human activities causing land degradation pose a danger to riparian areas. Depending on the nature of the water source (dry stream, continuous stream, lake surface area, flow rate, base width, etc.), topographic structure and ecosystem structure, the waterfront buffer zones should be protected by separating a certain distance (Avdan and İnan, 2010). When Riparian areas are destroyed, the ecosystem integrity of the coastline is disrupted, reducing water quality and biodiversity. As a result, the body of water can become unusable and hundreds of species based on it can be affected (URL-1).

Land Degradation Neutrality (LDN) aims to provide a balance by improving the damaged land as well as reducing the land loss. Thus, it is aimed to stop the loss of productive and healthy land resulting from destruction (Ateşoğlu & Şenyaz, 2018). Improvement of Riparian area ecosystems plays an important role in LDN. Vegetation in riparian areas reduces the amount of sediment flowing into streams, rivers, ponds, dams and rivers, stabilizing the soil and balancing the water temperature (Welsch, 1991; Stevens, Backhouse & Eriksson, 1995). Hydrological changes also affect riparian environments effectively and shape waterfront vegetation (Wang, Yuan, Willison, Zhang & Liu, 2014; Özbucak & Taş, 2016).

Geographic Information Systems (GIS) and Remote Sensing (RS) methods are widely used in order to quickly access up-to-date and accurate information about the geography we live in. In addition to determining the land cover / land use needed in earth science studies, these techniques are also used to observe temporal and spatial changes (Kaya et al., 2020). Remote sensing technology can be used for analysis, evaluation and modeling of land use / cover maps, which form the database of Geographical Information Systems and produced as a result of image classification (Lillesand & Kiefer., 1994; Ma, Hart & Redmond 2001). Land cover / use classes that contain a lot of information provide important advantages in terms of the production of maps, protection, use and development of land assets. Many applications such as the management of environmental and natural resources, determination of global and regional land cover / use changes can be realized by observing the world from space (Brivio, Colombo, Maggi & Tomasoni 2002; Ostir, Veljanovski, Podobnikar & Stancic, 2002; Ormeci & Ekercin, 2007; Gençer, 2011). Remote sensing image data are used in many studies because it is less costly in evaluating riparian regions where the length of the stream is greater than 200 km, and it determines the length of the riparian area and stream bed very precisely. (Avdan and İnan, 2010).

In this study, the usability of the Collect Earth method in monitoring and evaluating riparian ecosystem areas was investigated, and the advantages and disadvantages of the method were examined.

River Edge Ecosystem Areas (Riparian Areas)

Riparian Areas are lands adjacent to streams, rivers, lakes, ponds and wetlands (Figure 1). These areas are often flooded transition areas with no defined boundaries

between the water body and drier uplands. In the riparian zone, there are stream beds, floodplain, plant and animal communities. These areas have diverse plant communities that include both water-loving and upland plants. Many animal species, including some species at risk, depend on these riverside areas for survival (Harris, 2010).

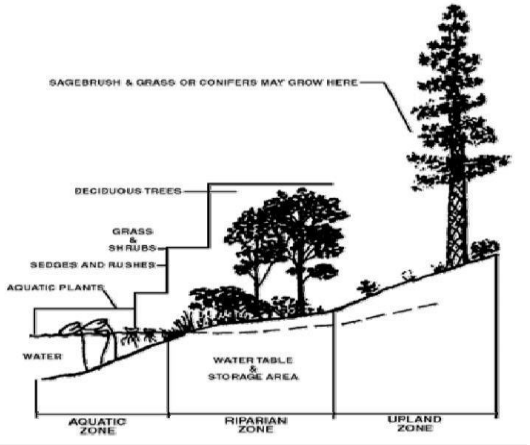

Figure 1. Riparian zone (URL-1).

Functions of Riparian Zones

Filtering Runoff for Clean Water

Coastal vegetation helps to slow runoff and its roots also absorb surface water into the soil. Sediments, nutrients and pollutants are trapped in the soil and absorbed by deeper plant roots

Controlling Erosion for Decreased Sedimentation

Trees and plants stabilize the shoreline and prevent erosion thanks to their root systems that hold soil layers in place. Leafy trees reduce the effect of rainwater and prevent water from hitting the soil and washing it.

Managing Storm Water & Controlling Floods

When the water exceeds its capacity, flooding occurs and causes the water to overflow over the dry land. Flooding can be caused by heavy rains, broken dams, or the rapid melting of snow and ice. Healthy shoreline can help manage these fluctuations. The vegetation slows the flow of currents and allows it to be absorbed into the soil rather than dumped directly into a lake, river or stream.

Providing Habitat for Plants and Animals

Throughout their various life cycles, up to 90% of fish and wildlife species rely on a healthy coastline. They use this area for food, shelter, migration and reproductive resources. Coastal vegetation provides a corridor for wildlife as they move from land to water. The vegetation that settles in the water provides a habitat for aquatic life.

Cooling Temperature & Providing Shade

Coastal vegetation is a source of shade for terrestrial and aquatic wildlife. It provides a lot of relief in summer temperatures and intense sunlight.

Economic and Aesthetic Benefit

Landowners can generate economic income by selectively collecting firewood, timber, nuts, orchards and alternative crops in these regions. Harvesting and irrigation of crops can be done in these regions, provided that it does not exceed the allowable harvest. Healthy riparian areas offer a visual richness with many native trees, shrubs and non-woody plants, showy spring flowers, summer fruits, birds and other wildlife living in the riverside habitat, water and vibrant autumn colors that contribute to the landscape (Harris, 2010).

Remote Sensing (RS) and Geographical Information System (GIS)

Remote Sensing (RS); It is a method of obtaining information about the physical and chemical properties of an object, a natural event or a land structure with the help of data collected by various sensor systems without any physical contact in between (Avdan & İnan, 2010). Images that provide fast, economical and efficient information about the features of the earth can be obtained by remote sensing systems and can be used in Geographical Information Systems (GIS) applications (Saroğlu, 2004; Güre, Özel & Özcan, 2009; Yıldız, 2018).

GIS: It is a system of software, hardware and methods that includes processes such as the production, storage, viewing, querying, analysis and publishing of data (such as parcel, building, road, stream, pole) whose location in the space (x, y, z) is determined. In order to establish GIS; Software, hardware,

methods, data and people are necessary elements. (Küpçü, 2019a). It is a very important technology for the GIS database in analysis, evaluation and modeling by producing land cover / use maps as a result of the classification of the image obtained with RS. (Lillesand and Kiefer., 1994; Ma et al., 2001).

With the use of GIS,

- Spatial data can be easily collected, stored regularly and in a standard manner,
- Finding and correcting errors by the computer system,
- Easy updating of data,
- Sharing data with different people in electronic environment, the margin of error is extremely low in decisions,
- Data access is easy and it can be analyzed when necessary (Küpçü, 2019b).

Today, it is very important to maintain the balance between ecology and social and economic development and to maintain sustainable development. GIS methods can be used to analyze and interpret the relationships between ecological environment and economic conditions. GIS should be kept up-to-date and sustainability should be ensured. Changing riparian areas should also be checked periodically and the database should be updated. (Avdan and İnan, 2010).

Collect Earth

Today, there are many methods used, including maps, censuses, surveys, ground sampling and RS techniques, to collect field data for land use classification, as well as different methods and approaches (Tzamtzis, Federici & Hanle, 2019). Collect Earth is an open-source software that has many modules, facilitates effective data collection, analysis and reporting, and works in integration with Google Earth (Ateşoğlu & Şenyaz, 2018) (Figure 2).

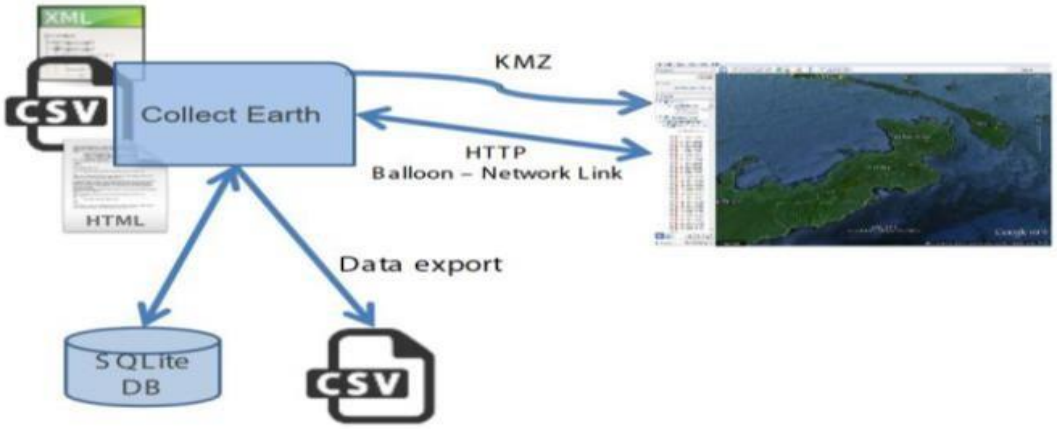

Figure 2. Collect Earth (Open Foris, 2015).

Collect Earth has made a significant contribution to remote sensing in the last decade by improving access to free-to-use satellite images, making it more accessible to all users (Bey, Sánchez-Paus, Maniatis, Marchi, Mollicone, Ricci & Patriarca, 2016). It has been stated in the studies that the Collect Earth software can be used effectively in monitoring and evaluating different land classes (Yıldız, 2018; Ateşoğlu et al., 2016; Ateşoğlu, Arslan, Yılmaz, Arıkan & Yıldız, 2017; Yılmaz, 2019; Ateşoğlu & Şenyaz, 2018).

Collect Earth is a software with Open Foris main module that connects the Google Earth interface with a web-based data entry form. Using the Collect Earth method, it is a software that can help to throw points in the total area in a homogeneous or non-homogeneous way of desired size, to examine satellite images to collect data on these points, to comment on the use of the land and the reasons if there is a change in the area (Figure 3). Collect Earth, which works simultaneously with Google Earth Engine, Google Earth and Bing Maps data providers during point evaluation, provides the opportunity to open the points thrown in the field on Google Earth and access the data entry form. Thanks to the Google Earth software, it allows each point to

visually examine the terrain status, height, location and change over the years (Yıldız, 2018; Ateşoğlu & Şenyaz, 2018).

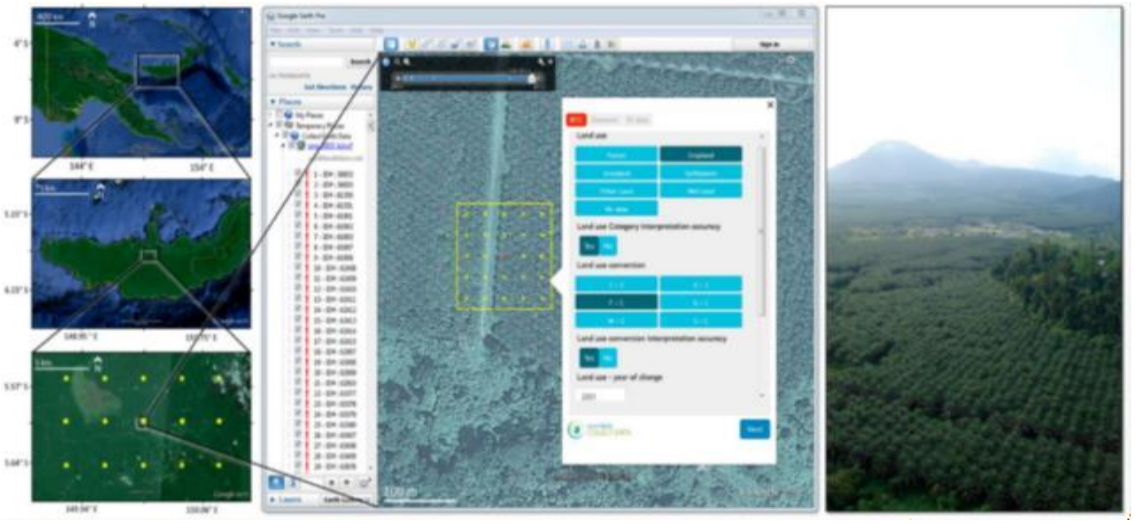

Figure 3. Determination of Trial Areas (Bey et al., 2016).

Points thrown into the field are evaluated based on the comments of experts in the field and entered into the data entry form (Figure 4). These entry forms are created according to which field the person will work on. The following data can be processed in the data entry form for the purpose of the study (Yıldız, 2018).

- Vegetation types and vegetation cover rates,
- Number of trees and shrubs available in the area,
- All artificial surfaces (buildings, houses, roads ...), empty spaces, rocky areas, wetlands and land cover percentages,
- NDVI (Normalized Difference Vegetation Index) and NDWI (Normalized Difference Water Index), average value and years of change,
- Land degradation areas
- Areas with greening tendencies
- FRA (Food and Agriculture Organization) and IPCC (Intergovernmental Panel on Climate Change) land use classes, changes and years of change.

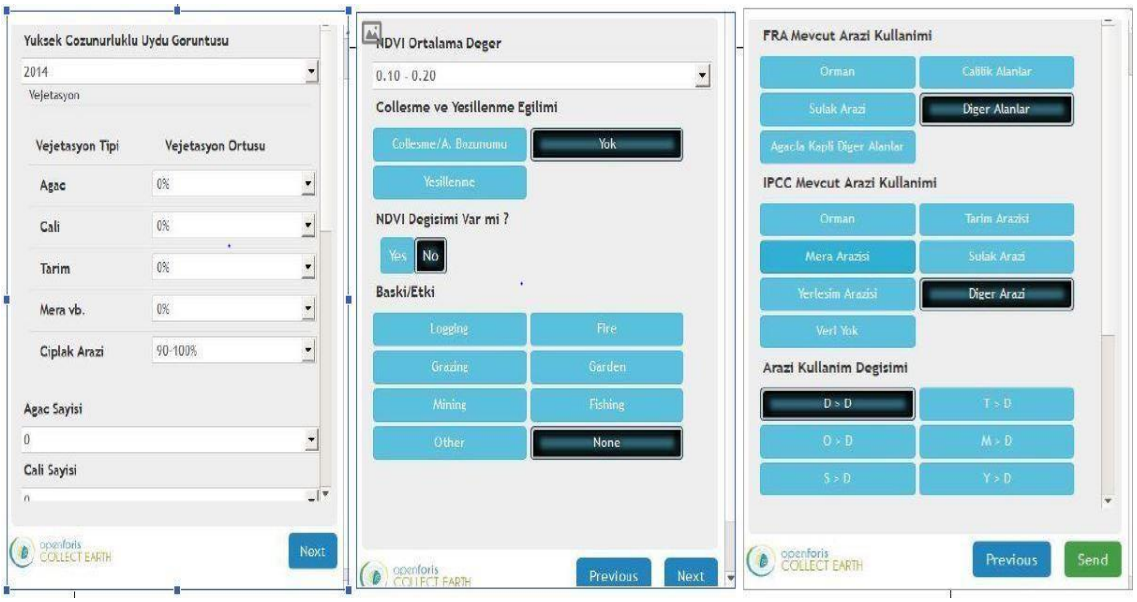

Figure 4. Data entry forms of the points in the sample area (FAO, 2018).

While making the assessment, the opinion about the areas where the points coincide is entirely dependent on the knowledge of the expert on that subject. In this case, the person determines how much of the trees or bushes falling into the yellow squares and how much of the artificial surface is, and enters the information in the data entry form, and as a result of this information, land use classes are created. Settlement lands, agricultural lands, forest lands, pasture lands, wetlands and other areas follow the priority order in determining the land use classes (Table 1).

Table 1. Hierarchy of land use classes (FAO, 2018).

Hierarchy	Threshold value
1.Settlement land	20%
2.Agricultural land	20%
3.Forest land	20%
4.Pasture land	20%
5.Wetland	20%
6.Other land	20%

While determining the land use changes, Landsat 7 and 8, which have medium resolution on yearly basis for each grid, based on Modis and ESA (European Space Agency) data, regarding the sample areas and their surroundings NDVI, NDWI, EVI (Enhanced Vegetation Index), SSO (Top-of-Atmosphere Reflectance) reflection values et al. It allows the use of all data sets and their transfer to graphics (Figure 5) (Ateşoğlu & Şenyaz, 2018). It is possible to verify the satellite images of these changes by looking at past years thanks to Google Earth. According to the increase in these changes and the decrease, desertification and greening tendencies of the land, the previous and next land use status, pressure / impact reasons are determined and recorded in the data entry form.

The data obtained are stored in the database and written into charts and tables with Saiku statistics program. Maps are created by analyzing each point.

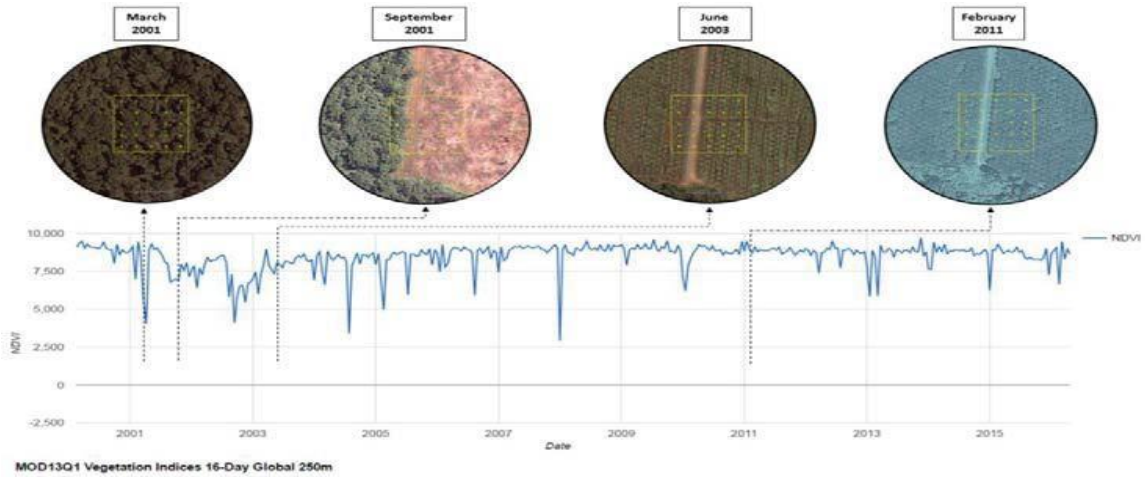

Figure 5. Comparison of NDVI graphics and satellite images (Bey vd., 2016)

Evaluation and Conclusion

Today, land monitoring and evaluation studies are getting more and more important against increasing global climate problems. Collect Earth, which came out first as a new approach at this point, is an effective software to be used in this field. LDN, besides reducing land loss, also aims to provide a balance by improving the damaged land. Therefore, as in other land classes, revealing the current situation for Riparian areas, determining the damages and improving their ecosystems play an important role in LDN. By using the Collect Earth software in monitoring and evaluation of Riparian areas;

- Accuracy and diversity can be increased in obtaining numerical data as well as obtaining effective, faster, low-cost and high-accuracy results in larger areas.
- Gain and lost areal assets can be calculated exactly including coordinate data.
- Collect Earth can be used as auxiliary data to monitor the historical course of loss / gain areas with the help of Google Earth Engine and interpret the process for the analyst. In addition, a clear idea can be produced on the reasons with the local study.
- Collect Earth software can be used effectively to identify and evaluate changes in land cover / uses with different structures and will facilitate obtaining numerical data on large areas in different branches at local and global scale.
- In the mapping of data, passing from point to area and obtaining maps with density analysis can be considered as a disadvantage.
- The fact that the riparian areas are constantly changing enables access to current data in a short time by using the software under its control.
- Thanks to the software's ability to determine the increase and decrease in the existing water resources, it provides a prediction that protection or improvement works can be carried out as soon as possible.

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Valuation of Water as an Ecosystem Service and a Case Study from Turkey: Yamula Water Dam

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Abstract

Aim of study: It is to calculate the production cost of water including whole interest groups such as the General Directorate of Forestry (GDF) and the General Directorate of State Water Affairs (GDSWA), in the Yamula Dam Basin of Turkey.

Area of study: This research was conducted at Yamula Dam Basin, located within the boundaries of Kayseri province in Turkey.

Material and methods: The cost of water in Yamula Dam Basin was calculated by using the cost method for two different institutions. These institutions are GDF and GDSWA. Investments made within the determined basin boundaries based on Geographical Information System (GIS) were calculated with different interest rates (between 3% -10%) until the end of year 2129 through the WACUM program produced within the scope of this study.

Main results: The WACUM program was developed to calculate the cost of water more precisely.

Highlights: The cost of water was calculated as 1.40 kurus for the GDF and 18 kurus for the GDSWA. It has been considered that these cost values should be included in national accounting system as the part of natural resources and ecosystem services valuation. This will also contribute to funding ecosystem rehabilitation and restoration via compensation and repayment of costs and lead the development of nature friendly green economy (based on natural resources) model.

Keywords: Valuation of Water, Cost of Water, Global Climate Change, Payment for Ecosystem Services, Cost Method

Introduction

When the distribution of water resources in the world is examined, it is observed that potable fresh water resources are more abundant in areas where dense forests are located. In highly populated areas, fresh water is considered to be a scarce resource due to low availability of potable water. This situation creates water stress on countries where the level of water is inadequate.

Considering the global water amount, it can be thought that the world will not be in a water scarcity. In fact, the total amount of water in the world is approximately 1.360.000.000 m^3. If this amount of water was assumed to spread all over the earth's surface, the entire surface would turn into a water layer with 2.7 kilometres depth. However, 97% of this huge amount of water is salty water in the oceans and seas. The remaining 3% share (35.000.000 km^3) is the total amount of fresh water that living things can meet their needs. However, small amount of this 3% fresh water is at accessible quality. Because 77.2% of the total amount of fresh water is composed of ice masses in the poles and permanent glaciers on mountain peaks. In addition, the remaining 22.4% is groundwater, which is very difficult to obtain. Therefore, lakes and swamps that can meet the needs of all living things and ensure the continuity of life compose 0.35% of the total amount of fresh water and rivers constitute 0.01% of it. The conclusion from this fact is that the share of the amount of fresh water that living things meet their needs in the total amount of water is quite small. Moreover, the amount of fresh water available is not equal in every region of the world (Eker, 2005).

Material and Methods

Material

The selected study area, Yamula Dam Basin, is within the boundaries of Kayseri Regional Directorate of Forestry and the 12th

Regional Directorate of State Water Affairs. Yamula Dam is located on the Kızılırmak River and it was built in 1998, started to hold water in 2003 and was put into use in 2005.The dam was built for irrigation, energy production and flood control. Its reservoir area is 85.3 km².According to GDSWA data, the total reservoir volume was calculated as 3.476 hm³ and active volume as 2.025 hm³.Actual water level in the dam is 1.100 m.Its installed power for energy production is 2x50MW andannual energy production is 443 GWh. The area to be opened to irrigation is planned as 118.170 ha. While determining the basin boundaries, the afforestation areas made by GDF to increase the amount and quality of water in Yamula Dam were taken into consideration. With the support of ArcGis an area with 1.781.098 hectares was evaluated as a study area. The map of Yamula Dam Basin showing the basin boundaries produced in the ArcGis environment is presented in Figure 1.

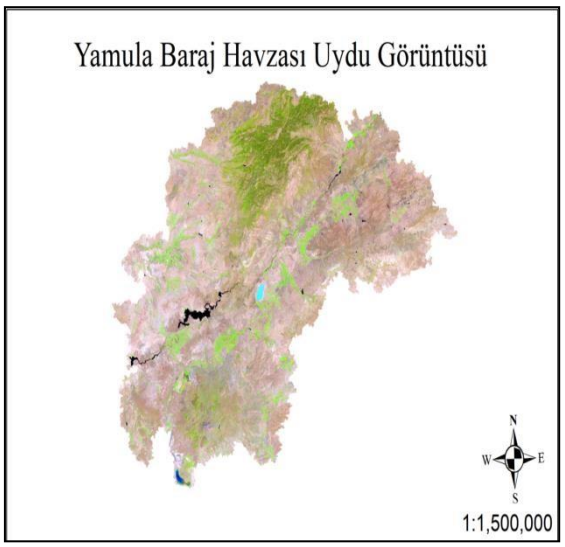

Figure 1. Yamula Dam Basin

Method

Since the investments made in the basins for water production are long-term investments, it is difficult to compare the costs over the years. In this context, the formula (Vn = Vo.1,0pn) representing the time value of money can be used with a selected interest rate. With the application of formula, the costs incurred by the sectors could be compared and processed by discounting the costs spread over many years to a single target year or by taking them to the future.

The value of a certain amount of money (Vo) today, with a certain percentage of interest rate (p) and on the basis of compound interest, in n years later is equal to Vn as a result of the mathematical relationship. The interest rate determined in the formula is an important factor for calculating the future value of money. While this rate is chosen as high as 10-15% for short-term investments, lower interest rates such as 2-3% are determined for long-term investments such as road, bridge, dam constructions and afforestation investments. Within the scope of this study, the interest rate was started with 3% and calculated up to 10% separately and led on to the future.

3 different water volumes have been determined to be used when calculating the water cost. These are;

1. Active water volume,
2. The volume of water in the dam for that year; for the year which the cost is to be calculated,
3. The amount of water obtained by subtracting the volume of water retained in the previous year from the volume of water retained for the year to be calculated for cost value.

The projections made and the related calculation tables are based on these determined water volumes. In addition, the prospective water shortage scenario and the cost of drinking and utility water were calculated within the scope of Yamula Dam Basin development scenario.

The WACUM software was coded and developed for use, utilizing the PYTHON programming language as an important output and calculation interface of this study. With the help of basin data and conversion rates (interest rate) to be entered from the WACUM program menu, the cost calculations of water are computed by the interface and reflected on the screen. The WACUM program, which aims to achieve faster, more accurate and precise results in a short time by preventing the loss of time and effort during the execution of water cost calculation, has been turned into an algorithm as a user-friendly program.

The General Directorate of Forestry has afforested 4.813,48 hectares between 2009 and 2014 to increase the amount of water in the basin, reduce sedimentation and improve water quality. For this afforestation investment, it was determined that 19.070.416,63 TL was spent as a result of the calculation made with the real values of 2019 obtained from TURKSTAT data.

In the basin, 5.708.754,54 TL was spent between 2009 and 2016 for the maintenance and renovation of the afforestation area with 2019 values. For the general administration of the area, it was determined that 3.169.986,61 TL was spent with 2019 values. GDF's total investment for Yamula Dam Basin is 27.949.157,78 TL (Table 1).

Tablo1: Investment costs for Yamula Dam Basin

	Afforestation Costs		Maintenance Costs		General Administration Costs		Total Costs (In Real Values)
Years	Nominal Values.	2019 Real Values	Nominal Values	2019 Real Values	Nominal Values.	2019 Real Values	
2009	1.850.000,0 TL	4.576.939,09 TL			110.261,76 TL	272.789,92 TL	4.849.729,01 TL
2010	3.105.962,88 TL	7.102.835,89 TL	1.705.991,71 TL	3.901.327,74 TL	238.573,84 TL	545.579,88 TL	11.549.743,51 TL
2011	320.000,0TL	697.603,50 TL			368.046,60 TL	811.019,27 TL	1.508.622,77 TL
2012					260.792,55 TL	529.546,26 TL	529.546,26 TL
2013					136.271,36 TL	260.533,46 TL	260.533,46 TL
2014	3.926.676,54 TL	6.693.038,15 TL	1.060.382,48 TL	1.807.426,80 TL	142.958,36 TL	255.707,67 TL	8.756.172,62 TL
2015					149.689,28 TL	250.850,52 TL	250.850,52 TL
2016					159.238,28 TL	243.959,63 TL	243.959,63 TL
						TOTAL	27.949.157,78 TL

Results and Discussion

Calculation of Water Cost in Yamula Reservoir in terms of GDF Investments

The active water volume retained in the Yamula Dam basin was calculated as 2.025.000.000 m3 by using GDSWA data. According to the result of the proportional operation between the total investment amount calculated and the amount of water collected in the basin for the same years, it is calculated that the cost arising from forestry investments for 1 m^3 of water is 0,014 TL / m^3.The expression of 0.014 TL / m^3, which is the cost value revealed as accounting, corresponds to 1,40 kurus in terms of integer currency. In other words, the cost arising from forestry investments (GDF) for 1 m3 of water was calculated as 1.40 kurus.

In addition, for the ease and precision of calculation, the basin data entered from the WACUM program menu developed within the scope of this study and the GDF basin investments in year 2019 were taken to year 2129. By this way, the future cost value of 1 m3 of water was calculated.

The expression of 0,35 TL / m^3, which is the cost value stated as accounting, corresponds to 35 kurus in terms of integer currency. In other words, the water cost for the year 2129 arising from forestry investments (GDF) for 1 m3 of water was calculated as 35 kurus.

Calculation of Water Cost in Yamula Reservoir in terms of GDSWA Investments

For the Yamula Dam Basin, it was calculated that GDSWA incurred a total cost of 365.905.945,51 TL, of which 365.201.820,69 TL for expropriation and 704.124,84 TL for the general administration, as a result of the calculation made with 2019 real values obtained from TURKSTAT data for the years 2003-2019.
The details of the investments made by GDSWA in this period amounting to 365.905.945,51 TL in total are given in Table

2. The active water volume kept in the Yamula Dam basin between 2003 and 2019 was calculated as 2.025.000.000 m3.According to the result of the proportional mathematical operation between the total investment amount calculated and the amount of water collected in the basin for the same years, the cost arising from the investments of the GDSWA for 1 m^3 of water was calculated to be 0,18 TL / m^3.The expression of 0,18 TL / m³, which is the cost value stated as accounting, corresponds to 18 kurus in terms of integer currency. In other words, the cost arising from GDSWA investments for 1 m3 of water is calculated as 18 kurus.

In addition, for the ease and precision of calculation, the basin data entered from the WACUM program menu developed within the scope of this study and the GDF basin investments in year 2019 were taken to year 2129 at a 3% interest rate. By this way, the future cost value of 1 m3 of water was calculated.

The expropriation and general administration expenses made by GDSWA in year 2019 were taken to year 2129 at a 3% interest rate. As a result the cost of 1m³ of water in 2129 was calculated to be 4,66 TL / m³.

In other words, the cost of 0,18 TL / m³ of water spent by GDSWA in 2019 was calculated to be 4,66 TL / m³ in 2129 through the WACUM water cost program developed here.

In addition, according to the findings obtained, it is concluded that with the cost values of 2019, GDF and GDSWA together in the Yamula Dam basin bear a total cost of 19,40 kurus for 1 cubic meter of water as represented below:

1,40 kurus/m³ (GDF) + 18 kurus/m³ (GDSWA) =19,40 kurus/m³

Accordingly, it was observed that the share of forestry (GDF) in the total unit water cost value was 7,2%, whereas the share of GDSWA was 92,8%.

With the help of the WACUM program, when the water cost projection of the GDF and GDSWA investments for the year 2129 is calculated over 3% interest rate, it is concluded that they will bear a total cost of 5,01 TL / m3 for 1 m3 of water.

0,35 TL/m³ (GDF) + 4,66 TL/m³ (GDSWA)= 5,01 TL/m³

Accordingly, it was seen that the share of forestry (GDF) in the total unit water cost value obtained was 6,98%, whereas the share of GDSWA was 93,02%.

Conclusion

The value of 19,40 kurus, which is the unit cost of water that GDF and GDSWA institutions have to bear due to their investments in the Yamula dam basin, which is calculated in this statement, shows that the relationship between water scarcity and water price is important. The price of water will change according to the time and place and whether there is water stress due to drought. The water cost calculated in this study; water scarcity, drought and water stress can also be expressed by the relationship between the existence of demand elasticity for water.

As a first step, GDF should immediately prepare a water cost action plan for 26 water basins of Turkey and unit cost for each water basin should also be calculated. As a second step, how much cubic meter of water and energy will be produced annually in the basin should be calculated. The calculated unit costs would be reflected to the users and included in the GDF budget and fiscal through the revolving fund of the forestry sector at the forestry business directorates in whole Anatolia. This situation will enlarge GDF's budget, as well as allocate the majority of its area of responsibility to the production of clean water and increase the water quality. By doing this State Forestry Enterprises, which end the year with a loss because they cannot produce wood, will also make a profit.

Some of this income will be spent for the conservation, renewal, restoration and rehabilitation of the forest, so it is called as Payment for Ecosystem Services. Financial support will be provided through Forest and Village Relations (FVR) to the afforestation carried out in order to make an agreement with the forest villages in the water basins to ensure that the quality of the water is not deteriorated and the amount of water is not

reduced, and support will be created for the development of forest villagers.

It is thought that this study will help to overcome the bottlenecks of ecosystem service payments obtained from the forest by contributing to the accounting of water that has not been recognized so far in our country.

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Precommercial thinning effects on tree water relations in Anatolian Black Pine stand

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Abstract

Aim of study: The objective of this study was to determine the effects of precommercial thinning (PCT) on water relations parameters in Anatolian black pine stand.

Area of study: The study area was located in Pazarköy/Isparta province. Its mean altitude was 1550 m a.s.l. and have a mean slope of 57%.

Material and methods: Three levels of PCT (control, 2-2.5X2-2.5 m, 3-3.5X3-3.5 m spacing) were established with three replications at the end of March 2014 in natural Anatolian black pine stand. After precommercial thinning, water relation parameters were periodically measured between the beginning of May 2014 and November 2015. Osmotic potential at full turgor ($\psi_{\pi 100}$), the osmotic potential at turgor loss point ($\psi_{\pi TLP}$), symplastic water at saturated point per dry weight of the shoot (Vo/DW) and the relative water content (RWC) were determined.

Main results: There was no significant difference between the treatments in two measurement years in applied precommercial thinning of Anatolian black pine stand according to $\psi\pi_{TLP}$, $\psi\pi_{100}$, and RWC. Vo/DW was significantly different between treatments in May 2015. Precommercial thinning applied with 3-3.5 m spacing had the highest Vo/DW. When seasonal changes of water relation parameters were evaluated, there were significant differences in the $\psi\pi_{TLP}$, $\psi\pi_{100}$, RWC and Vo/DW in some treatments.

Highlights: Generally, PCT treatments did not significantly effect on water relations parameters in natural habitat for the first two years result.

Keywords: Anatolian Black Pine, Spacing, Water Relations, Tree

Introduction

The Anatolian black pine is one of the most common coniferous species in Turkey. The Anatolian black pine is distributed across 4.35 million hectares in Turkey (OGM, 2019), except for the Eastern and Southeastern Anatolia and Eastern Black Sea regions. It is one of the coniferous species of economic value in Southern Europe. It is widely used to afforest large areas because it has high adaptability to different climatic conditions, from humid, semi-humid to semi-arid climate (Atalay & Efe, 2010). The Anatolian black pine, which has a high economic value in terms of wood production, is ubiquitous in habitats with different climate, topography, soil, and vegetation characteristics. Therefore, silvicultural interventions should be performed until the regenaration, and their outcomes should be accurately analyzed. To achieve that, physiological changes in trees and environmental factors affecting them should be studied. Precommercial thinning (PCT) is a tending operation performed at the thicket stage, a bottleneck for many tree species and creatures in the soil (lack of enough light, temperature, water, etc.) (Çolak & Odabaşı, 2004). A large number of individuals per hectare at a stand intensifies competition for light, water, and nutrition. The higher the competition, the higher the stress of the trees in the stand. Drought stress is the most common natural stressor affecting plant vitality, growth, and yield (Ayan et al., 2006). Water content is measured to estimate the stress level of trees. The water state is defined by its water stress or water potential (Landis, 1989). The parameters of water relations depend on phenology, temperature, day length, and water availability (Major & Johnsen, 1999). Osmotic potential at turgor loss point ($\psi\pi_{TLP}$) is a water potential component that is of critical importance for vital activities (Genç & Yahyaoğlu, 2007) and an essential indicator for drought tolerance (Farrell et al., 2017). In a study on water

potential relationships, a natural mixed stand of fir (*Abies balsamea* (L.) Mill.) and birch trees (*Betula papyrifera* Marsh.) treated with PCT had higher sugar content and lower $\psi\pi_{TLP}$ than the control plot (Pothier & Margolis, 1990). Another study investigated the effects of PCT treatment on the water relations of *Fagus sylvatica* L. seedlings planted under the stand in a plantation plot of 50-year-old scotch (*Pinus sylvestris* L.) pine trees. The control plot seedlings had high $\psi\pi_{TLP}$ and $\psi\pi_{100}$ (osmotic potential at full turgor), and also restricted osmotic adjustment under dark conditions. Osmotic adjustment, known as a drought tolerance mechanism, restricted the drought adaptation of beech seedlings under the PCT-untreated stand (Aranda et al., 2001). This study investigated the variations in water parameters (e.g., osmotic potential at turgor loss point) and it also examined the effects of PCT intensity on water parameters in the natural habitat.

Material and Methods

Study Area

The experimental plot was located within the borders of Isparta Regional Directorate of Forestry, Eğirdir Directorate of Forestry Management, Pazarköy Forestry Directorate (37° 24' N, 30° 11' E). It had an aspect of north-northwest with an average elevation of 1550 m, an average slope of 57%, and a mean age of 26. The stand was located in the forest area of $Çkab_3$ Anatolian black pine. The experimental plot had a semi-humid to humid climate according to the Erinç climate index (Çepel, 1995). Precommercial thinning was performed at three different levels (control, 2-2.5X2-2.5 m and 3-3.5X3-3.5 m) in three iterations using a block randomized trial design. Each PCT parcel was 400 m^2 for the homogeneity of individuals in terms of age and distribution. PCT was performed in March 2014. The control plot had an average of 4100 individuals per hectare. The plots thinned to spacings of 2-2.5X2-2.5 m and 3-3.5X3-3.5 m had an average of 2283 and 1242 individuals per hectare, respectively.

Water Relations

Following the PCT, water relationship parameters were measured periodically between May 2014 and November 2015. From each replication of each treatment, shoots were cut using pruning shears from the two-thirds of the crown at the south slopes of five trees. The shoots were immediately put in polyethylene bags and placed in a mini-fridge and then brought to the Forestry Faculty laboratory and prepared for measurement. Measurements were performed using a plant pressure chamber to develop a pressure-volume curve (Scholander et al., 1965). Osmotic potential at turgor loss point ($\psi\pi_{TLP}$), osmotic potential at full turgor ($\psi\pi_{100}$), symplastic water at saturated point per dry weight of the shoot, (V_0/DW), relative water content (RWC) were determined.

Data Analysis

All statistical analyses were performed using SPSS 25.0 software. Variance analysis (ANOVA) was used to evaluate the differences in the mean values among sampling dates for each treatments. If significant differences were found, Duncan's tests were performed.

Results and Discussion

In the study area, PCT had not statistically effected on the $\psi\pi_{TLP}$ and also there was no significant difference in $\psi\pi_{TLP}$ between measurement months in 2014. However, there was a statistically significant difference in $\psi\pi_{TLP}$ between measurement months only in the stand thinned to spacings of 3-3.5 m in 2015 ($P<0.01$). The $\psi\pi_{TLP}$ in the stand treated with PCT with spacings of 3-3.5 m was very low in January, started to increase in March, and remained relatively high between May and August and then declined again between September and November in 2015. The two-year data for May to November did not show any significant difference between PCT treatments, but it did show significant differences between months. The high values in May and June decreased from July to November in the control group, which was also the case in the stand treated with PCT with spacings of 2-2.5 m. PCT treatment with of 3-3.5 m spacings had relatively high $\psi\pi_{TLP}$ from May to September, which was low in November (Figure 1). The measurements in 2014 did not show any difference in $\psi\pi_{100}$ between PCT treatments and between measurement periods ($P>0.05$).

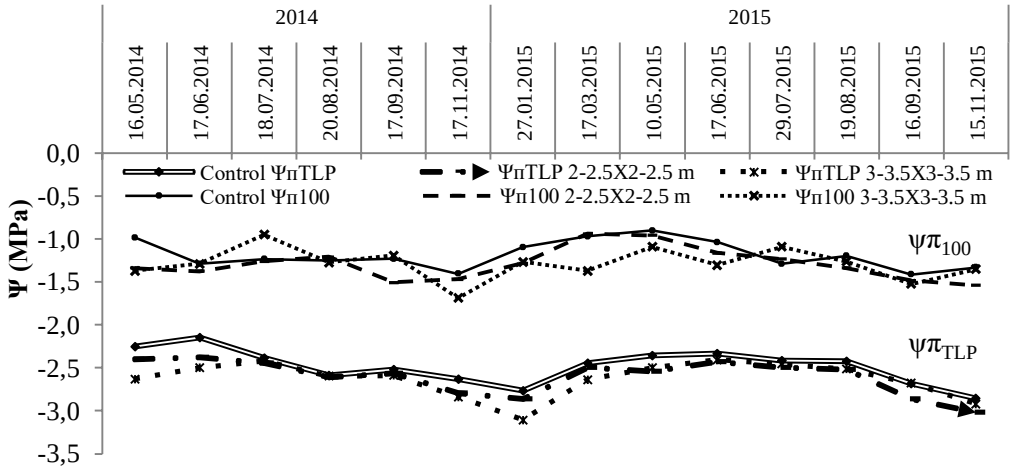

Figure 1. Seasonal changes in $\psi\pi_{TLP}$ and $\psi\pi_{100}$ for PCT treatments in the Anatolian black pine stand

The 2015 data did not show any difference ($P>0.05$) between PCT treatments but pointed to a significant difference in $\psi\pi_{100}$ between measurement periods only in the PCT treatment with 2-2.5 m spacings ($P<0.05$). The $\psi\pi_{100}$, which was low in January, increased in March and May and then decreased again ($P>0.05$; Figure 1). PCT in May 2015 had a significant effect ($P<0.01$) on the Vo/DW. The stand treated with PCT with spacings of 3-3.5 m in May 2015 had higher Vo/DW than others. As for measurement periods, there were significant differences in Vo/DW in the PCT treatment with 3-3.5 m spacings in 2015 ($P<0.05$; Figure 2).

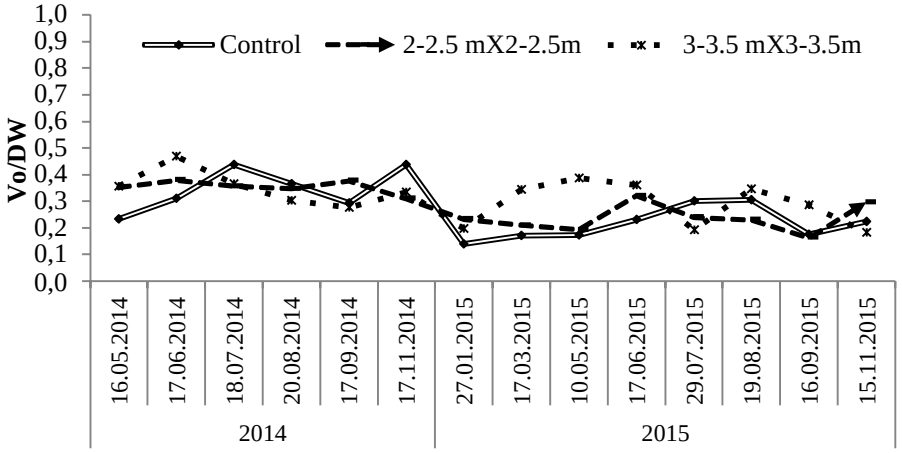

Figure 2. Seasonal changes in Vo/DW for PCT treatments in the Anatolian black pine stand

Changes in RWC were determined using variance analysis and Duncan test. There was no significant difference in RWC between the PCT treatments performed in 2014 and 2015 ($P>0.05$). The significant difference in RWC between measurement periods in 2014 was observed only in the PCT treatment with 3-3.5 m spacings. However, there were significant differences in RWC between measurement periods in 2015 in all stands. Therefore, RWC in the experimental plot was low in May and June during the first and second periods of growth, respectively (Figure 3).

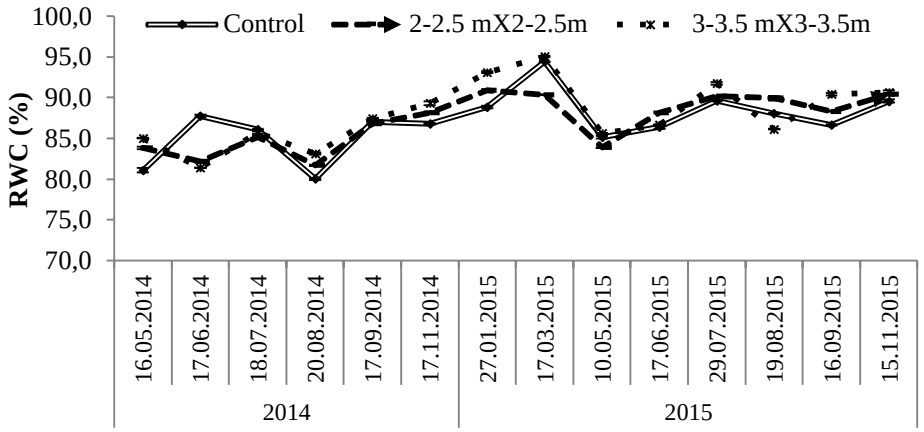

Figure 3. Seasonal changes in RWC for PCT treatments in the Anatolian black pine stand

Discussion

PCT treatments had no significant effect on the $\psi\pi_{TLP}$ in the experimental plots. Osmotic potential at turgor loss point ($\psi\pi_{TLP}$) varies from season to season (Dirik, 1991; Kubiske & Abrams, 1991; Semerci, 1994). In the experimental plot, a significant change in $\psi\pi_{TLP}$ was observed only in the stand treated with PCT with spacings of 3-3.5 m in 2015. While it was quite low in January, it increased as of March and remained relatively high between May and August and then declined again between September and November. In some Mediterranean shrub species, the $\psi\pi_{TLP}$ increases from January to May and decreases until mid-summer, and then rises again (Tognetti et al., 2000). $\psi\pi_{100}$ is the pressure exerted by fluid in a cell that presses the cell membrane against the cell wall (Dirik, 2000). In the experimental plots, PCT treatments did not significantly affect the $\psi\pi_{100}$. In a study, $\psi\pi_{TLP}$ and $\psi\pi_{100}$ were examined during two periods of growth in control and PCT-treated stands of *Abies balsamea* and *Betula papyrifera* species. Although the PCT-treated stands had significantly higher $\psi\pi_{TLP}$ and $\psi\pi_{100}$ than the control plot in the first period of growth, there was no significant difference in the second period of growth (Pothier & Margolis, 1990).

The effect of measurement periods on the $\psi\pi_{100}$ was observed only in the PCT treatment with 2-2.5 m spacings in 2015. It was low in January, and then increased between March and May and then decreased again. *Olea oleaster* and *Laurus nobilis* species had lower $\psi\pi_{100}$ in September than in May (Lo Gullo & Salleo, 1988). While $\psi\pi_{TLP}$ and $\psi\pi_{100}$ change seasonally throughout the year (Ritchie & Shula, 1984), water potential decreases in winter (Gross & Koch, 1991). Harayama et al. (2006) found that $\psi\pi_{TLP}$ and $\psi\pi_{100}$ was high in May (growing period) and low in mid-winter. Bucci et al. (2008) argue that trees perform different morphological and physiological adjustments that allow them to keep their xylem water potential greater than $\psi\pi_{TLP}$ in the dry season. There were significant variations in Vo/DW in the PCT treatment with 3-3.5 m spacings in the second year. It was high in May and June but very low in November, which may be because May is the onset of growth, while the amount of symplastic water decreases in November. Dirik (1999) also detected the lowest Vo/DW rate in January and February and attributed that result to the fact that plants perform osmoregulation to reduce the symplastic water volume in the cells in winter, increasing the amount of solute per cell. Tognetti et al. (2000) has been reported that Vo/DW is high in late spring and declines during summer in *Erica arborea L.*, *Juniperus communis L.* and *Myrtus communis L.* that grow under natural conditions in the Mediterranean region. There was a significant difference in RWC between measurement periods in the stand treated with PCT with spacings of 3-3.5 m during the first growing period. And there were significant differences in RWC between measurement periods in 2015 in all stands. It was low in May and June. Nardini et al. (1999) reported that the RWC in *Q. cerris* leaves was high in spring and autumn, and decreased in summer. Schonfeld

et al. (1988) stated that RWC does not always decrease under drought stress. In this study, for the first two years, generally, PCT treatments did not significantly effect on water relations parameters in natural habitat.

Acknowledgments

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The Specimens of Kastamonu Plants at Herbarium ANK

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Abstract

Aim of study : In this study, it was aimed to examine the dried plant samples belonging to the province of Kastamonu in the herbarium of ANK (Ankara University Faculty of Science, Department of Biology), which is one of the oldest and richest plant museums.

Area of study : Kastamonu province is geographically located in the Western Black Sea region within the Black Sea Region. The area is phytogeographically located in the European-Siberian region and in A4, A5 squares according to Davis' Grid system. The altitude in the region is 784 m. (Yaralıgöz Mountain; 1.985m., Göynük Mountain; 1.770m., Dikmen Mountain; 1.471m., Kurtgirmez Mountain; 1450m., constitutes important heights. Ilgaz Mountain lies in the south of the province), Kastamonu Province mostly consists of rough terrain. The annual average temperature is 10.3 °C and the annual average rainfall is 508 mm. February is the driest month of the year.

Material and methods : The study material consists of 2.331 herbarium specimens belonging to Kastamonu Province and their lists. Various botanical books were used to control the information on plant samples. A database of plant samples has been created and their lists have been prepared. Database program was used in the preparation of the lists.

Maintain results : 87 families were identified as a result of the examination of 2.331 plant samples belonging to Kastamonu Province. The first three families containing the most plant specimens are as follows: The richest family is the *Compositae* family; sample number is 271. *Leguminosae* family takes the second place with the number of 257 specimens, and the *Labiatae* family, which takes the third place, contains 201 samples. Families represented by a single example; *Tamaricaceae, Taxaceae, Verbenaceae, Amaranthaceae, Ebenaceae, Zygophyllaceae, Loranthaceae, Oxalidaceae* and *Myrtaceae*. The oldest examples belong to the 1930s. The most samples were collected in 1981. Most samples belong to the *Compositae* family and were collected by Y. Akman. The collected samples were identified by Y. Akman, E. Yurdakulol, O. Ketenoğlu, M. Demirörs and other researchers. Most of the samples were collected from heights between 1.000 and 1.300 m.

Highlights : Plant samples and prepared plant lists are kept in the herbarium of Ankara University Faculty of Science, Department of Biology.

Keywords: Herbarium, ANK, Flora, Kastamonu, Turkey

Introduction

The places where pressed-dried plant samples are arranged and stored within the framework of scientific rules are called herbarium. Herbariums, which serve as a consultation and documentation center for researchers working on biology, medicine, pharmacy, forestry, agriculture and similar subjects, are also teaching and research centers (Geven et al., 2008; Geven et al., 2014; Ketenoğlu & Körüklü, 2009). Herbariums can belong to individuals, private organizations, research institutes, research centers, and universities (Seçmen et al., 1989).

The label information of the herbarium specimens includes the plant's family and species name, the sample number, the place where it was collected, the height and date it was collected, the name of the person who has collected the specimen, the name of the person who named the specimen and other information (habitat, habitus characteristics). Examples are grouped as species, genus, family. In the herbarium of Ankara University, family, genus and species are placed in a phylogenetic order in accordance with the Engler system.

There are 54 herbariums in Turkey and 35 of them are registered to Herbariorum Index (Uma & Düzenli, 2012). ANK Herbarium was founded in Ankara in 1933 with the University Reform at the High Institute of

Agriculture by Prof. Dr. Johan Wilhelm Kurt Krause (Çelebioğlu, 1958). Prof.Dr. Krause was a valuable scientist who contributed to the recognition of Turkey's flora (Baytop, 2008). The first Turkish botanical researcher who worked hard for the development of ANK Herbarium was Prof. Dr. Hikmet Ahmet Birand.

The current sample number of ANK Herbarium has reached 215.000 (200.000 flowering plants, 15.000 mushrooms), the number of species has reached 7.500, the number of type samples has reached 1.000 (URL-1, 2020). This number is increasing with ongoing studies. The richest five genera in terms of species number in ANK Herbarium are *Astragalus*, *Verbascum*, *Centaurea*, *Silene* and *Campanula* (Table 1).

Table 1. The richest genera in terms of number of species; species numbers, ANK Herbarium sample numbers, endemic species numbers and rates

Genus	ANK sample numbers	Number of flora species	Endemic species numbers	Endemism rate (%)
Astragalus	1.114	410	247	60
Verbascum	546	233	199	85
Centaurea	707	179	111	62
Silene	726	136	54	40
Campanula	468	114	61	53

In this study, the samples belonging to Kastamonu province in ANK herbarium, which has a great importance in floristic research, were analyzed. Kastamonu province is geographically located in the Western Black Sea region within the Black Sea Region. The area is phytogeographically located in the European-Siberian region and in A4, A5 squares according to Davis' Grid system. The altitude in the region is 784 m. (Yaralıgöz Mountain; 1.985m., Göynük Mountain; 1.770m., Dikmen Mountain; 1.471m., Kurtgirmez Mountain; 1.450m., constitutes important heights. Ilgaz Mountain lies in the south of the province), Kastamonu Province mostly consists of rough terrain. The annual average temperature is 10.3 °C and the annual average rainfall is 508 mm. (Figure 1). February is the driest month of the year (URL-2, 2020).

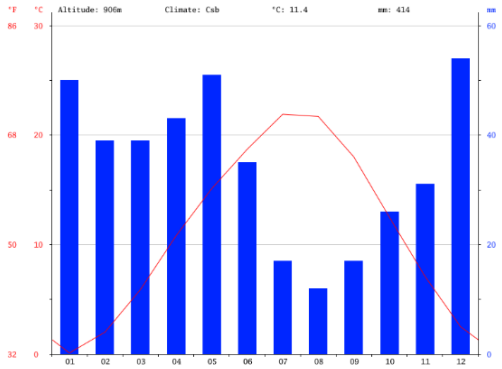

Figure 1. Rainfall-temperature graph of Kastamonu province

Material and Method

Material

The study material consists of 2.331 plant specimens and their lists found in ANK Herbarium. The samples were collected by many non-Turkish and Turkish researchers between 1933-1998 and turned into a herbarium sample. All of the plant samples are located within the borders of Kastamonu province.

Method

In order to control the label information of plant samples; 'Flora of Turkey and the East Aegean Islands' (Davis, 1965 ; Davis et al., 1988; Güner, 2000), 'Flora Europea Vol I' (Tutin, 1964), 'Flore de J'Iran' (Parsa, 1951), Distibution Maps (Donner, 1990) has been used. In addition, various botanical books were used (Heywood, 1978; Hickey & King, 1997; Birand, 1952; Brummit & Powell, 1992; Baytop, 1998). For control purposes, Med Checklist (Grauter et al., 1956) and Index Kewensis (Durand & Jackson, 1886-1895) were consulted.

Taxa are listed alphabetically. The list previously prepared under DOS operating system was taken as basis, and each sample was reviewed one by one and the data of the samples were renewed. Photographs of some plant samples were taken and added to the plant list, and some of the photographs were given as figures. The database program was used in the preparation of the lists (Geven et al., 2008). Database program main menu, label and picture page are shown in Figure 2.

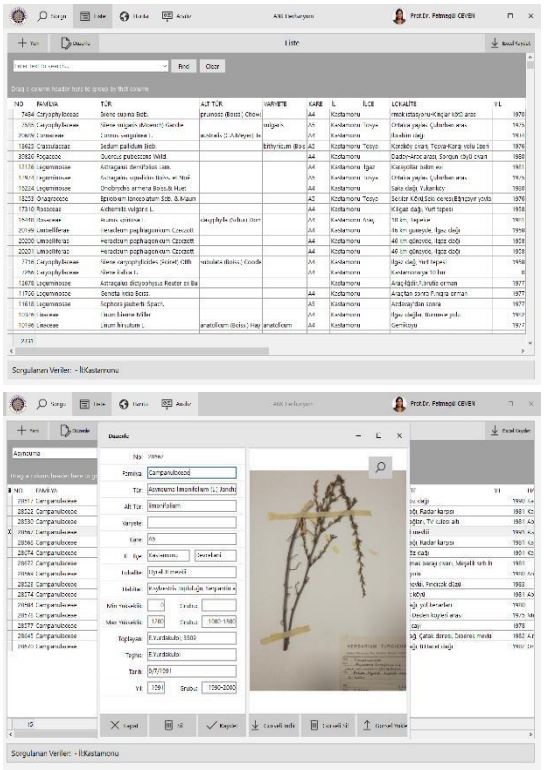

Figure 2. Main menu and label page of the database program

Some of the worn cardboards of the plant samples from Kastamonu province were renewed. Plant lists belonging to taxa have been prepared and taken under protection in Ankara University Science Faculty Herbarium (ANK).

Results and Discussion

There are 2.331 samples belonging to Kastamonu province in Ankara University Science Faculty Herbarium (ANK). These samples were collected by many researchers between the 1930s and 1990s.

As a result of the examination of the herbarium samples belonging to the province of Kastamonu, it was determined that the samples belong to 87 families and the family names with the number of samples are given in Table 2. The richest family is the Compositae family; sample number is 271. Leguminosae family takes the second place with the number of 257 specimens, and the Labiatae family, which takes the third place, contains 201 samples. Families represented by a single example; Tamaricaceae, Taxaceae, Verbenaceae, Amaranthaceae, Ebenaceae, Zygophyllaceae, Loranthaceae, Oxalidaceae and Myrtaceae. The oldest examples belong to the 1930s. The most samples were collected in 1981. Most samples belong to the Compositae family and were collected by Y. Akman. The samples collected were identified by Y. Akman, E. Yurdakulol, O. Ketenoğlu, M. Demirörs and other researchers. Most of the samples were collected from heights between 1.000 and 1.300 m.

All kinds of search, display and print out processes of plant samples were prepared using a database program running under the Windows operating system (Figure 2). The list of some taxa belonging to Kastamonu province (Table 3), the list of plants belonging to the researcher Y. Akman who collected the most samples (Table 4) and the herbarium list of the plant samples with a height of 1.200 m (Table 5) are given.

The distribution of plant samples according to the maximum height varies between 1.000 and 1.500 m (Figure 3), it is seen that the most plant samples are collected from 1.000 m, 1.300 m, 1.200 m respectively (Figure 4). In the distribution of the collected plant samples by years, the year in which the most samples were collected is 1981 (Figure 5). Most samples were collected and identified by Yıldırım Akman (Figure 5).

Table 2. Distribution of plant samples belonging to Kastamonu province according to families

Family	Number	Family	Number
Compositae	271	Aspidiaceae	7
Leguminosae	257	Berberidaceae	6
Labiatae	201	Anacardiaceae	6
Scrophulariaceae	149	Illecebraceae	6
Rosaceae	131	Aristolochiaceae	5
Cruciferae	122	Rhamnaceae	5
Caryophyllaceae	113	Staphyleaceae	5
Umbelliferae	102	Asclepiadaceae	5
Rubiaceae	78	Celastraceae	5
Boraginaceae	75	Sinopteridaceae	4
Ranunculaceae	69	Rutaceae	4
Campanulaceae	56	Santalaceae	4
Euphorbiaceae	37	Ulmaceae	4
Guttiferae	35	Globulariaceae	4
Geraniaceae	32	Orobanchaceae	4
Ericaceae	31	Araliaceae	4
Cistaceae	28	Pinaceae	4
Primulaceae	28	Aguifoliacea	3
Dipsacaceae	25	Paeoniaceae	3
Linaceae	24	Plumbaginaceae	3
Crassulaceae	23	Athyriaceae	3
Fagaceae	23	Hypolepidaceae	3
Papaveraceae	18	Buxaceae	3
Gentianaceae	18	Cupressaceae	3
Caprifoliaceae	17	Polypodiaceae	3
Valerianaceae	17	Elaeagnaceae	3
Saxifragaceae	16	Betulaceae	2
Onagraceae	16	Capparaceae	2
Solanaceae	16	Lauraceae	2
Polygonaceae	16	Lythraceae	2
Convolvulaceae	14	Morinaceae	2
Violaceae	14	Tiliaceae	2
Aspleniaceae	13	Phytolaccaceae	2
Polygalaceae	13	Equisetaceae	2
Corylaceae	12	Tamaricaceae	1
Aceraceae	12	Taxaceae	1
Plantaginaceae	11	Verbenaceae	1
Cornaceae	10	Amaranthaceae	1
Chenopodiaceae	10	Ebenaceae	1
Oleaceae	10	Zygophyllaceae	1
Salicaceae	9	Loranthaceae	1
Malvaceae	9	Oxalidaceae	1
Thymelaeaceae	8	Myrtaceae	1
Resedaceae	8	Total	2331

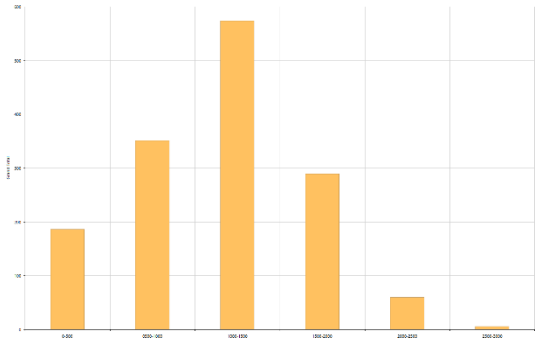

Figure 3. Distribution of plant samples according to height

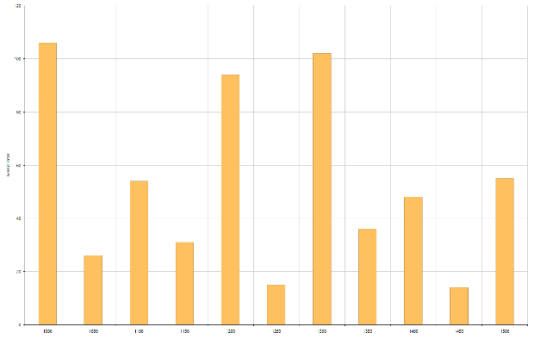

Figure 4. Distribution of plant samples according to the maximum height (between 1000-1500 m)

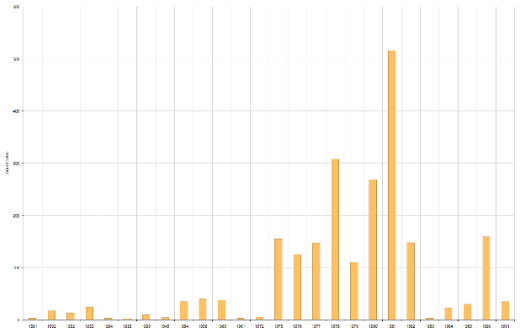

Figure 5. Distribution of plant samples by years

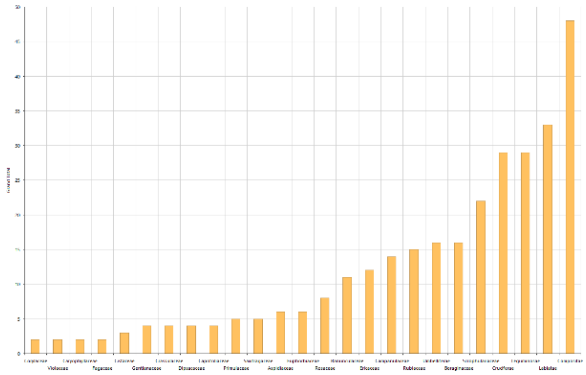

Figure 6. Distribution of plant samples collected by Yıldırım Akman

Table 3. Herbarium list of some taxa belonging to Kastamonu province

Family	Species	Grid	District	Locality	Year	Habitat
Leguminosae	*Astragalus densifolius* Lam.	A4	Ilgaz	Karayollar bakm evi	1981	
Rubiaceae	*Galium album* Miller	A4	Ilgaz	Ilgaz Dağları, B. Hacet Tepesi	0	*Thymus praecox* birliği
Campanulaceae	*Jasione supina* Sieber	A4	Ilgaz	Ilgaz Dağı, K. Hacet tepesi	1982	
Compositae	*Centaurea depressa* Bieb.	A4	Ilgaz	Ilgaz Dağları, Küçük Hacet tepesi	1982	
Compositae	*Cicerbita mulgedioides* (Schultz Bip.ex Vis.& Panc) Beauverd	A4	Ilgaz	Ilgaz dağı, K. Hacet tepesi	1982	
Compositae	*Crepis armena* DC.	A4	Ilgaz	Ilgaz dağı, K. Hacet tepesi	1982	
Compositae	*Pilosella hoppeana* (Schultes) C.H.& F.W.Schultz	A4	Ilgaz	Ilgaz dağı, K. Hacet tepesi	1982	
Compositae	*Jurinella moschus* (Habl.) Bobrov	A4	Ilgaz	Ilgaz Dağları, Büyük Hacet Dağı	1982	Hareketli kayalar arasındaki toprak kısım
Compositae	*Pilosella x macrotricha* (Boiss.) C.H.& F.W.Schultz	A4	Ilgaz	Ilgaz Dağları, Küçük Hacet Dağı, Kar Uçuran mevkii	1982	Alpin kuzey yamaç, kalker anakaya
Dipsacaceae	*Scabiosa columbaria* L.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi, Kar uçuran mevkii	1982	Alpinik kuzey yamaç, Kalker anakaya
Umbelliferae	*Pimpinella tragium* Vill.	A4	Ilgaz	Ilgaz dağı, K.Hacet dağı, Kar uçuran mevkii, kuzey	1982	Kalker anakaya
Campanulaceae	*Asyneuma virgatum* (Labill.) Bornm.	A4	Ilgaz	Ilgaz dağı, B.Hacet dağı	1982	*Onobrychis cornuta* topluluğu, Kalker anakaya
Compositae	*Scorzonera pygmaea* Sibth.& Sm.	A4	Ilgaz	Ilgaz dağı, Küçük Hacet dağı	1982	Alpin kat, kalker anakaya, güney yamaç
Globulariaceae	*Globularia trichosantha* Fisch.& Mey.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi, güney yamaç	1982	Alpin kat, Kalker anakaya
Rosaceae	*Cotoneaster nummularia* Fisch. & Mey.	A4	Ilgaz	Ilgaz dağı,Küçük Hacet dağı	1982	Alpin kat Batı yamaç, Kalker ana kaya
Rubiaceae	*Asperula capitellata* Hausskn.& Bornm.ex Bornm.	A4	Ilgaz	Ilgaz dağı, Büyük Hacet dağı	1982	*Onobrychis cornuta* topluluğu
Scrophulariaceae	*Odontites glutinosa* (Bieb.) Bentham	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1982	
Umbelliferae	*Antriscus kotschyi* Fenzl ex Boiss & Bal.	A4	Ilgaz	Ilgaz dağı, Büyük Hacet dağı	1982	Hareketli kayalar arası
Umbelliferae	*Bupleurum falcatum* L.	A4	Ilgaz	Ilgaz dağı, K.Hacet dağı	1982	Alpin kat, Güney yamaç, Anakaya kalker
Boraginaceae	*Cynoglossum montanum* L.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Alpin vejetasyon, Kalker anakaya
Boraginaceae	*Onosma aucheranum* DC.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Kalker anakaya, Alpin vejetasyon
Compositae	*Aster alpinus* L.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Kalker anakaya, Alpin vejetasyon
Rosaceae	*Potentilla crantzii* (Crantz) G.Beck ex Fritsch	A4	Ilgaz	Ilgaz dağı, B.Hacet tepe	1982	*J.nana* topluluğu, Kalker anakaya
Rubiaceae	*Galium incanum* Sm.	A4	Ilgaz	Ilgaz Dağları, Büyük Hacet deresi	1982	*F.varia* topluluğu
Saxifragaceae	*Saxifraga adscendens* L.	A4	Ilgaz	Ilgaz dağı, Büyük Hacet tepesi	1982	*J.nana* topluluğu,Kalker anakaya
Scrophulariaceae	*Pedicularis condensata* Bieb.	A4	Ilgaz	Ilgaz dağı, B. Hacet tepesi	1982	Kalker anakaya, *J.nana* topluluğu
Compositae	*Helichrysum plicatum* DC.	A4	Ilgaz	Ilgaz Dağ, Büyük Hacet Dağı	1982	Ranunculus - *V.gentianoides* topluluğu
Primulaceae	*Androsace villosa* L.	A4	Ilgaz	Ilgaz dağı	0	
Compositae	*Jurinella moschus* (Habl.) Bobrov	A4	Ilgaz	Küçük Ilgaz Dağı, Yurt tepesi	1958	Kalker
Leguminosae	*Onobrychis cornuta* (L.) Desv.	A4	Ilgaz	Ilgaz dağı, Yurt tepesi	1958	Kalker kaya
Rubiaceae	*Asperula nitida* Sm.	A4	Ilgaz	Küçük Ilgaz Dağı, Yurt tepesi	1958	Kalker kayalıklar
Campanulaceae	*Campanula stevenii* Bieb.	A4	Ilgaz	Ilgaz dağı, Yurt tepesi	1958	*J.nana*, çayır, Kalker anakaya
Compositae	*Aster alpinus* L.	A4	Ilgaz	Küçük Ilgaz dağı, Yurt tepesi	1958	Kalker
Euphorbiaceae	*Euphorbia petrophila* C.A.Meyer	A4	Ilgaz	K.Ilgaz dağı, Yurt tepesi	1958	Kalker anakaya
Leguminosae	*Onobrychis montana* DC.	A4	Ilgaz	K.Ilgaz dağı, Yurt tepesi	1958	Kalker
Primulaceae	*Androsace villosa* L.	A4	Ilgaz	K.Ilgaz dağı, Yurt tepesi	1958	Kalker anakaya, *J.nana*, Çayırlık
Rosaceae	*Alchemilla vulgaris* L.	A4	Ilgaz	K.Ilgaz dağı, Yurt tepesi	1958	*J.nana*, Kalker toprak
Rosaceae	*Potentilla humifusa* Willd.	A4	Ilgaz	Küçük Ilgaz dağı, Yurt tepesi	1958	Kumtaşı
Scrophulariaceae	*Veronica gentianoides* Vahl	A4	Ilgaz	K.Ilgaz dağı, Yurt tepesi	1958	Kalker kayalar

(Table 3 Continued)

Gentianaceae	*Gentiana verna* L.	A4	Ilgaz	Ilgaz dağı	0	
Boraginaceae	*Onosma bornmuelleri* Hausskn.	A4	Ilgaz	TV kulesi	1981	Kalker anakaya, Subalpin vejetasyon
Campanulaceae	*Asyneuma virgatum* (Labill.) Bornm.	A5	Devrekani	Yaralıgöz dağı	1991	Kalker anakaya, Subalpin kat
Campanulaceae	*Campanula stevenii* Bieb.	A4	Ilgaz	Ilgaz dağı, K.Hacet epesi	1981	Kalker anakaya, Alpin vejetasyon
Compositae	*Anthemis melanoloma* Trautv.	A5	Devrekani	Yaralıgöz Dağları	1991	Subalpin kat, kalker anakaya
Compositae	*Anthemis melanoloma* Trautv.	A4	Ilgaz	Ilgaz TV kulesi	1981	Kalker anakaya, supalpin vejetasyon
Compositae	*Centaurea reuterana* Boiss.	A5	Devrekani	Yaralıgöz Dağları	1991	Subalpin kat, kalker anakaya
Compositae	*Senecio pseudo-orientalis* Schischkin	A4	Ilgaz	Ilgaz dağı, TV kulesi	1981	Kalker anakaya, subalpin vejetasyon
Crassulaceae	*Sedum acre* L.	A4	Ilgaz	Ilgaz dağı, Küçük Haçet tepesi	1981	Alpin vejetasyonu, Kalker ana kaya
Crassulaceae	*Sedum hispanicum* L.	A5	Devrekani	Yaralıgöz dağı	1991	Subalpin kat, Kalker ana kaya
Euphorbiaceae	*Euphorbia myrsinites* L.	A5	Devrekani	Yaralıgöz dağı	1991	Kalker anakaya, Subalpin kat
Euphorbiaceae	*Euphorbia myrsinites* L.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Alpin vejetasyon, Kalker anakaya
Euphorbiaceae	*Euphorbia stricta* L.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Kalker anakaya, Alpin vejetasyon
Labiatae	*Salvia aethiopis* L.	A4	Ilgaz	Ilgaz dağları, TV kulesi	1982	
Leguminosae	*Anthyllis vulneraria* L.	A4	Ilgaz	Ilgaz dağı, Küçük Hacet tepesi	1981	Alpin vej., Kalker anakaya
Leguminosae	*Onobrychis cornuta* (L.) Desv.	A4	Devrekani	Yaralıgöz dağı	1991	Supalpin kat, *J.nana* topluluğu,kalker anakaya
Leguminosae	*Onobrychis cornuta* (L.) Desv.	A4	Ilgaz	Ilgaz dağı, Küçük hacet tepesi	1981	Alpin vejetasyonu, Kalker anakaya
Leguminosae	*Onobrychis montana* DC.	A4	Ilgaz	Ilgaz tv kulesi	1981	Kalker ana kaya,Sub alpin vejetasyonu
Orobanchaceae	*Orobanche alba* Stephan	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Kalker anakaya, Alpin vejetasyon
Rosaceae	*Alchemilla valdehirsuta* Buser	A4	Ilgaz	Ilgaz TV kulesi	1981	Kalker anakaya, Subalpin vejetasyon

Table 4. Herbarium list of plant samples belonging to Y. Akman

Family	Species	Grid	District	Locality	Year	Habitat
Rubiaceae	*Galium album* Miller	A4	Ilgaz	Ilgaz Dağları, B.Hacet Tep.	0	*Thymus praecox* birliği
Campanulaceae	*Jasione supina* Sieber	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1982	
Compositae	*Centaurea depressa* Bieb.	A4	Ilgaz	Ilgaz Dağları, Küçük Hacet tepesi	1982	
Compositae	*Cicerbita mulgedioides* (Schultz Bip.ex Vis. & Panc) Beauverd	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1982	
Compositae	*Crepis armena* DC.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1982	
Compositae	*Pilosella hoppeana* (Schultes) C.H.& F.W.Schultz	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1982	
Compositae	*Jurinella moschus* (Habl.) Bobrov	A4	Ilgaz	Ilgaz Dağları, Büyük Hacet dağı	1982	Hareketli kayalar arasındaki toprak kısım
Compositae	*Pilosella x macrotricha* (Boiss.) C.H.& F.W.Schultz	A4	Ilgaz	Ilgaz Dağları, Küçük Hacet deresi, Kar Uçuran mevkii	1982	Alpin kuzey yamaç, kalker anakaya
Dipsacaceae	*Scabiosa columbaria* L.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi, Kar uçuran mevkii	1982	Alpinik kuzey yamaç, Kalker anakaya
Umbelliferae	*Pimpinella tragium* Vill.	A4	Ilgaz	Ilgaz dağı, K.Hacet dağı, Kar uçuran mevkii, kuzey alpin yamaç	1982	Kalker anakaya
Campanulaceae	*Asyneuma virgatum* (Labill.) Bornm.	A4	Ilgaz	Ilgaz dağı, B.Hacet dağı	1982	*Onobrychis cornuta* topluluğu, Kalker kaya
Compositae	*Scorzonera pygmaea* Sibth.& Sm.	A4	Ilgaz	Ilgaz dağı, Küçük Hacet dağı	1982	Alpin kat, kalker anakaya, güney yamaç
Globulariaceae	*Globularia trichosantha* Fisch.& Mey.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi, güney yamaç	1982	Alpin kat, Kalker anakaya
Rosaceae	*Cotoneaster nummularia* Fisch. & Mey.	A4	Ilgaz	Ilgaz dağı, Küçük Hacet dağı	1982	Alpin kat Batı yamaç, Kalker ana kaya
Rubiaceae	*Asperula capitellata* Hausskn.& Bornm.ex Bornm.	A4	Ilgaz	Ilgaz dağı, Büyük Hacet dağı	1982	*Onobrychis cornuta* topluluğu

(Table 4 Continued)

Scrophulariaceae	*Odontites glutinosa* (Bieb.) Bentham	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1982	
Umbelliferae	*Antriscus kotschyi* Fenzl ex Boiss & Bal.	A4	Ilgaz	Ilgaz dağı, Büyük Hacet dağı	1982	Hareketli kayalar arası
Umbelliferae	*Bupleurum falcatum* L.	A4	Ilgaz	Ilgaz dağı, K.Hacet dağı	1982	Alpin kat, Güney yamaç, Anakaya kalker
Boraginaceae	*Cynoglossum montanum* L.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Alpin vejetasyon, Kalker anakaya
Boraginaceae	*Onosma aucheranum* DC.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Kalker anakaya, Alpin vejetasyon
Compositae	*Aster alpinus* L.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Kalker anakaya, alpin vejetasyon
Rubiaceae	*Galium incanum* Sm.	A4	Ilgaz	Ilgaz Dağları, Büyük Hacet deresi	1982	*F.varia* topluluğu
Saxifragaceae	*Saxifraga adscendens* L.	A4	Ilgaz	Ilgaz dağı, Büyük Hacet tepesi	1982	*J.nana* topluluğu, Kalker ana kaya
Scrophulariaceae	*Pedicularis condensata* Bieb.	A4	Ilgaz	Ilgaz dağı, B.Hacet tepesi	1982	Kalker anakaya, *J.nana* topluluğu
Compositae	*Helichrysum plicatum* DC.	A4	Ilgaz	Ilgaz Dağ, Büyük Hacet Dağı	1982	*Ranunculus-V.gentianoides* topluluğu
Boraginaceae	*Onosma bornmuelleri* Hausskn.	A4	Ilgaz	Ilgaz, TV kulesi	1981	Kalker anakaya, Subalpin vejetasyon
Campanulaceae	*Campanula stevenii* Bieb.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Kalker anakaya, Alpin vejetasyon
Compositae	*Anthemis melanoloma* Trautv.	A4	Ilgaz	Ilgaz TV kulesi	1981	Kalker anakaya, supalpin vejetasyon
Compositae	*Senecio pseudo-orientalis* Schischkin	A4	Ilgaz	Ilgaz dağı, TV kulesi	1981	Kalker anakaya, subalpin vejetasyon
Crassulaceae	*Sedum acre* L.	A4	Ilgaz	Ilgaz dağı,Küçük Haçet tepesi	1981	Alpin vejetasyonu,Kalker ana kaya
Euphorbiaceae	*Euphorbia myrsinites* L.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Alpin vejetasyon, Kalker anakaya
Euphorbiaceae	*Euphorbia stricta* L.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Kalker anakaya, Alpin vejetasyon
Labiatae	*Salvia aethiopis* L.	A4	Ilgaz	Ilgaz dağları, TV kulesi	1982	
Leguminosae	*Anthyllis vulneraria* L.	A4	Ilgaz	Ilgaz dağı, Küçük Hacet tepesi	1981	Alpin vej., Kalker anakaya
Leguminosae	*Onobrychis cornuta* (L.) Desv.	A4	Ilgaz	Ilgaz dağı, Küçük hacet tepesi	1981	Alpin vejetasyonu, Kalker anakaya
Leguminosae	*Onobrychis montana* DC.	A4	Ilgaz	Ilgaz TV kulesi	1981	Kalker ana kaya, Subalpin vejetasyonu
Orobanchaceae	*Orobanche alba* Stephan	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Kalker anakaya, Alpin vejetasyon
Rosaceae	*Amelanchier rotundifolia* (Lam.) Dum.-Courset	A4	Ilgaz	Ilgaz dağı, TV kulesi	1981	Kalker anakaya, Supalpin vejetasyon
Scrophulariaceae	*Veronica fuhsii* Freyn & Sint.	A4	Ilgaz	Ilgaz dağı, K.Hacet tepesi	1981	Alpin vejetasyon, Kalker anakaya
Thymelaeaceae	*Daphne oleoides* Schreber	A4	Ilgaz	Ilgaz dağı, TV kulesi	1981	Kalker anakaya, subalpin vejetasyon
Umbelliferae	*Pimpinella tragium* Vill.	A4	Ilgaz	Ilgaz dağları, TV kulesi çevresi	1981	
Compositae	*Centaurea triumfettii* All.	A4	Ilgaz	Gökyar, Ilgaz Dağı	1981	
Leguminosae	*Trifolium hybridum* L.	A4	Ilgaz	Ilgaz dağı, Gökyar	1981	
Primulaceae	*Primula auriculata* Lam.	A4	Ilgaz	Ilgaz dağları, Gökyar	1981	
Athyriaceae	*Cystopteris fragilis* (L.) Bernh.	A4	Ilgaz	Ilgaz dağı, Gökyar	1981	
Boraginaceae	*Myosotis alpestris* F.W.Schmidt	A4	Ilgaz	Ilgaz dağı, Radar yangın kulesi	1981	
Campanulaceae	*Campanula olympica* Boiss.	A4	Ilgaz	Ilgaz dağları, Gökyar	1981	
Compositae	*Hieracium paphlagonicum* Freyn & Sint.	A4	Ilgaz	Ilgaz Dağları, TV kulesi çevresi, kayalık yerler	1981	
Compositae	*Pilosella cymosa* (L.) C.H.& F.W.Schultz	A4	Ilgaz	Ilgaz Dağları	1981	*J.nana* topluluğu
Compositae	*Tripleurospermum rosellum* (Boiss.& Orph.) Hayek	A4	Ilgaz	Ilgaz Dağı, Radar yangın kulesi	1981	
Crassulaceae	*Sedum album* L.	A4	Ilgaz	Ilgaz dağları	1981	*J.nana* topluluğu
Cruciferae	*Erysimum thyrsoideum* Boiss.	A4	Ilgaz	Ilgaz dağı, Gökyar	0	
Ericaceae	*Vaccinium myrtillus* L.	A4	Ilgaz	Ilgaz dağları	1981	*J.nana* topluluğu
Gentianaceae	*Gentiana verna* L.	A4	Ilgaz	Ilgaz dağı, Kızılgöller yaylası	1982	Islak çayırlar, *J.nana* topluluğu
Labiatae	*Lamium purpureum* L.	A4	Ilgaz	Ilgaz Dağı, Gökyar	1981	
Labiatae	*Ziziphora clinopodioides* Lam.	A4	Ilgaz	Ilgaz dağları, TV kulesi çevresi	1981	
Leguminosae	*Trifolium pratense* L.	A4	Ilgaz	Ilgaz dağı, Gökyar	1981	

(Table 4 Continued)

Primulaceae	*Androsace villosa* L.	A4	Ilgaz	Ilgaz dağı, TV kulesi	1982	
Ranunculaceae	*Ranunculus constantinopolitanus* (DC.) Urv.	A4	Ilgaz	Ilgaz dağları, Gökyar	1981	
Rubiaceae	*Galium incanum* Sm.	A4	Ilgaz	Ilgaz Dağı, Gökyar	1981	
Saxifragaceae	*Saxifraga exarata* Vill.	A4	Ilgaz	Ilgaz dağı, Radon yangın kulesi	1981	
Umbelliferae	*Bunium microcarpum* (Boiss.) Freyn.	A4	Ilgaz	Ilgaz dağı, Gökyar	1981	
Campanulaceae	*Asyneuma amplexicaule* (Willd.) Hand.-Mazz.	A4	Ilgaz	Ilgaz dağları, TV kulesi altı	1981	*Abies* ormanı
Rubiaceae	*Galium odoratum* (L.) Scop.	A4	Ilgaz	Ilgaz dağları, TV kulesi altı	1981	*Abies* ormanı
Scrophulariaceae	*Digitalis ferruginea* L.	A4	Ilgaz	Ilgaz dağı, TV kulesi altı	1981	*Abies* ormanı
Boraginaceae	*Alkanna tictoria* (L.) Tausch	A4	Ilgaz	Ilgaz dağı, Karayolları, Şantiye	1981	Kalker anakaya
Boraginaceae	*Symphytum orientale* L.	A4	Ilgaz	Ilgaz dağı, TV kulesi	1982	Kalker anakaya
Compositae	*Doronicum bithynicum* J.R.Edmondson	A4	Ilgaz	Ilgaz Dağı, Küçük Çal tepe	1981	
Saxifragaceae	*Saxifraga cymbalaria* L.	A4	Ilgaz	Ilgaz dağı, Küçük Çal tepe	1981	
Boraginaceae	*Cerinthe glabra* Miller	A4	Ilgaz	Ilgaz dağı, Karayolları bakımevi	1981	
Compositae	*Doronicum orientale* Hoffm.	A4	Ilgaz	Ilgaz Dağı, Karayolları bakımevi	1981	
Leguminosae	*Lathyrus czeczottianus* Bassler	A4	Ilgaz	Ilgaz dağı, Karayolları bakımevi	1981	
Scrophulariaceae	*Scrophularia scopolii* [Hoppe ex] Pers.	A4	Ilgaz	Ilgaz dağı, Karayollar bakımevi	1981	
Compositae	*Solidago virgaurea* L.	A4	Ilgaz	Ilgaz dağı, Soğuksu karayolları bakımevi arası	1981	*A.bornmuelleriana* ormanı
Campanulaceae	*Campanula glomerata* L.	A4	Ilgaz	Ilgaz dağı, Soğuksu karayolları bakımevi	1981	
Scrophulariaceae	*Verbascum abieticolum* Bornm.	A4	Ilgaz	Ilgaz dağı, Karayolları bakımevi	1981	
Campanulaceae	*Asyneuma amplexicaule* (Willd.) Hand.-Mazz.	A4	Ilgaz	Ilgaz dağı, Radar karşısı	1981	Kayalık dibi
Campanulaceae	*Asyneuma limonifolium* (L.) Janchen	A4	Ilgaz	Ilgaz dağı, Radar karşısı	1981	Kayalık
Campanulaceae	*Campanula rapunculoides* L.	A4	Ilgaz	Ilgaz dağı, Küçük Çal tepe	1981	
Compositae	*Anthemis tinctoria* L.	A4	Ilgaz	Ilgaz Dağı, Küçük Çal tepe	1981	
Compositae	*Cicerbita variabilis* (Bornm.) Bornm.	A4	Ilgaz	Ilgaz dağı, Radar karşsı	1981	Kayalık dibi
Compositae	*Lapsana communis* L.	A4	Ilgaz	Ilgaz dağı, Radar karşısı	1981	Kayalık dibi
Compositae	*Leontodon asperrimus* (Willd.) J.Ball	A4	Ilgaz	Ilgaz Dağı, Radar karşısı	1981	Kayalık dibi
Compositae	*Leontodon hispidus* L.	A4	Ilgaz	Ilgaz dağı, Radar karşısı	1981	Kayalık
Compositae	*Senecio hypochionaeus* Boiss.	A4	Ilgaz	Ilgaz Dağı, TV kulesi çevresi	1981	Kayalık dibi
Crassulaceae	*Sedum pallidum* Bieb.	A4	Ilgaz	Ilgaz dağı, Küçük Çal tepe	1981	
Leguminosae	*Vicia truncatula* Fischer ex Bieb.	A4	Ilgaz	Ilgaz dağı	1977	*Abies* ormanı
Saxifragaceae	*Saxifraga rotundifolia* L.	A4	Ilgaz	Ilgaz dağı, Radon karşısı	1981	Kayalık dibi
Scrophulariaceae	*Lathraea squamaria* L.	A4	Ilgaz	Soğuksu	1977	
Scrophulariaceae	*Linaria genistifolia* (L.) Miller	A4	Ilgaz	Ilgaz dağı, Küçük Çal tepe	1981	
Scrophulariaceae	*Pedicularis condensata* Bieb.	A4	Ilgaz	Ilgaz dağı, Karayolları bakım evi yanı	1977	
Campanulaceae	*Campanula rapunculoides* L.	A4	Ilgaz	Soğuksu	1981	
Compositae	*Achillea biserrata* Bieb.	A4	Ilgaz	Ilgaz Dağı, Handüzü, Yayla dere	1981	
Compositae	*Erigeron acer* L.	A4	Ilgaz	Ilgaz Dağları, Soğuk su	1981	
Compositae	*Pilosella piloselloides* (Vill.) Sojak	A4	Ilgaz	Ilgaz Dağları, Handüzü, Yayla dere	1981	
Compositae	*Tragopogon aureus* Boiss.	A4	Ilgaz	Ilgaz dağları, Karayolları bakımevi	1981	
Dipsacaceae	*Scabiosa columbaria* L.	A4	Ilgaz	Ilgaz dağları, Soğuksu	1981	
Euphorbiaceae	*Euphorbia amygdaloides* L.	A4	Ilgaz	Ilgaz dağı, Handüzü, Yayla dere	1981	
Gentianaceae	*Gentiana asclepiadea* L.	A4	Ilgaz	Soğuksu	1981	

Table 5. List of taxa spread at 1200 m altitude

Family	Species	Grid	District	Locality	Year	Max Height
Araliaceae	*Hedera helix* L.	A4	İnebolu	Baldıran serisi, Göcen geçidi	1978	1200
Boraginaceae	*Paracaryum paphlagonicum* (Bornm.) R.Mill	A4	Ilgaz-Yenice	Ilgaz dağı	1982	1200
Buxaceae	*Buxus sempervirens* L.	A4	Azdavay	Kızılcasu mevkii	1977	1200
Campanulaceae	*Asyneuma limonifolium* (L.) Janchen	A5	Devrekani	Oyrak II mevkii	1991	1200
Campanulaceae	*Campanula lyrata* Lam.	A5	Tosya	Seki köyü, Seki deresi mevkii	1975	1200
Campanulaceae	*Campanula olympica* Boiss.	A4	Küre	Ağlı yolu	1978	1200
Campanulaceae	*Campanula olympica* Boiss.	A4	Küre	Ecevit	1978	1200
Campanulaceae	*Campanula olympica* Boiss.	A4	Daday	Ballıdağ	1978	1200
Compositae	*Anthemis tinctoria* L.	A4	Ilgaz	Ilgaz Dağları, Hacıhasan köyü, Akçeşme mevkii	1982	1200
Compositae	*Anthemis tinctoria* L.	A5	Tosya	Seki köyü, Seki deresi mevkii	1975	1200
Compositae	*Centaurea urvillei* DC.	A4	Daday	Araç-Daday arası	1981	1200
Compositae	*Cichorium intybus* L.	A4	Ağlı	Seydilerden sonra	1978	1200
Compositae	*Cirsium hypoleucum* DC.	A4	Küre	Ağlı yolu	1978	1200
Compositae	*Doronicum bithynicum* J.R.Edmondson	A4	Daday	Ballıdağ	1978	1200
Compositae	*Gnaphalium sylvaticum* L.	A4	Ilgaz	Ilgaz dağları, Derbent karakolu	1981	1200
Compositae	*Hieracium artabirense* (Zahn) Juxip	A4	Ilgaz	Ilgaz Dağları, Hacıhasan köyü, Akçeşme mevkii	1982	1200
Compositae	*Lapsana communis* L.	A4	Ağlı	Seydilerden sonra	1978	1200
Compositae	*Lapsana communis* L.	A4	İnebolu	Baldıran mevkii, Göcen geçidi	1978	1200
Compositae	*Pilosella hoppeana* (Schultes) C.H.& F.W.Schultz	A4	Ağlı	Seydilerden sonra	1978	1200
Compositae	*Pilosella piloselloides* (Vill.) Sojak	A4	Küre	Ecevit	1978	1200
Compositae	*Pulicaria dysenterica* (L.) Bernh.	A4	Araç	Ahlatçık köyü orman açıklığı	1981	1200
Compositae	*Senecio vernalis* Waldst.& Kit.	A4	Ilgaz	Ilgaz Dağları, Çilesiz, Handüzü	1981	1200
Compositae	*Tanacetum parthenium* (L.) Schultz Bip.	A5	Tosya	Seki köyü, Seki deresi mevkii	1975	1200
Compositae	*Tanacetum poteriifolium* (Ledeb.) Grierson	A4	Araç	Araç-Daday arası	1981	1200
Cornaceae	*Cornus mas* L.	A5	Tosya	Tosya-Kilkuyu arası	1977	1200
Crassulaceae	*Sedum hispanicum* L.	A4	İnebolu	Baldıran mevkii, Göcen geçidi	1978	1200
Crassulaceae	*Sedum pallidum* Bieb.	A5	Tosya	Seki köyü, Seki deresi mevkii	1975	1200
Cruciferae	*Barbarea verna* (Mill.) Aschers.	A5	Tosya	Karaköy köyü, Ortayayla mevkii	1975	1200
Dipsacaceae	*Knautia involucrata* Somm.& Lev.	A4	Araç	Araç-Daday arası	1981	1200

Conclusion

As a result of examining the plant samples belonging to Kastamonu province in ANK herbarium, their families and taxon numbers were determined. A database of taxa belonging to the samples has been created, and various lists of taxa have been prepared. During the herbarium examinations, care was taken to work without damaging the plant samples. In addition, some of the cardboard and cases of damaged samples belonging to Kastamonu province in ANK have been changed. The labels on the cardboards have been renewed in accordance with the original and plant samples have been lined up according to their genus numbers and species numbers. Photographs of the samples were taken, various lists were prepared and taken under protection in ANK herbarium for the service of the researchers. In addition, some photographs of Kastamonu province plant samples in the herbarium (Figure 7) and the image of ANK herbarium are given in Figure 8.

The study will shed light on the future researches and provide the opportunity to work without damaging the herbarium samples.

Fumana paphlagonica Bornm&Janchn | *Hieracium paphlagonicum* Freyn & Sint. | *Scabiosa columbaria* L.

Astragalus coodei Chamb.&Matthews. | *Sempervivum armenum* Boiss.&Huet. subsp. *insigne* M. | *Heracleum paphlagonicum* Czeczott

Onosma bornmuelleri Hausskn. | *Erysimum thyrsoideum* Boiss | *Crepis armena* DC.

Figure 7. Some plant samples belonging to ANK Herbarium

Figure 8. Entrance of ANK Herbarium building

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Comparison of Istanbul University - Cerrahpaşa Faculty of Forestry Campus in terms of Plant Diversity

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Abstract

Aim of study: Istanbul University - Cerrahpaşa Faculty of Forestry campus is not only a long-established campus, but also rich in plant diversity. The main purpose of this study is to evaluate the natural and exotic plant taxa in the campus area, and to compare it with the plant presence in other campus areas.

Area of study: Istanbul University - Cerrahpaşa Faculty of Forestry campus area, which was known to be within the borders of the Belgrad Forest in the past and as a result of the time and urbanization it remains among the residential areas, has been determined as the study area.

Material and methods: All natural and exotic, herbaceous-woody plant species have been identified within the boundaries of the Istanbul University - Cerrahpaşa Faculty of Forestry campus. Subsequent studies on the plant diversity of university campuses in Turkey, has been investigated from 'YÖK Thesis Center' and 'Google scholar'. A total of plant taxa of 35 campus areas have been evaluated. The area, age, plant taxa (natural species, exotic species, medicinal plants, herbaceous plants, etc.) of each campus were compared.

Main results: In the campus area of Istanbul University - Cerrahpaşa Faculty of Forestry, 282 genera and 494 plant taxa belonging to 101 families were identified. The data identified in the study area compared with the plant taxa of 35 other university campuses in Turkey.

Highlights: While Istanbul University - Cerrahpaşa Faculty of Forestry campus has the smallest area, it is ranked 3rd in terms of plant taxa and 1st in terms of family diversity. And also it has been determined to be the richest campus in terms of exotic plant species diversity.

Keywords: Flora, Campus, Diversity

Introduction

In recent decades, urban biodiversity has became more important due to the increasing impacts of urbanisation on natural ecological systems. Although they face strong anthropogenic pressures (McKinney, 2002), urban areas can contain rather high levels of biodiversity (Araújo, 2003; Kuhn et al., 2004; Luck, 2007). University campuses are powerful systems for various reasons: they have relatively homogenous conditions compared to cities, which makes them suitabile for comparisons across large environmental scales; and they often have reliable plant surveys (Moerman & Estabrook, 2006; Liu et al. 2017).

Urban green space vary considerably in design, management, and biodiversity conservation value (Aronson et al. 2017), but some of the largest intact green spaces in large cities exist on University campuses and offer diverse habitat for native and rare taxa. University campuses often contain contiguous areas of urban green space which are otherwise scarce in large cities and, thus, may provide critical habitat for numerous species. University campuses include mature trees and managed forests, ravines, and other cultivated gardens; they are designed and maintained by practitioners and landscape management teams. Further, they tend to be close to research labs, where many students can be put to task to document biodiversity for credit, research, and course-based projects (Krasny & Delia, 2015; Nagase et al. 2018).

The university campus green space carries the history and tradition of the campus, describes the culture and spirit of the school, and is the most vital and appealing part of the campus environment. The beautiful campus

green space can create a suitable environment for students to learn, explore and grow. It is good for students to feel the nature, discover the nature, create beauty, and subtly cultivate beautiful behavior, beautiful language and beautiful personality in the beautiful environment (Wang, 2018). The campus green space is also so important for the students that are studying about the forests, plants and the nature.

Different colleges and universities have different geographical environment, campus context, school-running characteristics, etc. Campus greening should combine these elements to create a unique campus green landscape, and build a sustainable ecological campus and humanities campus where people and nature live in harmony. Due to its rich ornamental characteristics, flexible configuration, and unique environmental protection and improvement functions, plants have become the most important framing elements in university campus greening. Therefore, it is of great significance to study the plant diversity of university campus to improve the quality of campus greening and to create a better campus environment, so as to achieve the purpose of nature education such as forestry, landscape architecture, propagation of ornamental plants etc (Wang, 2018)

There has been some studies about the plant diversities of the campus areas in Turkey and over the world. When we evaluated the last 5 year studies in 'Web of Science' with the key words "campus", "diversity" and "plants", we reached totally 25 articles. In 22 of these studies the research area is a campus area but the other 3 studies dealt with the botanical garden, forest area and island ecosystem. 14 of these articles are dealt with the plant science, while the 5 of them is especially dealing with campus plant diversity (Güler, 2019; Nugroho, 2018; Liu et al. 2017; Saadi et al. 2017; Evans et al. 2016). In the other 9 studies; invasive plant species, edible plant species, phylogenetic system, rural restoration, land use and woody plant diversity has been investigated (Maciel et al. 2019; Anderson & Crosby, 2018; Jaksetic et al. 2018; Huang & Whittall, 2018; Muchayi et al. 2017; Fabiane et al. 2017; Bianchi et al. 2016; Rodriguez et al. 2015; Aquino et al. 2015).

Although some universities have addressed the importance of green spaces on campus (Kimata & Saito 2012, Jones 2013), the value of biodiversity at university campuses is not yet fully recognized. In this research Istanbul University- Cerrahpasa Faculty of Forestry campus (IUCFF) area has been chosen as the study area, and the plant diversity of this campus area has been the main material of this study. The main aim of this research is to compare the plant taxa of the campus area with the other studied 35 campus plants of Turkey.

Material and Methods

Material

IUCFF campus area is located on the north side of Istanbul, between the 41º 10' 30.00" north latitude, 28º 59' 29.35" east longitude. The campus covers an area about 14 hectares. Its altitude ranges from 115 to 135 m. (Figure 1).

Figure 1. Location of the IUCFF campus

The climate around the campus area is a humid, mesothermal and maritime climate with a moderate deficit of water in the summer months, according to Thornthwaite's classification. Mean annual precipitation is about 823 mm, and mean annual temperature is 14.4°C. Most of the precipitation occurs between the months of October and March.

The campus area shows a sloopy topography going from the north-south side to the west side. This sloopy feature causes the These steep sloped parts lose its feature in the mostly used sides. Acoording to Natianol Soil Database ; soil structure of the research area is evaluated as shallow and stony lime-free

forest soil in the region where coniferous plantation is located. The rest part of the area is determined as industrial and residential area. Although the area is an extension of the Belgrad Forest, the deciduous taxa of the forest and also the plantation of evergreens and ornamentals are dominantly exist.

Method

Many studies on the detection of existing vegetation on college campuses in many areas in our country was carried out. Some of university campuses examined in terms of vegetation; Abant Izzet Baysal University (Turgut, 1996), Akdeniz University (Unal & Gokceoğlu, 2003), Anadolu University (Ture & Bocuk, 2001), Artvin Coruh University (Simsak, 2014), Balikesir University (Sanon, 1998), Baskent University (Töre & Erik, 2012), Bozok University (Yilmaz, 2016), Cumhuriyet University (Çelik & Yıldız, 1998), Cukurova University (Turkmen, 1987), Dokuz Eylul University (Uğulu, Dogan & Kesercioglu, 2012), Dumlupinar University (Tatlı et al., 2002), Gaziantep University (Ocak & Ture, 2001), Hacettepe University (Mutlu, Erik, & Tarikahya, 2008), Harran University (Parmaksız, Atamov & Aslan, 2006), Inonu University (Mutlu & Karakus, 2015), Kafkas University (Yilmaz, 2012), Kahramanmaras Sutcu Imam University (Yağmur, 2017), Karadeniz Technical University (Coskuncelebi, 1995), Kastamonu University (Oztürk & Bilgili, 2015), Kirikkale University (Nugay et al., 2007), Manisa Celal Bayar University (Uğurlu & Altan, 1998; Güler et al., 2017), Mersin University (Zeren & Ispirgil, 2001), Middle East Technical University (Bilge, 2001), Mugla University (Ceylan, 2007), Mustafa Kemal University (Yıldız, 2008; Altay, 2012), Nigde Ömer Halisdemir University (Baskose et al., 2012), Ordu University (Deveci et al., 2012), Osmangazi University (Ocak & Türe, 2001), Samsun Ondokuz Mayis University (Kilinç & Ozen, 1988; Özen & Kilinç, 1996), Selcuk University (Cıtak et al., 2016), Suleyman Demirel University (Fakir et al., 2009), Trakya University (Salık, 2015), Uludag University (Tarımcılar, 1992), Usak University (Deniz, 2008), Yeditepe University (Yucebas, 2014). In some of these studies only natural plant species studied, while in some native and exotic plant taxa were examined together.

Literature studies has been done about the study area and its surrounding. The studies of Yaltırık (1966), Yönelli (1986), Yaltırık & Efe (1989), Yaltırık, et al. (1997), Kavgacı (2002), Erol (2005), Colak et al. (2013) were evaluated. 50 field works were carried out to collect plant samples between 2015-2016 in the area. In addition, field works for control purposes were carried out in 2017-2018. In the stage of identification of specimens; Flora of Turkey (Davis, 1965-1985, Davis et al., 1988; Güner et al., 2000), Flowers of Europe (Polunin, 1969), Floristic Analysis of Belgrad Forest vegetation (Yaltırık, 1966), Systematic of Herbaceous Plants (Yaltırık & Efe 1989) were used. For the identification of exotic species; the sources of Pamay 1992; 1994, Yaltırık et al.,1997 and the web sites of Missouri Botanical Garden, KEW Herbarium Catalogue, Royal Horticultural Society, USDA Natural Resources Conversation Service were used. For determining the threaten categories of the taxa; current data of IUCN (2019) and Red Data Book of Turkey (Ekim et al., 2000) were used.

In this study, the relationship between campus area and taxa richness variables was examined. In order to query the relationship between variables two tailded linear Pearson Correlation Analysis was used. Analyzes were carried out using SPSS software.

A detailed comparison table was prepared to provide the basis for the correlation study and to compare the family, genus, species, endemism and phytogeographic data. Detrended correspondence analysis (DCA) (Hill & Gauch, 1980) was used for the interpretation of the composition of phytogeographic data and visualized in ordination axes.

Results and Discussion

As a result of the study, 101 families, 202 genera and 494 taxa were identified, 2 of which belong to the Pteridophyta group and 99 of them belong to Spermatophyta group. Of the taxa, 398 are in the status of species, 20 are subspecies, 72 are cultivar and 4 are in variety status. In the campus area where 277 natural and 217 exotic taxa are located; it is

found out that 374 taxa are widely distributed and phytogeographical region are unknown, 86 taxa are Eur. – Sib. element, 33 taxa are Mediterranean Element and 1 taxon is Iran – Turan element. When we evaluated 70 taxa according to IUCN (2019) data; it is stated that 4 taxa are in (DD), 64 taxa are in (LR(lc)), 1 taxon is in (LR(nt)) and 1taxon is in (VU) categories. According to the data of 'Red Data Book of Turkey' (2000), it is stated that 4 taxa are in (VU) and 1 taxon is in (LR(lc)) categories.

The flora of Istanbul University-Cerrahpasa, Faculty of Forestry campus were compared with other 35 campus floras in Turkey (Table 1).

Table 1. Comparisons of floristic campus studies (Abbreviations are below the table)

University Name	Area (km^2)	Total Taxa	Culture Taxa	Endemic taxa	Family	Genus	Species	Subspecies	Variety	Iran-Turan	Mediterra-nean	Euro-Siberian	Multi Regional or Unknown
AIBU.	10	445	30	19	70	268	435	6	4	19	45	110	271
AU.	3.6	452	20	30	78	326	335	69	48	12	185	7	248
ANU.	1.1	363	151	10	74	241	361	52	31	28	12	32	291
ACU.	50	369	-	11	82	271	369	73	35	16	9	134	210
BAUN.	1.52	267	21	1	62	206	195	55	17	8	53	22	184
BU.	3.64	382	45	63	51	216	373	2	7	119	20	15	228
BOU.	3.64	315	2	33	63	225	191	79	45	68	24	27	196
CUMU	11	403	-	68	-	-	403	-	-	140	24	24	215
CU.	18	415	-	20	67	265	415	-	-	11	109	7	288
DEU.	0.092	108	3	-	52	94	106	2	-	-	-	-	-
DU.	4	214	-	28	44	140	214	48	31	83	14	8	109
GU.	1.32	176	-	3	51	133	149	18	9	39	29	1	107
HU.	12	510	145	65	57	264	504	4	2	134	21	24	331
HRU.	27	204	-	5	37	129	153	36	15	65	26	7	106
IUC.	0.14	494	72	2	101	282	470	20	4	1	33	86	374
IU.	15	552	96	46	85	320	534	9	9	134	29	9	310
KAU.	5.09	293	7	5	51	172	291	1	1	64	5	56	168
KSIU.	3.14	279	-	2	65	194	244	22	13	21	54	10	194
KTU.	1.11	192	-	1	50	146	144	34	14	7	18	47	120
KU.	2.15	42	-	3	16	36	36	3	3	-	-	-	-
KKU.	12	371	15	45	61	238	371	58	47	96	26	9	225
MCBU.	11	366	-	10	62	222	276	57	33	8	122	16	220
MU.	12.14	75	-	-	29	67	63	5	7	-	-	-	-
METU.	50	463	21	48	72	251	463	-	-	110	36	28	289
MSKU.	2,3	376	-	21	62	233	275	72	39	15	189	11	161
MKU.	20	352	129	12	68	242	245	58	49	10	145	13	184
NOHU.	3.5	405	22	33	74	262	284	93	28	85	26	25	269
OU.	1	223	3	5	58	167	180	29	14	1	5	56	161
OGU.	7	352	-	35	53	228	346	-	6	63	22	17	250
SOMU.	10	403	117	-	67	230	403	-	-	-	-	-	-
SU.	11	262	-	8	43	187	262	-	-	78	17	-	-
SDU.	1	161	-	33	38	119	110	35	16	25	30	6	68
TU.	2.6	427	70	4	77	245	324	69	35	2	65	59	301
UU.	10	356	-	9	56	217	252	71	33	4	78	39	235
USKU.	2.5	240	53	23	48	163	154	52	34	29	36	9	166
YU.	0.27	281	-	1	64	85	209	51	21	2	48	32	233

Abbreviation: **AIBU**.: Abant Izzet Baysal University – Golkoy Campus, **AU**.: Akdeniz University – Main Campus, **ANU.**: Anadolu University – Yunus Emre Campus, **ACU**.: Artvin Coruh University, **BAUN**.: Balıkesir University – Cağıs Campus, **BU**.: Başkent University - Bağlıca Campus, **BOU**.: Bozok University – Erdoğan Akdağ Campus, **CUMU**.: Cumhuriyet University – Main Campus, **CU**.: Çukurova University – Main Campus, **DEU**.: Dokuz Eylul University – Main Campus, **GU**.: Gaziantep University – Main Campus, **HU**.: Hacettepe University – Beytepe Campus, **HRU**.: Harran University – Osmanbey Campus, **IUC**.: Istanbul University – Cerrahpasa – Bahcekoy Campus of Faculty of Forestry, **IU**.: Inonu University – Main Campus, **KAU**.: Kafkas University – Main Campus, **KSIU**.: Kahramanmaraş Sutcu Imam University – Avsar Campus, **KTU**.: Karadeniz Technical University – Main Campus,

KU.: Kastamonu University – Kuzeykent Campus, **KKU**.: Kirikkale University – Main Campus, **MCBU**.: Manisa Celal Bayar University – Sehit Prof. Dr. Ilhan Varank Campus, **MU**.: Mersin University – Main Campus, **METU**.: Middle East Technical University – Main Campus, **MKU**.: Mustafa Kemal University – Tayfur Ata Sokmen Campus, **NOHU**.: Nigde Omer Halisdemir University – Main Campus, **OU**.: Ordu University – Main Campus, **OGU**.: Osmangazi University – Meselik Campus, **SOMU**.: Samsun Ondokuz Mayıs University – Kurupelit Campus, **SU**.: Selcuk University – Alaeddin Keykubat Campus, **SDU**.: Suleyman Demirel University – Main Campus, **TU**.: Trakya University – Balkan Campus, **UU**.: Uludag University – Gorukle Campus, **USKU**.: Usak University – 1 Eylül Campus, **YU**.: Yeditepe University – 26 Agustos Campus. **Note**: **-** symbol not state in relevant reference and absent.

As a result of the analysis, it was concluded that there was a low level of positive (r=0.280) in the correlation relationship between the variables of area and taxa richness, and also the significance level (Sig. (2-tailed)) was less than 5%, that means there was no significant relationship between the variables (Table 2; Figure 2).

Table 2. Scatter Plot of Area by Total Taxa

Correlations

		Area (km^2)	Total Taxa
Area (km^2)	Pearson Correlation	1	0.280
	Sig. (2-tailed)		0.098
	N	36	36
Total Taxa	Pearson Correlation	0.280	1
	Sig. (2-tailed)	0.098	
	N	36	36

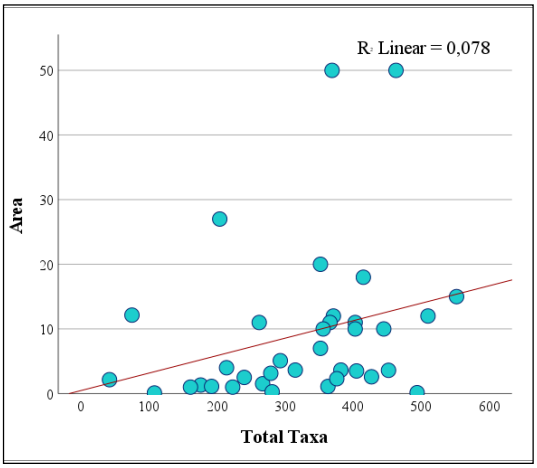

Figure 2. Correlation graphic between campus areas size and total taxa

Comparision of flora of different university campus areas will help to see the similarities and differences between phytogeographic region elements and families. In Figure 3, the phytogeographical similarities of the campus areas in the nearby regions is observed.

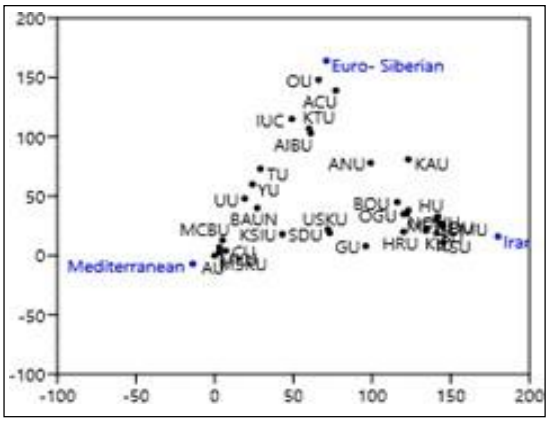

Figure 3. Phytogeographic region analysis – DCA

Endemism of plant species is an important parameter used in the conservation of biological diversity (Knapp et al., 2009). The existence of endemic taxa was not specified in 3 of the examined campus flora studies. When the ratio of the taxa richness of the campus areas to the number of endemic taxa is calculated, the highest endemism rate was belong to Suleyman Demirel University with 20.50% and the lowest endemism rate was belong to Yeditepe University with 0.36% (Figure 4).

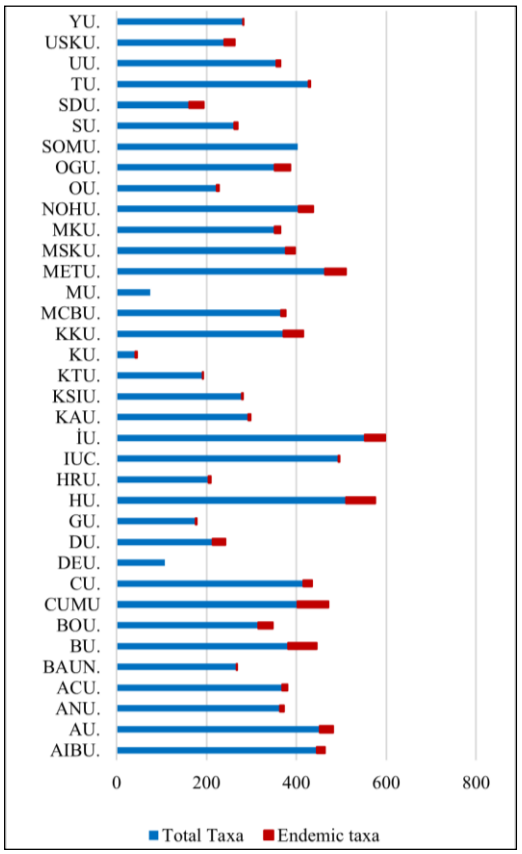

Figure 4. Endemism rate graphic

Conclusion

Plant species richness in university campuses was mainly driven by anthropogenic factors, specifically, diversity increased with campus age and size. This corresponds to results found by a global study which revealed that the species–area relationship is congruent between cities and regional assemblages (Ferenc et al., 2014). However, according to the data obtained from the study, this situation is not valid for every campus area. The relationship between the area of the campus and the plant diversity, with accumulation of time and diversification of habitats, species richness and abundance may then increase (Pautasso & Parmentier, 2007). Based on this, we can assume that the number of taxa is not directly related to the surface area, but it is related with the habitat and topographic variations of the area and also with the plantations.

In our country university campus areas provide natural laboratory services to students (Türe & Böcük, 2001). In the comparison made among 36 campus areas, Istanbul University-Cerrahpasa, Faculty of Forestry campus, which has the smallest area, ranks 3rd with its taxa richness and 1st with family diversity. Unlike other campus areas, the exotic plant diversity is very high.

In addition, unlike other campus areas, on the current campus there has been 35 registered woody plant taxa; 6 of them have the status of monumental trees and 19 of which are veteran status (Asan, 2014). These are; *Quercus robur* - 505 years, *Pinus pinea* –333 years, *Pinus pinea* –287 years, *Pterocarya fraxinifolia*- 262 years, *Calocedrus decurrens* – 236 years, *Quercus rubra* - 182 years, *Tilia argentea* - 119 years, *Quercus robur* - 197 years, *Tilia argentea*– 161 years, *Platanus acerifolia* – 167 years, *Quercus rubra* – 117 years, *Quercus robur* – 144 years, *Cedrus libani* - 189 years, *Aesculus hippocastanum* - 96 years, *Cedrus libani*-201 years, *Aesculus hippocastanum* – 86 years, *Pinus coulteri* – 213 years, *Quercus castaneifolia* – 120 years, *Quercus palustris* - 125 years, *Tilia argentea* - 131 years, *Picea pungens* – 208 years, *Cedrus atlantica* – 170 years, *Sequoiadendron giganteum* - 268 years, *Fraxinus angustifolia* – 154 years, *Sequoia sempervirens* - 263 years.

According to the results obtained, university campuses provide important biodiversity benefits for the regions they are located in, as well as for educational purposes. It enables the preservation and maintenance of biodiversity by providing a living environment to many different habitats, especially in the urban ecosystem. For example, Istanbul University - Cerrahpasa Faculty of Forestry, which is located on the bird migration route in Istanbul, hosts 39 different bird species every year during the migration period (Arslangündoğdu, 2005).

Although campus areas are well protected, but these areas will be exposed to development pressure in the future. Natural area in campuses are getting smaller and cultivated plants substitute natural flora because of afforesting and landscape planning activities are gradually increasing (Mutlu et al., 2008).

Despite the cutting-edge applied ecological research ongoing at campuses around the world, guidelines that encourage appropriate management for biodiversity on university campuses are rare (Dixon et al.

2006). In order to ensure the sustainability of the plant taxa in the campus areas, it is necessary to carry out regular maintenance and protection activities, especially in areas where woody plant taxa are concentrated.

The Istanbul University, Faculty of Forestry campus has a very important role in the protection of biodiversity and nature education with its unique plant and animal diversity. For this reason, management plans should be established to protect and maintain biodiversity in the area. In this way, the participation of the public and especially the students on nature conservation will be ensured and many other areas with rich biodiversity such as the campus area will be protected.

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The Effect of Nano Zinc Oxide (ZnO) and Hollow Ceramic Spheres on Scratch Resistance in Water-Based Varnishes

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Abstract

Aim of study: To determine the scratch resistance of water-based varnishes modified with nanoparticles against accelerated UV aging effect in some ThermoWood materials.

Material and methods: American ash (Fraxinus americana) and scotch pine (Pinus sylvestris Lipsky) wood were heat treated at a temperature of 190 °C for 1,5 hours and 212 °C for 2 hours. Later two-component water-based varnishes, with D70 - D99 commercial codes, modified with 1%, 3% and 5% ZnO and hollow ceramic spherical (HCS) nanoparticles were applied to the sample surfaces. And then the samples were then subjected to accelerated aging for 240 hours according to ASTM G154. The scratch resistance of varnish layers was determined by TS EN 15186 principles.

Main results: ZnO and HCS nanoparticles used for modifying water-based varnishes increased the scratch resistance in D99 and decreased in D70.

Highlights: In D99 varnish, ZnO and HCS additive increased scratch resistance. When it is desired to increase the resistance against mechanical effects, especially 5% ZnO and HCS additives can be recommended. At the same time, new studies with different additive ratios of different nanoparticles can be suggested to increase scratch resistance in water-based varnishes.

Keywords: Water Based Varnish, Heat Treatment, ThermoWood, UV Aging, Nanotechnology, Scratch Resistance.

Introduction

Wood material continues to be used in a wide range because of its many superior properties (despite its lightness, it is resistant, aesthetics, easy to process and it has color, pattern variety, low thermal conductivity, etc.). However; dimensional changes in changing atmospheric conditions, being susceptible and susceptible to biological attacks and degradation, and the changes caused by the effects that the wood material will be exposed to in its final use are among its significant disadvantages (Hill, 2006; Kesik, 2009; Dagbro, 2016; Sandberg et al., 2017).

It is necessary to pass the wood material through various processes and change these negative features. These processes are to improve the wood material by treating it with different methods such as heat treatment, surface treatments and impregnation with chemicals or by modification (Wicks et al.1999; Pospíšil & Nešpurek, 2000; Cristea et al.2010; Dunningham & Sargent, 2015; Dagbro, 2016).

Thermal modification (heat treatment) is one of the environmentally friendly methods used to improve and develop the properties of wood materials. In this method, it is aimed to improve the properties of wood material without the use of chemicals. The method has shown that by exposing the wood material to temperatures between 170 °C and 220 °C in an oxygen-free environment, it is possible to modify wood components which are sensitive to moisture absorption and biodegradation. After thermal modification, if it does not directly contact the ground in use, dimensional stability and durability of the wood material increases substantially (Dagbro et al., 2010; Demirel, 2015; Dagbro, 2016).

Some properties of heat treated wood material have improved when compared to

non-heat treated (natural) material. However, when the wood material is exposed to the aging effect (outdoor conditions or UV aging), the surface degradation continues and the aesthetic appearance that it gains with heat treatment loses. For this reason, it is necessary to coat the natural and heat treated wood material with transparent protective layers in order to prolong its life and protect its appearance (Miklečić et al., 2011; Hill, 2009; Militz, 2002; Miklečić et al.2017). Yet, in some cases the aging process has some negative effects on the physical, mechanical and chemical properties of the protective layer (Pospıšil and Nešpurek, 2000).

In recent studies, water-based varnishes containing nano inorganic UV absorbers have been reported to be resistant to deterioration when exposed to ultraviolet (UV) light. Increasing the durability of translucent coatings and wood material can be achieved by using nano-sized inorganic UV absorbers (Cristea et al., 2010; Cristea et al., 2011; Miklečić et al., 2017).

In this study, water-based varnishes have been modified with zinc oxide (ZnO) and hollow ceramic spherical nanoparticles. It has been aimed to improve the scratch resistance properties of water-based varnish layers with ZnO and hollow ceramic spherical (HCS) additive. In this context, the aim of the study is to determine the scratch resistance properties of water-based varnishes modified with nanoparticles in some heat treated wood materials against UV aging effect.

Material and Methods

Material

Wood material: American ash (*Fraxinus americana)* and Scots Pine (*Pinus sylvestris* Lipsky) woods have been preferred as experimental material. Wood materials have been obtained from Nova Forest Products Trade Inc. as timber. Experimental materials have been taken from 1st class timber; Mixed from core and sapwood, with smooth fibers, no knots, no cracks, no difference in color and density, annual rings perpendicular to the surfaces and they have been chosen randomly by sampling method (ASTM D7787 / D7787M, 2013).

Varnish: In the study, double-component transparent water-based varnishes with D70 and D99 trade codes produced by KIMETSAN Chemistry Mining and Metallurgy Industries Domestic and Foreign Trade Engineering Consulting co. ltd. have been used. The varnishes have been modified by weight with 1%, 3% and 5% ZnO (zinc oxide) (solid) and hollow ceramic sphere (HCS) (solid) nanoparticles. Varnishes have been applied to the surface by mixing with improver at the rate of 6% and with distilled water at the rate of 6%, prepared by weight, in accordance with the company directives. The contents of the varnishes are given in Table 1 and their technical properties in Table 2.

Table 1. Contents of varnishes

Filling Varnishes
D70
• Acrylic styrene resin < 70% • Propylene < 5% • Water > 25%
D99
• Acrylic polyurethane resin < 50% • Propylene < 5% • Water > 45%
Top Coat Varnishes
D70
• Ethylene diglycol < 4% • Nanoacrylic copolymer resin < 75% • Propylene < 5% • Water >16%
D99
• Ethylene diglycol < 4% • Nanoacrylic copolymer resin < 30% • Acrylic Modified Polyurethane resin < 55% • Propylene < 5% • Water > 6%

Method

Heat treatment: Heat treatment of test samples for both pine and ash wood was carried out in accordance with the principles of widely used ThermoWood method in Nova Forest Products Industry and trade inc. operating in Bolu Gerede in a computer-controlled oven at 190 ° C for 1.5 hours and at 212 ° C for 2 hours. After the heat treatment, the samples were kept in the air conditioning room of Kastamonu University Faculty of Forestry, Forest Industry Engineering Department with a temperature of 20 ± 2 °C and a relative humidity of 65 ± 5% until it reached a constant rate (TS 642 ISO 554, 1997).

Table 2. Technical properties of the varnishes

Varnishes	Properties of the Varnishes						
					Application Conditions		
	pH	Density (g/cm^3)	Viscosity (sn./DINCup 4mm/20 °C)	Solid Material Percentage (%)	Amount of Varnish (g/m^2)	Nozzle Gap (mm)	Air Pressure (Atm/Bar)
D70 Filling	7.7	1.30	24	32.23	87	1	2
D70 Control	7.7	1.15	23	31.92	88	1	2
D70 %1 ZnO	9.2	1.22	23	32.25	87	1	2
D70 %3 ZnO	9.5	1.29	24	32.88	85	1	2
D70 %5 ZnO	9.8	1.25	24	35.73	78	1	2
D70 %1 HCS	8	1.18	23	32.2	87	1	2
D70 %3 HCS	8.2	1.1	24	31.95	88	1	2
D70 %5 HCS	8.4	1.2	24	32.35	87	1	2
D99 Filling	7.9	1.35	24	30.88	91	1	2
D99 Control	8	1.28	23	40.07	70	1	2
D99 %1 ZnO	9.4	1.25	23	38.28	73	1	2
D99 %3 ZnO	9.6	1.23	24	37.76	74	1	2
D99 %5 ZnO	9.9	1.15	24	36.75	76	1	2
D99 %1 HCS	8.2	1.18	23	37.7	74	1	2
D99 %3 HCS	8.5	1.2	24	37.37	75	1	2
D99 %5 HCS	8.9	1.1	24	30.97	91	1	2

Preparation of the experimental samples: The direction of the fibers of the samples used in the study was cut as a draft with the dimensions of 330x90x15 mm parallel to the length axis, with the annual rings parallel to the two sides perpendicular to the other two sides and the intersecting faces perpendicular to each other. Following this, the samples were kept in the air conditioning room (TS 642 ISO 554, 1997) of the Kastamonu University Faculty of Forestry, Forest Industry Engineering Department with a temperature of 20 ± 2 °C and relative humidity of 65 ± 5% until it reached a constant rate (TS 2471, 2005). After conditioning, the samples were cut to 320x75x10 mm in net dimensions. In order to smooth the surfaces of the samples, clean them and make the varnish perfect, fiber embossing process was applied to all samples with the first soaking. It was polished by using first 80 number sandpaper and then 100 number sandpaper. Afterwards, fiber embossing process was applied to the samples that weren't heat treated again with final soaking and the swollen fibers were sanded again with 220 number sandpaper. The samples were cut in measure 75x75x10 mm for the scratch test after aging. A total of 1344 samples were prepared.

Application of varnishes: After cleaning the surfaces of the samples with a soft bristle brush and compressed air, they were prepared for varnishing. The varnishing of the samples was done with a FUJI SPRAY Q4 GOLD brand machine in accordance with the manufacturer's recommendations and ASTM D3023-98 (2017). The samples were varnished with filler varnishes (1 cross coat) and then lightly sanded with 600 grit sandpaper.

Then the top coat (3 cross coats) varnishes were applied. We waited for 24 hours between the last layers in line in accordance with the company directives. The varnished samples were free from dust and dried in a room temperature environment parallel to the ground plane.

Accelerated aging: After heat treatment, the edges of 320x75x10 mm samples varnished with modified water-based varnishes were varnished with the same type of varnish against any adverse effect in accelerated aging. After the samples were varnished, they were left to dry in the air conditioning room at 20 ± 2 °C and 65 ± 5% relative humidity until they reached constant weight according to TS 642 ISO 554 (1997).

According to ASTM G154-16 (2016) Standard, varnished samples were exposed to 240 hours of aging respectively in UV treatment (one hour at 60 °C and 0.71 w/m^2 light intensity), water spray (ten minutes at 20 °C) and conditioning states (four hours at 50 °C) and in the QUV accelerated weathering tester with UV-A 340 coded fluorescent lamps.

After the aging process, the samples were kept in the air conditioning room at 20 ± 2 °C and 65 ± 5% relative humidity until they reached constant weight (TS 642 ISO 554, 1997; TS 2471, 2005) and then the scratch test was performed.

Scratch resistance test: Scratch resistance is determined in accordance with the principles of TS EN 15186 (2017). Measurements have been made with an ERICHSEN Model 413 scratch resistance test machine (Figure 1) in the Kastamonu factory of SFC Kronospan Integrated Forest Products.

Figure 1. Scratch resistance tester

After the samples are placed in the experimental setup; First of all, the sample is rotated with a force of 5 N and if a continuous line is not formed, the force is increased with 1 N ranks until a continuous line is formed. If a continuous line is formed in the application of 5 N force, the operation is carried on by decreasing the force in ranks of 0.5 N up to 2 N, 0.20 N up to 1 N and 0.1 N ranks below 1 N. Sample surfaces at each level are controlled in a viewing cabinet with a light source of 1000 lux (Figure 2). The experiment is terminated after interruptions begin to occur in continuous circle lines. It is determined according to the application forces giving the same repetition in 6 of the 8 regions on the sample surface divided into 8 equal regions.

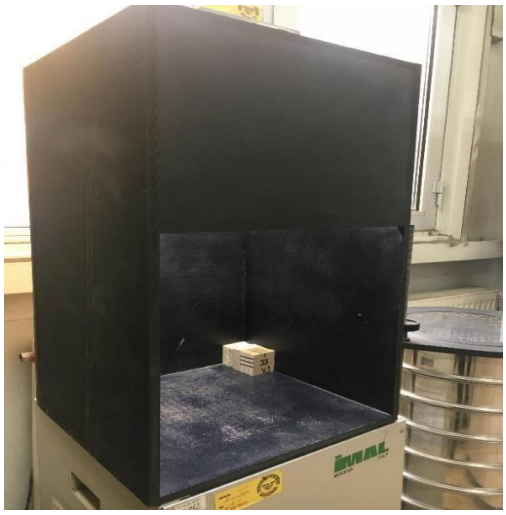

Figure 2. Viewing cabinet where sample surfaces are examined

Data analysis: SPSS V22 program has been used to evaluate the statistical analysis results in the study. In the statistical analysis, the results of the samples have been compared between the samples (control) which were varnished after being exposed to heat treatment at different times and temperatures and the ones which were prepared in the same way as the varnished samples and later on subjected to accelerated aging test. As a result of the Multiple Variance Analysis "ANOVA" tests, the effects of wood type, heat treatment, varnish type and aging period factors and their mutual interactions on scratch resistance have been determined. When factor interactions are significant with an error margin of $\alpha = 0.05$, comparisons have been made by Duncan test. According to the tests performed by using the least important difference (LSD) critical values, the factors that have caused this difference have been tried to be determined.

Results and Discussion

The scratch resistance values of the varnish layer have been found to be different according to the wood type, heat treatment period, varnish type and aging period. Multiple Variance analysis (ANOVA) has been performed to determine which factor caused this difference and the results are given in Table 3.

Table 3. Scratch resistance value variance analysis results

Factor	Degree of Freedom	Sum of Squares	Mean Square	F Value	Level of Significant
Wood type (A)	1	3.879	3.879	925.317	0.000*
Heat treatment (B)	2	0.033	0.016	3.917	0.020*
Varnish type (C)	13	37.489	2.884	687.989	0.000*
Aging period (D)	1	1257	1.257	299.847	0.000*
Interaction (AB)	2	0.188	0.094	22.428	0.000*
Interaction (AC)	13	2.722	0.209	49.957	0.000*
Interaction (AD)	1	0.055	0.055	13.128	0.000*
Interaction (BC)	26	0.870	0.033	7.987	0.000*
Interaction (BD)	2	0.004	0.002	0.515	0.598 **
Interaction (CD)	13	0.356	0.027	6.532	0.000*
Interaction (ABC)	26	1.849	0.071	16.969	0.000*
Interaction (ABD)	2	0.004	0.002	0.533	0.587 **
Interaction (ACD)	13	0.140	0.011	2.576	0.002*
Interaction (BCD)	26	0.058	0.002	0.537	0.973 **
Interaction (ABCD)	26	0.035	0.001	0.325	1.000 **
Error	1176	4.929	0.004		
Total	1344	927.685			

*: significant (according to $\alpha \leq 0.05$) **: insignificant

According to Table 3; -except from heat treatment - aging period (BD), wood type - heat treatment - aging period (ABD), heat treatment - varnish type - aging period (BCD), wood type - heat treatment - varnish type - aging period (ABCD) interactions- wood type, heat treatment, varnish type and aging period factors and their interactions have been found to be meaningful ($\alpha \leq 0.05$). Then, comparing results of Duncan test made at the level of wood type - heat treatment - varnish type and aging period using LSD critical value are given in Table 4.

Table 4. Comparison results of Duncan test regarding scratch resistance values at the level of wood type - heat treatment - varnish type and aging period.

Factor		x	HG	LSD±
Wood Type (A)	Pine	0.8600	A*	0.0068
	Ash	0.7526	B	
Heat Treatment (B)	Control	0.7998	C	0.0083
	190 °C	0.8075	AB	
	212 °C	0.8117	A*	
Varnish Type (C)	D70 Control	0.7250	FG	0.0179
	D70 %1 ZnO	0.7385	EF	
	D70 %3 ZnO	0.6010	J	
	D70 %5 ZnO	0.6531	I	
	D70 %1 HCS	0.6948	H	
	D70 %3 HCS	0.7073	GH	
	D70 %5 HCS	0.7010	H	
	D99 Control	0.7469	E	
	D99 %1 ZnO	0.9052	C	
	D99 %3 ZnO	0.9031	C	
	D99 %5 ZnO	0.8021	D	
	D99 %1 HCS	0.8885	C	
	D99 %3 HCS	0.9302	B	
	D99 %5 HCS	1.2917	A*	
Aging Period (D)	Control	0.7757	B	0.0068
	240 h	0.8369	A*	

x : Arithmetic mean, **HG:** Homogeneity group, **ZnO:** Zinc oxide, **HCS:** Hollow Ceramic Spherical, ***:** It represents the highest scratch resistance value.

According to Table 4, the scratch resistance of the varnish layer applied to the scotch pine test samples in the wood type was determined to be higher than the ash test samples. Especially, the scratch resistance of the experimental samples especially applied with nano ZnO and HCS doped D99 varnish has been determined to be higher than other samples. The dry film layer of D99 varnish applied to the experimental samples has become silky soft. This may have caused low values of scratch resistance to be measured in tissue control samples. However, while the scratch resistance of D99 varnish, which has been modified with zinc oxide and hollow ceramic spherical additives, has generally increased, the highest resistance has been obtained in pine test samples. This situation may have been caused by the effect of 5% hollow ceramic spherical additive, depending on the structure of D99 varnish, more penetration into pine wood and forming a thinner layer on the surface. This may have caused the scratch resistance to be measured at high levels.

In addition, D99 varnish is thought to bond strongly with nanoparticles and as a result, it is effective in increasing the scratch resistance of pine. In the literature, it has been stated that there may be fluctuations in the surface interactions and varnish layer hardness following the use of nanoparticles, while it has been reported that the scratch resistance of water-based varnishes mainly depends on their resin (Zhao et al., 2012; Sow et al., 2011; Nicolic et al., 2015).

The scratch resistance values of the varnish layer has increased according to the effect of the heat treatment. In some studies, it was determined that the scratch resistance decreases due to the increasing heat treatment time and temperature. In some other studies, it has been stated that scratch resistance increases in low temperature during the heat treatment applications and decreases in high temperature applications (Çakıcıer et al.2011; Ayata and Çakıcıer, 2017). In this study, increases in scratch resistance of varnish layers were determined with the increasing heat treatment effect.

According to the nanoparticle additives, differences have been determined in the scratch resistance values of the varnish layer depending on the varnish type. According to D99 control samples, scratch resistance has increased in all 1%, 3% and 5% additive of both ZnO and HCS nanoparticles. The highest additive of 1% in ZnO has been 21.2%, and a 5% additive in HCS has increased by 72.9%. In the D70 control samples, 1% ZnO has increased scratch resistance by 1.9% and decreased other nanoparticle additive. In this study, the effect of 5% ZnO additive on the scratch resistance of the varnish layer is less when compared with the additive rates of 1% and 3% in D99 varnish. Also, the scratch resistance of the layer has increased with the increase of HCS additives in D99 varnish. In the literature, it has been mentioned that water-based varnishes have a low scratch resistance value, while it has been reported that the scratch and abrasion resistance of the varnish layer has been improved with the additive of some nanoparticles (Sönmez et al.2004; Bauer and Mehnert, 2005; Jalili et al.2007).

In the aging period, 240 hours UV aging process has been determined to increase the scratch resistance value of the layer in all varnishes. In the literature, it has been stated that UV radiation increases the surface tension of the varnish layers in the aging process and thus leads to an increase in the scratch resistance values in the varnish layers (Ayata and Çakıcıer, 2017).

Conclusion

Modification of water-based varnishes with nanoparticles has increased the scratch resistance of varnishes against aging conditions. Especially, ZnO and HCS additives in D99 varnish has increased scratch resistance. When it is desired to increase the resistance of water-based varnishes against mechanical effects, especially 5% ZnO and HCS additive can be recommended. Therefore, it can be said that the use of water-based varnishes in indoor and outdoor furniture and accessories in which there will be external effects, may become widespread.

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Determining Perception on Ecosystem Services Provided from İnciraltı Urban Forest by using Q Methodology

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Abstract

Aim of study: The aim of this study is to determine the perception of ecosystem services provided from İnciraltı Urban Forest by using Q methodology.

Area of study: With an an area of 620 acres, İnciraltı Urban Forest is located in Balçova district of İzmir province, on the coast of İzmir Bay. While it was a natural wetland, the area gained by filling has been afforested over time and this area has turned into an urban forest used for recreational purposes.

Material and methods: The Q methodology, which allows the participants to determine their perspectives and priorities regarding the subject, was used in this study to determine the ecosystem services provided in the urban forest.

Main results: As a result of the analysis, three factors, namely three different perspectives, have emerged regarding the ecosystem services provided from İnciraltı Urban Forest. In factor 1 with the highest number of participants, the most agreed statement was "Urban forest contributes to the removal of pollutants in the air".

Highlights: The values that the participants attribute to urban forests through statements are important in terms of guiding the improvements to be made in the quality and quantity of urban forests.

Keywords: İnciraltı Urban Forest, Q Methodology, Ecosystem Services, İzmir.

Introduction

Ecosystem services, which express the processes associated with natural ecosystems that benefit humanity, include the provision, production, protection and maintenance of a range of goods and services that people perceive as important (Van Wilgen et al., 1996; Chee, 2004). On the other hand, the values attributed to ecosystem services by humans must be expressed in metrics in order to be evaluated as data in decision support systems (Martinez et al., 2007; Christie et al., 2012). With this aspect, Q methodology is an approach that can effectively reflect the abstract or concrete importance that individuals or a group attribute to a subject (Stephenson, 1935; Brown, 1993). Q methodology is a qualitative approach in terms of revealing the subjective opinions of individuals (Cross, 2005), and a quantitative approach in terms of expressing these opinions with measurable dimensions. Q methodology is based on the process of classifying perspectives from similar and different aspects of thoughts put forward by individuals or groups on a subject.

Depending on the practical approaches it offers in revealing the perspectives on the issues, the Q methodology is increasingly used in the evaluation of ecosystem services, such as, ecosystem services provided from coastal lagoons (Maki Sky, et al., 2018), urban parks (Buchel & Frantzeskaki, 2015), coastal areas (Simpson et al., 2016), marine environment (Pike et al., 2015), vineyard landscapes (Winkler and Nicholas, 2016), and water resources (Armatas et al., 2017).

In this study, it is aimed to determine the ecosystem services provided from İnciraltı Urban Forest with the help of Q methodology. The results obtained are intended to guide the development of urban forests and similar studies to be conducted on the subject.

Material and Methods

Material

The study was carried out in the example of İnciraltı Urban Forest located in the city of İzmir. With an area of 62 hectares, the urban forest, which is also adjacent to a natural lagoon on the shores of the Izmir Bay, is an

area that was acquired by filling and turned into a recreation area by afforestation.

The urban forest offers a rich recreational potential to the city people with its sports and picnic areas, walking and cycling routes, developed vegetation cover and panoramic landscape views (Figure 1).

Method

Q methodology used in determining the perception towards ecosystem services was carried out in four stages: i) determination of statements, ii) design of the chart, iii) determination of participants, and iv) analysis.

In a Q methodology study, statements are important tools that participants use to express their views on the subject.

Figure 1. A view from İnciraltı Urban Forest

In this study, firstly, ecosystem services have been determined with the help of Millenium Ecosystem Assessment (MEA, 2005), Jim and Chen (2009), Nesbitt et al. (2017), and Çiftcioğlu and Aydın (2018), then they were transformed into statements. In the Q methodology study, it is emphasized that the statements must represent different views. Therefore, if all of the statements are positive as a result of the preliminary study, a negative of each statement should be prepared. (Amin, 2000; Demir & Kul, 2011). In this study, a negative of each statement was also prepared, and thus a total of 40 statements were obtained under the headings “provisioning, regulating, cultural and supporting”.

Statements must be placed on a chart that has negative and positive ends in the range of "Disagree - Neutral - Agree" to represent participants’ views. The chart used in this study is designed in mandatory distribution model to allow participants to prioritize among statements (Figure 2). Then, each statement was randomly written in the boxes and sent to the participants together with the chart and a letter stating that the participation was voluntary.

It is stated that a large number of people are not needed to carry out a Q methodology study, and 40-60 participants will be sufficient (Stainton Rogers, 1995). This study was carried out with 40 users of İnciraltı Urban Forest. 22 of the participants are female, 18 are male, 21 are university and 19 are high school graduates, 31 people are in the 20-40 and 9 people are in the 41-60 age group.

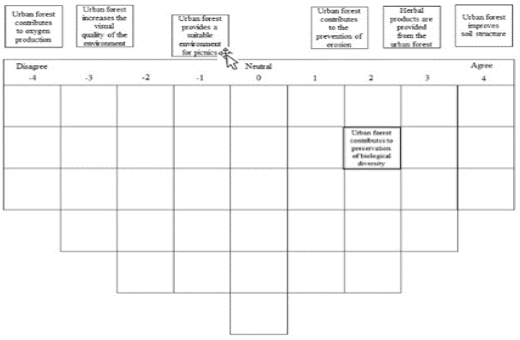

Figure 2. The chart and some statements used in the study

The charts prepared by placing the statements by the participants were analyzed using PQ Method 2.35 program. In the analysis, the participants are grouped based on the positions of the statements on the chart, and each group reflects view on the subject.

Results and Discussion

As a result of the analysis of the charts prepared by the participants, three factors, namely three different perspectives, have emerged regarding the ecosystem services provided from İnciraltı Urban Forest. The number of people involved in the factors and their characteristics are given in Table 1. 24 people came together on factor 1, 3 people on factor 2 and 12 people on factor 3, and 1 person was not included in any factor.

Table 1. Distribution of people and their characteristics by factors

	Number of people	Education		Gender		Age	
		Univ.	High Sc.	Female	Male	20-40	40<
Factor 1	24	17	7	12	12	20	4
Factor 2	3	2	1	1	2	3	-
Factor 3	12	3	9	6	6	8	4

In order to examine which statements (ecosystem services) come to the fore in the factors, the Z values taken by the statements as a result of the analysis are examined. As the positions of the statements on the chart approach towards the "Agree" side in the "4" part, the Z value rises to 1 and above, and when the approaches the "Disagree" side in the "-4" part, the Z value decreases to -1 and below. When the statements are placed in the middle part of the chart towards the "Neutral" side, the Z value approaches 0. When Table 2 is examined, it is possible to see which statements stand out in the factors by looking at the Z values. Table 2 also makes possible to compare the rank of an statement in each factor.

In all three factors, it was observed that the statements of regulatory and cultural ecosystem services were attributed to higher values by the participants. It is thought that this situation may be due to the higher awareness of the participants about the said ecosystem services.

In factor 1, the participants gave the highest value to the statement "Urban forest contributes to the removal of pollutants in the air", referring to the role of urban forests in eliminating environmental problems. In the same factor, a negative statement was placed in the second place, emphasizing that it is possible to have a picnic without urban forests. In the third place in factor 1, the role of urban forests in softening the extreme climate is emphasized.

In factor 2, the statements that urban forests play a role in improving the soil and regulate the climate of their region were given the first two places by the participants. In this factor, the statement that urban forests provide suitable environment for picnics was placed in the third place, and a situation opposite to factor 2 was displayed. In factor 3, the feature of urban forests to regulate surface flows is ranked first. In the second rank, a negative statement was used, as in factor 1, and it was stated that the longing for nature can be fulfilled even without urban forests. In this factor, the contribution of urban forests to oxygen production is ranked third.

Table 2. Values and rankings of statements in factors

Statements (Ecosystem services)	Factor 1		Factor 2		Factor 3	
	Z	No	Z	No	Z	No
Urban forest contributes to the removal of pollutants in the air.	1.812	1	1.058	8	0.462	16
Picnic can be enjoyed even without urban forests.	1.363	2	-1.700	40	0.455	17
Urban forest contributes to the softening of some extreme climatic events (Strong wind and rain, dust transport etc.).	1.355	3	-0.935	31	0.175	22
Urban forest provides opportunities and environments for physical and mental activities (sports, walking, reading, etc.).	1.295	4	-1.123	33	0.290	20
Urban forest provides a suitable living environment for wildlife.	1.242	5	0.436	17	0.065	25
Urban forest provides a suitable environment for pollination between plants.	1.137	6	-0.279	25	1.226	5
Urban forest contributes to the preservation and development of biodiversity.	1.096	7	1.105	6	1.080	7
Urban forest is effective in eliminating the longing for nature.	1.068	8	-0.923	30	0.298	19
Urban forest provides a suitable environment for picnics.	0.916	9	1.311	3	-0.065	26
Urban forest contributes to the development of awareness and love for nature.	0.872	10	0.358	18	0.471	14
Urban forest contributes to oxygen production.	0.781	11	1.188	4	1.327	3
Urban forest contributes to the prevention of erosion.	0.713	12	1.014	9	0.501	12
Pollination between plants can occur even without urban forests.	0.703	13	-1.403	35	-0.786	28

(Table 2 Continued)

Statements (Ecosystem services)	Factor 1		Factor 2		Factor 3	
	Z	No	Z	No	Z	No
Urban forest offers an environment to observe and learn about the natural environment.	0.597	14	-0.935	32	1.233	4
Urban forest mobilizes creativity to develop new ideas and works in the field of science, art and literature.	0.461	15	0.468	16	0.089	24
Urban forest contributes to the improvement of soil structure.	0.427	16	1.420	1	0.525	11
Urban forest contributes to the regulation of the climate of the region where it is located.	0.414	17	1.355	2	0.336	18
Urban forest increases the visual quality of the environment.	0.413	18	0.826	13	0.995	9
Global warming can be prevented even without urban forests	0.348	19	-1.512	37	-1.487	37
Urban forest contributes to prevent global warming by storing the carbon in the atmosphere.	0.280	20	1.184	5	1.043	8
Urban forest regulates the flow and infiltration of rainwater into the soil.	0.274	21	-0.091	23	1.931	1
Natural environment can be observed even without urban forests.	0.254	22	-1.591	39	0.472	13
Urban forest creates positive effect on human psychology.	0.119	23	0.870	12	0.578	10
It is possible to preserve biodiversity even without urban forests.	-0.351	24	0.327	19	-1.024	31
Wildlife can be continued even without urban forest.	-0.593	25	-0.158	24	1.161	6
Vegetable products (fruit, etc.) are provided from the urban forest.	-0.647	26	0.887	11	0.134	23
Rainwater can infiltrate the soil even without urban forests.	-0.807	27	-0.577	27	-1.641	39
Regulating the climate is a process that is not related to urban forests.	-0.935	28	-1.197	34	-0.971	30
The longing for nature can be fulfilled even without urban forests.	-0.970	29	-1.494	36	1.359	2
Urban forests are of little importance in the softening of extreme climatic events.	-1.045	30	0.327	20	-1.868	40
There is no relationship between the visual quality of the environment and urban forests.	-1.060	31	0.607	14	0.471	15
Urban forests have no effect on the improvement of soil structure.	-1.118	32	-0.468	26	-0.954	29
Urban forests do not play role in the development of awareness to nature.	-1.153	33	0.935	10	-1.422	36
Urban forests are unsuitable areas for obtaining vegetable products (fruit, etc.).	-1.187	34	0.498	15	-1.029	33
Urban forests are unsuitable environments for physical and mental activities to occur.	-1.271	35	0.079	22	-1.513	38
Urban forests have no effect on people's psychology.	-1.272	36	1.075	7	-1.125	34
The effect of urban forests is insignificant in increasing the amount of oxygen in the atmosphere.	-1.290	37	-0.826	29	-0.682	27
Urban forests are ineffective in providing erosion control.	-1.316	38	0.200	21	-1.281	35
Urban forests are places that have no effect on creativity.	-1.318	39	-0.747	28	0.197	21
The influence of urban forests is insignificant in clearing the air.	-1.607	40	-1.573	38	-1.025	32

With the help of Table 2, it is possible to determine on which statements the factors develop opposite or similar views. For example, the view that it is possible to have a picnic without urban forests is at the top in factor 1, while the participants in factor 2 disagree with this statement and rank it in the lower part.

Similarly, the statement that the longing for nature can be fulfilled even without urban forests was highly valued by the participants in factor 3, whereas in factors 1 and 2, the participants did not agree with this statement.

The contribution of the urban forests to the preservation and development of biodiversity is placed in upper parts in each factor. Similarly, the participants in all three factors positively approached the contribution of urban forests to preventing erosion.

Conclusion

With this study, it is aimed to determine the user perceptions on the ecosystem services provided from urban forests in the example of İnciraltı Urban Forest. In the study, the Q methodology was used, which enables the determination of different perspectives and priorities on the subject.

In the study where ecosystem services were presented to the participants as a

statement, three different perspectives were determined as a result of the analysis. Participants generally attributed high values to regulatory and cultural ecosystem services.

This study revealed that the Q methodology enables the determination of the views of groups, whether large or small, and thus, to gain knowledge on all perspectives (Pike et al., 2015). With the Q methodology, perceptions and perspectives can be determined with a certain number of people who have the potential to think about the subject without the need for a large number of people (Stainton Rogers, 1995; Buchel & Frantzeskaki, 2015). Combining positive and negative statements in the Q methodology enables the reflection of the opinions on the subject from a broad perspective. Indeed, balance and representation are important elements in statements and play a key role in putting forward similar and different views on a subject.

Based on the data obtained and the evaluations made within the scope of this study, it is possible to develop a series of suggestions for researchers and similar studies. The values that the participants attribute to urban forests through statements are important in terms of guiding the improvements to be made in the quality and quantity of urban forests.

Conducting similar studies for different urban forests and comparing the results will be useful in determining the general public perception on urban forests.

It is thought that using the Q methodology study in researches such as environmental pollution, visual analysis, landscape planning and design will be beneficial in guiding researchers.

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Determining Recreation Potential of İzmir Karagöl Nature Park

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Abstract

Aim of study: To determine the recreation potential of Karagöl Nature Park which is one of the most visited destinations in İzmir from the viewpoint of recreation and tourism uses, and to assess the relationship between land use types and actual status of the study area.

Area of study: Karagöl Nature Park, which is located in the Yamanlar Mountain area of Menemen district of Izmir, has the characteristics of a landslide set lake formed as a result of geological movements.

Material and methods: The recreation potential of the Karagöl Nature Park has been determined by using Gülez method considering some criteria such as landscape value, climate, accessibility, recreational convenience, and negative factors. In addition, SWOT analysis was carried out to ensure sustainable use of the area.

Main results: As a result of the study carried out, the recreation potential of Karagöl Nature Park was determined as very high.

Highlights: Maintaining the sustainability of human-environment relationship in recreation areas with high natural potential is the primary goal.

Keywords: Recreation Potential, Karagöl Nature Park, Gülez Method, İzmir.

Introduction

Recreation is the activities carried out to regain the physical and spiritual health of people negatively affected by the intense work tempo, habitual lifestyle or environmental conditions (Çetinkaya et al., 2016). Recreation defines activities performed in leisure time depending on economic, cultural and social conditions and contribute to human health and social life (Sayın & Karadağ, 2016).

Nowadays, recreational needs of people are increasing in cities where environmental conditions tend to deteriorate, and as a result of this, people tend towards recreation areas with high natural quality in their surrounding rural areas (Şimşek & Korkut, 2009). However, knowing the recreational potential of an area is of great importance in providing an area for recreational use effectively. Because, evaluation of recreation activities and revealing the recreational potential are very important for the future of the area. The suitability of an area for recreation is directly related to the recreational potential of that area. Recreational potential can be defined as the capacity of the natural and cultural qualities of the area to meet the recreational needs of people.

Natural parks are among the main recreation areas popular with people who want to get away from urban environments in our country. There are about 250 natural parks in our country, where people can directly interact with nature and access some standard services. The sustainability of the natural and recreational qualities of nature parks, where people show great interest, depends on the planning of these areas in line with their potential. Because planning can only be done consciously thanks to the presence of concrete data on environmental features.

In this study, it is aimed to determine the recreation potential of the Karagöl Nature Park, which is located in the province of İzmir. The data obtained are intended to guide similar studies realised on recreational land use planning.

Material and Methods

Material

With an area of 18.92 hectares, the study area, Karagöl Nature Park, is located in Menemen district, in Izmir. It was registered as a Type B recreation area in 1973, it was

turned into a Type A Recreation in 2007, and it was declared as a Nature Park in 2011.

İzmir Karagöl Nature Park, which is 850 meters above sea level, is located in Yamanlar Mountain in Menemen. Karagöl is a small lake with a surface area of approximately 3.5 ha, and the lake is known to be formed as a result of volcanic activities (Toprakkara et al., 2017) (Figures 1,2 and 3).

Figure 1. Geographical location of the research area

Figure 2. A panoramic view of Karagöl Nature Park.

Karagöl Nature Park has rich and well developed vegetation cover. Some species in the park are *Salix alba*, *Pinus brutia*, *Pinus nigra*, *Cupressus sempervirens* and *Hedera helix* (Anonymous, 2020).

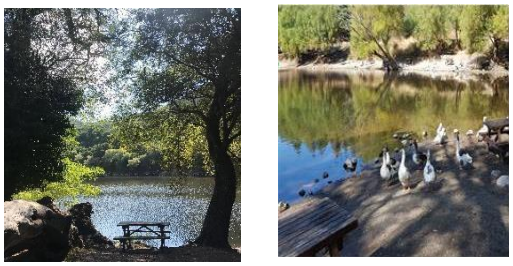

Figure 3. Images from the Karagöl Nature Park

There is a diversity in the fauna of the nature park. In the field researches, 70 invertebrate animal species, vertebrate species such as bony fish, amphibia, reptilia, 18 bird species belonging to 14 families, 13 mammal species were identified (Anonymous, 2020).

Trekking, photo safari and cycling activities can be done in and around Karagöl Nature Park, where magnificent views can be watched in every season. Around the lake there are restaurants, buffets, picnic units, tent camping and caravan areas (Figure 4).

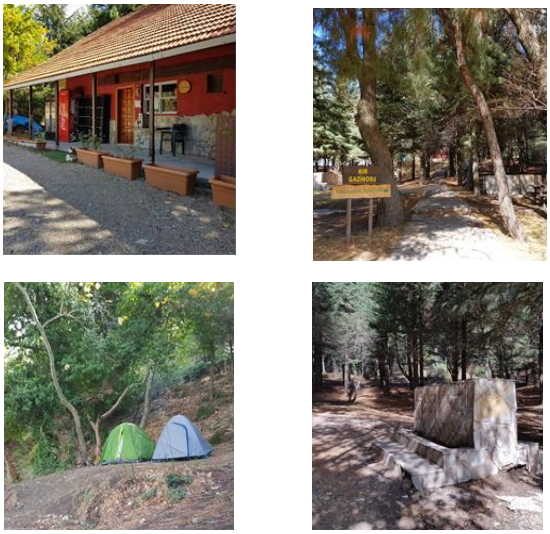

Figure 4. Images from the Karagöl Nature Park

Method

In determining the recreation potential, the method of "Determination Forest Recreation Potential" developed by Gülez (1990) was used.

In the method, the negative factors affecting the area are extracted from the total landscape value, climate value, accessibility and recreational facilities of the area, and the recreational potential is calculated. (Altunöz et al., 2014).

The method is based on a simple mathematical formula and expressed with "RP = P + I + U + RK + OSE". Among the symbols that enter the formula;

P is Landscape value,
İ is Climate,
U is Accessibility,
RK is Recreational convenience, and
OSE is negative factors (Birinci, et al., 2017).

An "In-Forest Recreation Potential Assessment Form" was prepared showing the detailed scores of the elements in the method for the recreation area. With this form, it is possible to make a decision based on observations.

In Table 1, it is possible to see the maximum values which factors can get.

Table 1. Maximum points which values can get

Symbol	Meaning	Maximum Score
P	Landscape Value	35
I	Climate	25
U	Accessibility	20
RK	Recreational Convenience	20
OSE	Negative Factors	0 (minimum - 10)
% RP	Recreation Potential	100

Landscape Value: The most important feature in evaluating the recreational potential of an area is the landscape potential. For this reason, the landscape value is in the first place of the evaluation with a weight of 35%.

Climate Value: Considering that climate has a great impact on recreational activities, it is deemed appropriate to include the climate effect with a weight of 25% in the assessment.

Accessibility: The recreational potential of a place is directly related to the accessibility of that place. Therefore, the accessibility element has joined the recreation assessment method with a weight of 20%.

Recreational Convenience: In determining the recreational potential, all the recreational facilities available in that place have a positive effect on the increase of the recreational potential. In this case, it was deemed appropriate to evaluate the recreational facilities with a weight of at most 20%.

Negative Factors: In determining the recreational potential of a place, it is obvious that it is necessary to consider the negative factors existing in that place. There may be negative factors that can get a maximum of (-10) points. The scores of the negative factors are taken as minus (-) in the evaluation, so they are subtracted from the total score (Yılmaz et al., 2009).

The recreational potential values to be obtained as a result of the application of the method are shown in Table 2.

Table 2. Relationship between the recreation value obtained and recreation potential

Recreation Potential	% Value
Very low	Below 30
Low	30 - 45
Middle	46 - 60
High	61 - 75
Very High	Over 75

Results and Discussion

As a result of the calculation of the recreation potential of the Karagöl Nature Park, the total score was found as 81, and the recreation potential of the area was found as very high. The scores of the research area from the criteria (Table 3), and the evaluations for each criteria are given below.

Landscape Value (P) (31 points):

Size of the Area; Karagöl Nature Park has an area of 18.92 ha. In this context, the size of the study area was calculated as 4 points determined for areas larger than 10 ha.

Flora; Karagöl Nature Park has a high biodiversity in terms of trees, shrubs and meadows with the effect of hosting aquatic and terrestrial ecosystems together . In this context, vegetation was evaluated as 8 points.

Sea, Lake, Streams; The lake with the Karagöl Nature Park was evaluated as 7 points.

Topography; Karagöl Nature Park is evaluated as less inclined and flat in places and calculated as 3 points.

Visual Quality; The combination of forest and lake ecosystems in one area, containing rich flora and fauna diversity, and being in a gradual land structure provide unique panoramic views. In this context, the visual quality of the Karagöl Nature Park was calculated as 4 points.

Other Features; The Karagöl Nature Park has been evaluated as 5 points in the section of other features that contain ecological and cultural resource values, due to its high ecological potential, healthy habitats for wildlife, and many historical and archaeological values in its close vicinity.

Table 3. Gülez method scoring chart

Items in the Formula	Evaluation Score	Item Properties	Maximum Score	Explanation
Landscape Value (P)	4	Size of Area	4	4 points greater than 10 ha 5 - 10 ha 3 points 1 - 5 ha 2 points 0.5-1 ha 1 point
	8	Flora	8	Woodland, bush, meadow 7-8 points Lonely woodland and meadow 6-7 points Bush, meadow, sparse tree 5-6 points Meadow, sparsely wooded 4-5 points Lonely bush and meadow 3-4 points Bushy, sparsely wooded 3-4 points Meadow, sparse bush 2-3 points Lonely meadow 1-3 points
	7	Sea, Lake, Streams	8	Seashore 7-8 points Lake shore 6-7 points Streamside 4-5 points Streams 1-4 points
	3	Topography	5	Flat area 5 points Slightly wavy 4 points Less inclined, some flatness 3 points Least rugged 2 points Medium rugged 1 point
	4	Visual Quality	4	Panoramic views 3-4 points Nice view and vistas 2-3 points The overall visual aesthetic value of the area is 1-3 points
	5	Other Features	6	For example, natural monuments, waterfalls, caves, historical and cultural values, wild animals, birds etc. 1-6 points
Climate Value (I)	9	Temperature	10	Summer months (June, July, August) average ° C 16 17 18 19 20 21 22 23 24 25 34 33 32 31 30 29 28 27 26 25 Score: 1 2 3 4 5 6 7 8 9 10
	8	Precipitation	8	Sum of summer months (June, July. August) mm 50 100 150 200 250 300 350 400 Score: 8 7 6 5 4 3 2 1
	5	Sunbathing	5	Cloudy average in summer Cloudiness: 0-2, 2-4, 4-6, 6-8, 8-9 Score: 5 4 3 2 1
	1	Windiness	2	Average wind speed in summer Less than 1 m / sec 2 points 1-3 m / sec 1 point

(Table 3 Continued)

	3	The Touristic Importance of the Region	4	Mediterranean, Aegean, Marmara coasts band 3-4 points Black Sea coastline 2-3 points Important highways, priority regions in tourism 1-3 points
Accesibility (U)	4	The City With At Least 100.000 Population In Its Area	5	Distance up to 20 km 4-5 points Distance up to 50 km 3-4 points Distance up to 100 km 2-3 points Distance up to 200 km 1-2 points
	3	Time Reached (from a nearby city with at least 5,000 inhabitants)	4	Up to 1 hour on foot or by car 0-1 / 2 hours 4 points 1 / 2-1 hour 3 points 1- 2 hours 2 points 2 - 3 hours 1 point
	1	Transportation (except taxis and private cars)	4	Walking or finding a vehicle at any time 3-4 points Finding a vehicle at certain times 1-3 points
	1	Other transportation facilities	3	For example, being a cable car, being accessible from the sea, etc. 1-3 points
Recreational Convenience (RK)	4	Picnic Facilities	4	Fixed picnic table, stove etc. (according to your qualifications) 1-4 points
	2	Water Condition	3	Drinking and utility water possibilities (according to their qualities) 1-3 points
	2	Overnight Facilities	2	Fixed overnight accommodations 2 points Opportunities to camp with or without a tent 1 -2 points
	2	WCs	2	1 -2 points according to qualifications
	2	Car park	2	1 -2 points according to qualifications
	2	Country Casino, Sales Buffet	2	1 -2 points according to qualifications
	2	Watchmen and Officers	2	Permanent guard / attendant 2 points 1 point in charge on weekends
	2	Other Conveniences	3	For example, beach, cabin and shower facilities, rental boat facilities, ball, etc. playgrounds and sports fields, facilities etc. (based on qualifications) 1 -3 points
Adverse Factors (OSE)	0	Air pollution	-3	-1 - (-3) points according to the degree of pollution
	-1	Not Insecure	-2	-1 - (-2) points according to the security status
	-1	Water pollution	-1	For sea, lake and rivers
	-1	Neglect	-1	Insufficient maintenance in the area
	0	Noise	-1	Traffic, crowd, etc. noises
	0	Other Negative Factors	-2	For example, stone and gravel quarries, construction and factory remains, etc. -1 - (-2) points
Overall Score or Forest Recreation Potential (%) 81 points				

Climate Value (I) (23 points)

Temperature; The average temperature value for the summer months for the area was taken as 26 and the temperature value in the table was evaluated as *9 points*.

Precipitation; The average precipitation during the summer months was calculated to be less than 50mm and evaluated as *8 points* .

Sunbathing; The average cloudiness rate in the summer months was calculated as 1.17, and this value was evaluated as *5 points* according to the Gülez method table.

Windiness; It was calculated as 2.5 (Bora, et al., 2015), and based on this, it was evaluated as 1 point according to the Gülez method.

Accessibility (U) (12 points)

Touristic Importance of the Region; Karagöl Nature Park is located in the Aegean band, but its transportation is not easily provided due to its location. For this reason, the study area was calculated as *3 points*.

The City With At Least 100.000 Population In Its Area; The distance of Karagöl Nature Park to Karşıyaka, one of the central districts of İzmir province , is 27 km. In this context, Karagöl Nature Park was calculated as *4 points* in the city assessment with a population of 100,000.

Time Span Reached (from a nearby city with at least 5,000 inhabitants); In terms of transportation by walking or vehicle, the distance between Karagöl Nature Park and Karşıyaka district, one of the central districts, has been calculated as *3 points,* stated as 1/2 - 1 hour.

Transportation (except taxis and private cars)*;* Karagöl Nature Park is not sufficiently developed in terms of accessibility. There is no potential for transportation other than private vehicles. In this context, transportation is calculated as *1 point*.

Other transportation facilities; There is no other means of transport other than road transport. For this reason, *it* was evaluated as *1 point.*

Recreational facilities (RK) (18 points)

Karagöl Nature Park has sufficient equipment in terms of picnic facilities, overnight facilities, WC, parking lot, country casino, sales kiosk, guard and attendants. In this context, the evaluation was made to give the maximum points they can get in the Gülez method.

Usage possibilities in terms of drinking and potable water are evaluated as being increased and calculated as *2 points*.

Beach, cabin and shower facilities, boat rental facilities, ball, etc. On the other hand, in the section of other facilities that include facilities such as playgrounds and sports facilities, the facilities / facilities are evaluated as *2 points* considering that they are not of sufficient quality and number.

Adverse Factors (OSE) (-3 point)

Due to its location and structure, the Karagöl Nature Park can stay away from air pollution and noise, and there are no facilities and / or areas in its immediate vicinity that will create any negative effects. The negative factor items in this scope are evaluated as *0 points*.

Despite the presence of security personnel in the area , the security status, water pollution and neglect were evaluated as *-1 points* due to the insufficient access to the area and the roads in the area in terms of security, the presence of dysfunctional spaces, not sufficient care in the area, pollution (especially inside the lake) .

In calculating the recreational potential of an area, it is necessary to consider the factors that limit its use, as well as the features that will provide advantage to the area. At this point, there are certain criteria under the title of negative factors. In this context, the maximum score that can be obtained in the Gülez method for negative factors was stated as -10, and the Karagöl Nature Park was calculated as -3 points as a result of the evaluations.

A SWOT study was conducted considering the field studies for the research area, literature studies and the recreation potential study (Table 4).

Table 4. SWOT analysis for Karagöl Nature Park

Strengths	Weaknesses
-Its high-value ecological structure has been preserved. -Habitat diversity is high due to the habitat ecosystem and forest ecosystem. -It allows for various recreational activities. It has a rich biodiversity. -It offers a calm environment away from noise. -Visual quality is high.	-Facilities to meet the recreation potential are not sufficient. -Access to the area is limited. The natural structure in the area does not have sufficient protection. -There is pollution in the area, especially in the lake. The area has low recognition. -It is poor in terms of nature-friendly recreational activities diversity.
Opportunities	**Threats**
-It is located in an area with high ecological and cultural values. -Tourism potential is high. -It provides opportunities for many nature sports due to its structure. -It contains a variety of creative activities. -Due to its location, the area provides the opportunity to meet the desire for clean air and return to nature. -It has the characteristic of a rural recreation area.	-The wetland habitat is damaged due to the pollution in the lake.

According to the SWOT analysis, it is seen that the values regarding the ecological structure of the area are high and it hosts rich biodiversity. In addition, it is seen that it provides different recreational activities and offers a quiet and calm environment. In addition to this, it is seen that it does not provide sufficient facility facilities, access to the area is insufficient, and there is an existing pollution in the area. Karagöl Nature Park, which is of great importance in terms of its social, cultural and economic potentials, has been evaluated as insufficient in terms of nature-friendly recreation diversity.

Conclusion

Karagöl Nature Park, which has a rich ecological potential, has a very high recreational potential with its features. It enables the realization of many recreational activities by providing picnic and camping facilities, children's playgrounds, resting places, walking paths, and various eating and drinking facilities. In addition to allowing daily use, it also carries the option of accommodation because it provides camping opportunity. Active and passive recreational activities increase the preference of the area and thus the use of the area is diversified.

According to the Gülez method, the recreation potential of Karagöl Nature Park, which is evaluated under 5 main headings has been evaluated as very high as a result of calculations. It is possible to make a detailed evaluation about the area with the Gülez method form, which reveals a parallel result with the SWOT analysis performed on the site.

Karagöl Nature Park, which has a high ecological potential, maintains its ecological balance almost without any damage. Preservi ng its natural character, combining different habitats creates effective learning environments, contributes to the love of nature and creates unique panoramic views. Karagöl Nature Park, which allows various recreational activities to take place, creates a quiet and calm environment. However, various threats such as pollution, transportation problem and security are factors that restrict the use of the area.

Considering the field studies carried out for Karagöl Nature Park, the scoring and SWOT analysis results to determine the recreational potential, it is possible to develop some suggestions to improve the qualities of the research area.

- A qualified usage-user analysis should be done in order to protect and support the diversity of creative activities.
- The recreational potential of the area and its carrying capacity should be evaluated together in ensuring the balance of use.
- Alternative transportation methods should be developed for the Karagöl Nature Park, which is in a difficult location to access.
- Pollution problem in the area should be resolved in order to protect natural resources.
- Security and neglect problems seen in the field and in transportation to the field should be assessed again.
- In order not to damage the ecological structure and to protect the habitats, recreational activities that may put pressure on the natural structure should not be allowed.
- Nature-friendly recreational activities should be supported.
- It should not be forgotten to protect the identity of the area and to ensure the sustainability of its natural feature.

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The Determinition of The Problems and Solution Ways, Interested in Allocated Forest Resources to Tourism Sector in Turkey

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Abstract

Aim of study: The determinition of the problems and solution ways, interested in allocated forest resources to tourisim sector in Turkey was researched.

Area of study: The developed model in this study, Antalya / Belek and Çankırı / Ilgaz Yıldıztepe tourism centers by applying was tested.

Material and methods: How to manage tourism functions of forest resources in the relevant public opinions and interests of pressure groups can be based on sustainable forest resource management and sustainable tourism criteria and indicators, using the sectoral social benefits in an analytical logic has been put forward. The value of social benefits / loss criteria, in the context of social and intrinsic values were determined. These values were determine by developed questionnaire forms. The results of questionnaire application is used in the model. Developed model with the technical analysis of the linear combination can be done on the detection of the options that provide a public benefit is provided.

Main results: In accordance with the purpose of the research, problems regarding the allocation of forest resources for tourism purposes have been identified, in this context, it will realize the appropriate allocation of resources to be allocated to tourism, ensure the balance of conservation-use, realize sustainable natural resource management and provide superior public interest, a two-sectoral and multi-criteria, the allocation model that provides a comprehensive assessment with criteria has been developed can be said.

Highlights: Criteria and indicators for the allocation of forest resources to tourism and sustainable land allocation model in forestry.

Keywords: Tourism and Forestry, Sustainable Forest Management and Sastainable Tourism, Public Benefit in Forestry, Forest land alocation to Tourism, Land Allocation Model

Introduction

The conflict between the sectors using land in Turkey and The wrong land use pattern that has resulted from this creates severe ecological and socio-economic problems. It is also noteworthy that new conflict areas such as tourism and residential areas are added to these problems. In this context, the whole problem is, that each sector using land uses the areas under its possession as efficiently and effectively as possible and realizes new methods to prevent conflict in common boundaries. Otherwise, sustainability faces a great danger in terms of both forestry and other sectors (tourism, agriculture, animal husbandry) (Geray, 1998). In the second paragraph of article 169 of Turkish Constitution, "ownership of state forests" cannot be transferred. State forests are managed and operated by the state, according to the law. These forests cannot be acquired by statute of limitations and cannot be subject to the right of easement except for the public interest ". In this context, based on article 169 of our Constitution, article 17 of Turkish forest law numbered 6831 and article 8 of the tourism law regulate the permits and easements to be granted for tourism in the state forests on the grounds of public interest.

The subject of our study; Permits and easements provided for tourism purposes within the scope of the 17th article of Turkish forest law numbered 6831 and the forest areas allocated to the former name Tourism region, Tourism area and centers with the new name Culture and Tourism Protection and

Development Regions and Tourism Centers within the scope of the 8th article of Turkish tourism law numbered 2634, allocation processes, methods and their results. It is thought that the pressure of tourism as an emerging sector in Turkey on forest resources will increase with each passing day. As a result of this pressure, it is estimated that the problem of deforestation and the prevention of the goods and services that society expects from forests may be faced. The increase in tourism demand, especially in developing countries such as Turkey, privileges in this sector leads to recognition. The most important of these privileges is the unquestioned and unquestioned, unconditional and unconditional allocation of land to the tourism sector. These privileges can affect other sectors that interact with the tourism sector in the long term, positively or negatively, externalities. Such policy practices have consequences such as deforestation and environmental degradation. This situation reveals that managerial processes are problematic and they are done with a more scientific and sustainable approach.

For this reason, this research is important both at national and international scale in order to allocate forest resources to different sectors with scientific methods, to use them in other sectors without compromising the goods and services expected by the society from forest resources and to manage them sustainably.

Purpose of the research

In this study; It is aimed to identify the problems related to the allocation of forest resources for tourism purposes, to realize the appropriate allocation of resources to be allocated to tourism, to ensure the balance of protection and use, to realize sustainable natural resource management and to develop an allocation model that will provide superior public benefit.

Assumptions

1-) The public benefit / loss generated by tourism activities to be established on forest resources and the levels of public benefit generated by forest resources in the same area can be compared with each other in an integrated approach within the scope of social and intrinsic values.

2-) The net economic value of forest resources and social benefits produced by tourism cannot be calculated.

3-) Maximization of social benefit that will occur as a result of tourism activities on forest resources; It can be achieved by sustainable forest resources management and ensuring sustainable tourism conditions.

4-) The maximization of utility flows and sustainability of these flows within the scope of this study are in the public interest.

5-) There is no theoretical and scientific approach regarding the allocation of Public Forest Lands to different sectors within the scope of public benefit.

6) On the allocation of forest areas for tourism in Turkey, scientific criteria and indicators are not available.

7-) İn turkey in forest areas allocated to tourism, deforestation occurs.

8-) Forest areas that are not suitable for tourism purposes within the scope of the public interest criterion in Turkey are allocated to tourism.

Approaches

There are three different approaches put forward by GERAY regarding the allocation of forest resources to tourism within the scope of public interest (Geray, 1997). These approaches;

1-) The public interest in the forest as a natural resource always results in superior public benefit. For this reason, it is necessary not to allocate any forest area to tourism.

2-) Tourism always provides more public benefits, so forests should be allocated to tourism under any circumstances.

3-) Forests and tourism generate public benefit in both sectors. The allocation of forests to tourism should be allowed within

the scope of certain coefficients, criteria and indicators, so that the public benefit generated by both sectors should be continuously utilized.

A questionnaire was applied in order to determine the approach that was found meaningful by the public and interest groups within three approaches. As a result of the survey application, the third approach was found to be significant by the public and interest groups. Therefore, the third approach was accepted as the hypothesis of the study.

Hypothesis

Forests and tourism produce public benefit in both sectors, the allocation of forests to tourism should be allowed within the scope of certain coefficients, criteria and indicators, so that the public benefit generated by both sectors can be continuously benefited.

Research Strategy (Data Collection Technique)

Social scientists strive to scientifically examine social reality and draw conclusions. It is understood that the studies carried out are scientific according to two criteria. The first is that it creates a systematic field of knowledge and reaches new data. The second is that it uses the scientific method while obtaining new data in this field of knowledge, that is, she reveals her thoughts through observation, assumptions, tests and generalizations (Şahin, 2006).

In this study, in addition to research, methods and techniques within the scope of social sciences, evaluation methods related to forestry discipline were used in an integrated manner. The research universe of the study; Tourism allocated forest areas in Turkey and affecting the allocation process the legal, political, administrative and technical processes are include. The first situation was determined in the research, related public and interest groups have been identified. Public and interest groups; Environment Group, Forest Group, Tourism Group, Judicial Group, Forest Villagers and Summer Houses, Non-Governmental Organizations and General Public are divided into 7 (seven) layers. Masters and doctorate theses related to the subject, directly or indirectly, were examined in the thesis scanning center of the Council of Higher Education (YÖK), The Scientific and Technological Research Council of Turkey (TUBITAK) Ulakbim database related issues from our domestic and foreign publications were screened. In this context, the historical process and theoretical principles regarding sustainable development, sustainable forest resources management and sustainable tourism, and the allocation of public lands to different sectors were examined. Studies have been conducted on the concepts of public benefit and superior public benefit. The literature has been scanned on the concept of value, value types and determination of economic value and the place of public interest in the concept of value has been determined. Within the scope of article 17 of the 6831 law of the jungle in Turkey and the 2634 tourism legislation within the scope of the allocation process of the allocated forest areas for tourism, Environment and Forestry and the Ministry of Culture and Tourism Ministry documents of the subject with relevant laws, regulations and court decisions it has been examined from relevant sources. In parallel with the literature review, face-to-face interviews were held on the coastline from Antalya's Kalkan district to Alanya Kargıcık region in order to learn the attitudes of the relevant public and interest pressure groups on the subject.

The intensity of allocations related to the subject was effective in the fact that this study was conducted in the Antalya region. Working principles of commissions in the allocation process, qualifications of commissioners, The evaluation methods of the commission and the reports of the commission were examined and the people working in the commission was Interviewed. The criteria used by the commissions and the methods used to evaluate these criteria with an integrated approach were determined. it was determined that the applications are scientific or not in Turkey. The public benefit criteria produced by the forestry and tourism sectors

in ecological-environmental, economic-financial and socio-cultural axes have been determined. İn order to determine the highest benefit from these criteria, a questionnaire form has been developed to select the criteria that provide superior benefit. In the development of the questionnaire, Baş (2006) and literature on forestry and tourism were used. Researches and publications about some areas that have been allocated to tourism have been examined and findings regarding deforestation and loss of quality in these areas have been evaluated. At the end of this process, the allocation model was developed.

Forestry and tourism

The forestry sector provides input to many sectors other than itself with many goods and services it produces. In other words, it creates infrastructure for many sectors, enables them to operate efficiently by creating ready-made supply, therefore, it is an important sector in achieving macro goals and developing the socio-economic structure (employment, added value, etc.). On the other hand, it is a sector with low backlinks as it receives very few inputs from other sectors (Geray, 1998).

The objectives of the forestry sector;

• Conservation forest resources against all kinds of adverse effects,

• In order to supply the society's expectations from forest resources in a versatile, sustainable, continuous and balanced manner, these resources within the principles of participation, effectiveness and fair sharing; To manage and operate efficiently and economically according to technical, economic, social and cultural requirements,

• Based on the functional characteristics of forest resources, increasing the collective benefits (employment creation, erosion prevention, public health, etc.) continuously and rationally with the production of goods and services to be obtained from them,

• Expanding forest areas by establishing new forests,

• To take measures to eliminate rural poverty in order to reduce socio-economic pressures on forest resources,

• It can be summarized as taking measures to prevent erosion in order to prevent soil loss and preserve natural balance, and to carry out rehabilitation studies in forests pastures.

From the foregoing, it is understood that it is necessary to benefit from multiple aspects in forestry (Türker, 1998). The functions of forests are in three axes as ecological-environmental, economic-financial and socio-cultural. All of the duties and functions undertaken by forests in these three axes are in interaction with each other and have direct or indirect effects on each other. This is a natural consequence of forests being ecosystems. The services provided by forests, the functions they undertake and the goods / services they produce also create social benefit flows.

The legal basis of forestry tourism relations in Turkey in 1983 is based on an arrangement made in the forest law. With this regulation, the construction of all kinds of buildings and facilities for the public benefit in the State forests outside the tourism regions, areas and centers were allowed (Coşkun, 2008). The place of forests in the legal system as an environmental good is important for the regulation and management of utilization from forests (Ayanoğlu, 1992). These public property such as forests are examined under the headings of State property, Public good, public property and administration property (Gülan, 1999). Public goods; They are goods that are directly related to public services and the people and are accepted to be subject to administrative law rules in this respect (Onar, 1966). Forests are the common heritage of society because they provide social benefits and therefore deemed to have been taken under state supervision and control in Turkey. In other words, forests are public property and have a special position among public property (Coşkun, 1998). This special position of forests in public property stems from the multidimensional benefits that forests provide to society.

Today, sustainable development is widely accepted as a concept and goal in the management of forests and other natural resources (Warner, 1997). Really naturally or grown forest resources suply the material and spiritual needs of people in a concrete and direct manner, while contributing positively to socio-economic life, on the other hand, help the protection and / or development of the balances of all natural systems as an "invisible hand". In other words, it provides an indirect benefit (Geray, 1998). As a result, this ecosystem, which will affect the fate of humanity today and in the future, has an indispensable role in sustainable development. Sustainable forest resources management ensures the fulfillment of this role that forest resources play in sustainable development.

Sustainable forest resources management; It is defined as the operation and use of forests and forest areas in a manner and intensity that can fulfill the ecological, economic and social functions expected of them today and in the future by conservation the biological diversity, productivity, rejuvenation capacity and vitality at local, national and global levels, and without harming other ecosystems. (Drengson & Taylor, 1997)

In this context, it would be appropriate to state that the definition of sustainable forest resources management is defined with criteria and indicators developed as a result of processes carried out in different regions of the world. In other words, sustainable forest resources management is characterized by these criteria and indicators. With the system of criteria and indicators, it is aimed to harmonize the economy and ecology in the direction of sustainable development and to balance each other. At the country level, the above-mentioned failure in harmonization, in other words, the inter-sectoral conflict (such as Forest-Tourism) that occurs during the management of forest resources, is closely related to both the management of forest resources and the failures in the management of other sectors that use land or nature (Geray, 1998).

In this context, what is the interaction of forest resources with tourism and the priority of use in tourism activities? By what means and by what principles should these priorities be determined? Its questions arise. Tourism is defined as the sum of the relationships and phenomena arising from travel and temporary accommodation that are not permanent and not intended to earn money (Burkart & Medlik, 1981).

Environmental values such as air, water, soil, flora, fauna, social and cultural accumulations, which are the basic elements of a country's natural, historical and cultural wealth, also constitute sources of supply in tourism as they are used by tourists. (Keleş & Hamamcı, 2002). Different expectations of tourists from tourism create tourism types. Increasing interest in nature and nature tourism increases the importance of forest resources, which are a source of supply for nature tourism, for tourism. Since the tourism sector is a sector that continues its existence primarily depending on natural, cultural and historical resources, rational tourism cannot be mentioned in an environment where natural resources, cultural and historical infrastructure are destroyed. In this respect, the concept of “sustainability” is of vital importance for the tourism industry, more than it does for other sectors (URL-1). On the other hand, tourism is a versatile economic activity that develops based on the environment and natural resource base (Tuna, 2007). As a result of the increasing economic expectations from tourism and the negative effects of intense tourism activities on the nature, the increase of concerns about the environment has revealed that the relationship between natural resources and tourism should be revised (Kalem, 2001). The land demand created by tourism transforms fertile agricultural areas into touristic facility areas and affects the sustainability of natural and historical sites and even publicly owned forests (Kahraman & Türkay, 2006).

At this point, sustainable tourism can be seen as an approach that can produce solutions to environmental negative externalities

arising from tourism activities. Sustainable tourism; Conservation the environment where human beings interact or not, from deterioration, that cultural integrity, ecological processes, biological diversity and living systems are maintained and also defined as a form of development in which all resources are managed in a way to satisfy the economic, social and aesthetic needs of the people and tourists in the region visited and to meet the needs of future generations (Dincer, 1996).Ensuring a balance between tourism and forest resources in mutual benefit and conservation use undoubtedly requires harmonization of sustainable approaches in the relevant fields. In this context, this study seeks to answer the question of how the allocation of forest resources to tourism in our country can be realized with a sustainable approach.

Legally, the sustainable allocation of a public good (Forests) to the tourism sector with the condition of public interest will be possible by measuring the public benefit or comparing the existing alternatives. The place of the public benefit in the world of value has been investigated in order to measure or compare the public benefit. It has been determined to be within the scope of social and intrinsic values (Brown & Manfredo, 1987; Kaya, 2002). Subsequently, criteria and indicators were developed for the allocation of forest resources to tourism on the basis of sustainable forest management criteria and indicators and sustainable tourism criteria and indicators (Leal, 1997; Canadian Forest Service, 1997; El & Lakany, 1997; URL-2, 2008). Within the scope of social and intrinsic values, by ensuring that these criteria and indicators are evaluated by the public and interest groups (coefficients and scores), alternatives that provide superior public benefit have been identified.

Material and Methods

In the research management, materials produced within this research and materials produced from other studies were used.

Published studies on sustainable forest management, sustainable tourism, public interest about public land allocations specific to our subject and valuation methods were used as a material in this study. Criteria and Indicators derived from sustainable forest management (Leal, 1997; Canadian Forest Service, 1997; El-Lakany, 1997) and sustainable tourism criteria and indicators (URL-2, 2008) are another group of materials used in this study. The questionnaire forms that prepared to measure the public benefit comparison within the scope of social and intrinsic values are another group of materials used in this research.

Criteria, Indicators, Method and Modeling for Sustainable Resource Management in Forest Areas where Tourism Activities will be Planned.

Developing sustainable planning methods and appropriate policies is possible by using indicators and measuring human activities in numerical form. Indicators are tools that assist planners and decision-makers in evaluating the success of their programs and plans and determining new plans or policies. Indicators, human activities that are the source of impact (potency), betwen the state of the conditions in which these activities take place (the state of the environment, ecosystem, society and economy) and effort to prevent harmful effects of activities.

Method

It is necessary to determine for which goods and service components the forest resources should be allocated, taking into account the demands and characteristics of the resource, that is, to realize functional partitioning. With this partitioning, the planning method and model for each function should be revealed (Geray,1998).

In this study, the principles, method and model for the allocation of forest resources to tourism activities within the scope of public benefit criteria are determined.

The most important problem in the practice of the allocation of forest resources for tourism purposes is that the boundaries of

the public benefit criterion, which constitute the reason for the allocation, cannot be drawn, cannot be measured, and its superiority cannot be determined. In order to eliminate the related problems, within the scope of the sustainability principle, it is necessary to measure the net economic value for the criteria that will determine the benefit flows that will occur as a result of the allocation application, or to make the benefit superiority comparison between the sectors.

For the allocation of forest resources to tourism, the measurement of public benefit should be done by using net economic value determination methods within the scope of economics, but the fact that some economic valuation criteria such as the consumer surplus criterion cannot be used due to the market failure of the goods and services produced by forest resources, the absence of market prices, the inability to draw demand curves in each benefit flows, and the inability to collect demand curves, and similar reasons, restrict the feasibility of this measurement. So it is necessary to develop a method to determine the superior public benefit in allocation practices. Questionnaire method and Likert scale were used in our study to develop a method with this feature. With the developed questionnaire forms, the benefit flows that may occur as a result of the allocation application are classified in three axes in ecological-environmental, economic-financial and socio-cultural in both sectors and different benefit criteria have been developed under each axis. These benefit criteria were evaluated in Likert scale within the scope of social and intrinsic values. For each benefit criterion, 5 different degrees of likert benefit scales, from 0 (zero) useless to 4 (four) completely useful, were placed in the questionnaire.

In addition, the different benefit axes of the two sectors were evaluated in the questionnaire in order to reveal the holistic evaluation of the benefit / harm flows in the related axes. In order to compare the harm flows that will occur as a result of the allocation application, again, 5 different degrees of likert harm scales, from 0 (zero) harmless to 4 (four) completely harmful, were placed in the questionnaire. With this rating, it is aimed to obtain numerical values that enable the comparison of benefit / harm criteria within the scope of social and intrinsic values. In the developed questionnaire form, explanation texts and the purpose of asking the questions are given in order to eliminate the difference in understanding of different public and interest groups that will participate in the survey and thus to ensure objective answers to the questions. n order to make spatial evaluations, 3 different levels of indicators were defined for each benefit criterion in the questionnaire, depending on the low or high level of the benefit / harm. Indicator definitions have been developed taking into account the principles of sustainable forest resources management, sustainable tourism principles, and national and international indicators.

The survey application was made on a sample that will represent the society. Sample; It can be defined as a set of units or elements that are selected by any method suitable for the purpose within the research universe and capable of representing the research universe (Baş,2006). Stratified sampling method was used for the survey application. At this point, the layers of society to be included in the stratified sampling are determined as follows; Forestry Sector, Tourism Sector, Judicial Group, Forest Villagers and Summer Houses, General public, NGOs, Environment Group.

The sample size for which the survey will be applied was calculated with the help of the formula given below (Baş, 2006).

$n = t^2 p.q / d^2$
n = the number of individuals to be sampled
p = Frequency of occurrence of the event examined (probability of occurrence)
q = Frequency of not occurrence of the event examined (probability of not occurrence)
Sampling error d = 10% and t = 90% confidence level
From this point, d = 0.1, t = 1.645.
$n = 1.645^2.0.50.0.50 / 0.1^2$

n = 2.7060. 0.25 / 0.01
n = 67.65

The number of samples should be distributed equally to 7 different layers in order to represent the target groups equally. In this case, the number of samples per layer (ntb);
ntb = 67.65 / 7
ntb = 9,66 = 10

The coefficient values attributed by the public and interest groups to the benefit flows within the scope of social and intrinsic values were calculated using the arithmetic mean method from the data obtained as a result of the survey application. The survey evaluation and coefficient values are given in Table 1.

Forestry is a sector that produces multi-dimensional benefits. As it is known, in every environment where there is a multidimensional decision problem, it is necessary to focus on goals, that is, to create a strategy. Therefore, different biological, physical, social, economic and cultural operating characteristics necessitate strategies tied to different weighted purposes (Geray, 1998). The logic of weighting the benefit criteria used in this study aims to form this strategy. The benefits provided by forestry to society in 3 axes are in a linear relationship with the benefits provided by the axes' benefit criteria. In other words, a positive change in the benefit provided by the benefit criterion in any benefit axis has a positive effect on the benefit axis it belongs to. This situation is the same for the benefit axes of tourism. These linear relationships show that the linear combination technique (Yılmaz, 2006) can be used in the analysis of the model in this research. Linear programming is a suitable decision-making tool under conditions whose details are known.

It uses a mathematical model to determine the purpose and characteristics of the problem in the decision-making process (Esin, 2003).

$$Z = \sum_{i=1}^{n} ai\ bi \quad \text{(Equation 1)}$$

In the above formula:
Z: Purpose Function
Ai: Constant Coefficients
Bi: Represents variables.
The explanations of the parameters in the model specific to our study are:
Z: Sum of benefits of benefit criteria representing benefit axis
Ai: Value attributed by public and interest groups to the relevant benefit criterion (constant)
Bi: Spatial indicator value (variable)

Although the application areas of linear programming are too many to be counted, its applications can generally be divided into industrial and economic fields. In this context, we can say that linear programming techniques are widely used in solving allocation problems (Esin, 2003).
As stated in the previous sections, the allocation of a public good that produces public benefit to a different sector for a different public service will only be possible with the decision of superior public benefit. There are three different approaches put forward by GERAY regarding the allocation of forest resources to tourism within the scope of public interest.

These approaches;

1-) The public interest in the forest as a natural resource always results in superior public benefit. For this reason, it is necessary not to allocate any forest area to tourism.

2-) Tourism always provides more public benefits, so forests should be allocated to tourism under any circumstances.

3-) Forests and tourism generate public benefit in both sectors. The allocation of forests to tourism should be allowed within the scope of certain coefficients, criteria and indicators, so that the public benefit generated by both sectors should be continuously utilized.

GERAY formulated this situation as follows in line with the above approaches (GERAY, 1997).

TF1 = OF + F - M 2
TF2 = F- M1- M2
TF3 = OF + F - M1 - M2

TF1: Total public benefit of the tourism activity to be carried out without damaging the forest ecosystem.
TF2: Public benefit of tourism activity to be made by damaging the Forest Ecosystem at an unsustainable level.
OF: Public Benefit Produced by Forest Ecosystem.
F: Benefit of the proposed tourism activity.
M1: Social cost that will occur with the allocation Of forest resources to a different sector For another activity (Failure to obtain wood raw material, loss of visual values, etc.).
M2: it shows the Social Costs (additional traffic, noise load, wastes, etc.) to be created by the new activity to be activated.

In the research for problem solving process, the approach (3rd approach) supported by the majority of public and interest groups was accepted as hypothesis and the model to solve the problem was established as follows.

Formulation of The Model
B = FB + TB - CF - CT

B: Total Benefit (Public Benefits During Operational Process)
FB: Benefit of Forest (Public Benefits Before Forest-Specific Event)
TB: Benefit of Tourism (Public Benefits)
CF: Social Costs of Forest Services Prevented Depending on the Tourism Activity to be Planned (Social Costs)
CT: Social Costs Caused By The Tourism Event To Be Planned

Public benefit is not just the sum of individual benefits, it has its own characteristic (holistic) this context, the benefit flows forming the relevant benefit axes should be evaluated in a holistic manner. İn this context, the X, Y, Z, P, Q, J coefficients in the formula below represent shows holistic values that related to benefit axes in the context of social and intrinsic value. Within the scope of the linear combination technique, the multiplication of the values of X, Y, Z, P, Q, J with the criteria and spatial indicator values constitutes the public benefit on the relevant axis.

FB = X.(BF1).(GBF1) + Y.(BF2).(GBF2) + Z.(BF3).(GBF3)

X: Average value that public and interest groups attribute to the environmental-ecological benefit axis of forests in the context of social and intrinsic values.
Y: Average value that the public and interest groups attribute to the economic-financial benefit axis of forests in the context of social and intrinsic values.
Z: The average value that public and interest groups attribute to the socio-cultural benefit axis of forests in the context of social and intrinsic values.
BF1: The Sum of Public Benefits of Forestry Benefit Criteria on the Environmental-Ecological Axis
BF2: The Sum of Public Benefits of Forestry Benefit Criteria on Economic - Financial Axis
BF3: The Sum of Public Benefits of Forestry Benefit Criteria on the Socio-Cultural Axis

BF1 = (BF1a.(G1) + BF 1b.(G2) + BF1c.(G3) + BF1d.(G4) + BF1e.(G5) + BF1f.(G6))
BF2 = (BF2a.(G7) + BF2b.(G8) + BF2c.(G9) + BF2d.(G10) + BF2e.(G11))
BF3 = (BF3a.(G12) + BF3b.(G13) + BF3c.(G14) + BF3d.(G15) + BF3e.(G16) + BF3f.(G17) + BF3g.(G18))

G: İt is spatial indicator value that showing the abundance or less of the benefit flows / losses in the related axes. This value can take the values of 0,1,2,3. 0 indicates that the relevant indicator has not been evaluated in the field.

The indicators are defined separately for each benefit / loss flows as G1, G2, G36.

FB= X.(BF1a.(G1) + BF1b.(G2) + BF1c.(G3) + BF1d.(G4) + BF1e.(G5) + BF1f .(G6))+ Y.(BF2a.(G7)+ BF2b.(G8) + BF2c.(G9) + BF2d.(G10) + BF2e.(G11))+ Z.(BF3a.(G12) + BF3b.(G13) + BF3c.(G14) + BF3d.(G15) + BF3e.(G16) + BF3f.(G17) + BF3g.(G18))
TB = P.(BT1) .(GBT1)+ Q.(BT2).(GBT2) + J.(BT3).(GBT3)

P: Average value that public and interest groups attribute to the environmental-ecological benefit axis of tourism in the context of social and intrinsic values.
Y: Average value that the public and interest groups attribute to the economic-financial benefit axis of tourism in the context of social and intrinsic values.
Z: The average value that public and interest groups attribute to the socio-cultural benefit axis of tourism in the context of social and intrinsic values.

BT1 = BT1a.(G24)
BT2 = (BT2a.(G19) + BT2b.(G20) + BT2c.(G21)+BT2d.(G22)+BT2e.(G23))
BT3 = (BT3a.(G25) + BT3b.(G26) + BT3c.(G27) + BT3d.(G28) + BT3e.(G29))

TB: Benefit of Tourism (Salt)
BT1: The Sum of Public Benefits of Tourism Benefit Criteria on the Environmental-Ecological Axis
BT2: The Sum of Public Benefits of Tourism Benefit Criteria on Economic - Financial Axis
BT3: The Sum of Public Benefits of Tourism Benefit Criteria on the Socio-Cultural Axis

CF = X.(CF1a.(G30) + CF1b.(G36))
CT = J.(CT3a.(G31) + CT3b.(G32)) + CT3c.(G33) + CT3d.(G34) + CT3e.(G35))

B = [X.(BF1a.(G1) + BF1b.(G2) + BF1c.(G3) + BF1d.(G4) + BF1e.(G5) + BF1f.(G6))+ Y.(BF2a.(G7)+ BF2b.(G8) + BF2c.(G9) + BF2d.(G10) + BF2e.(G11))+ Z.(BF3a.(G12) + BF3b.(G13) + BF3c.(G14) + BF3d.(G15) + BF3e.(G16) + BF3f.(G17) + BF3g.(G18))+Q.(BT2a.(G19) + BT2b.(G20) + BT2c.(G21) + BT2d.(G22) + BT2e.(G23)) +P.(BT1a(G24)) + J.(BT3a.(G25) + BT3b.(G26) + BT3c.(G27) + BT3d.(G28)+BT3e.(G29))] - [X.(CF1a.(G30) + CF1b.(G36)) +J.(CT3a.(G31) + CT3b.(G32) + CT3c.(G33) + CT3d.(G34) + CT3e.(G35))]

The B / FB value must be greater than 1 in order to make a superior public benefit decision.

Results and Discussion

The benefit coefficients results that calculated from the survey results applied to public and interest groups with a holistic perspective to ecological-environmental, economic-financial and socio-cultural axes are given below.

Table 1. Axes coefficients

Axes	Sector	Related Field	Coefficients
X	Forestry	Ecological-Environmental	3.8857
Y	Forestry	Economic-Financial	2.9714
Z	Forestry	Socio-Cultural	3.0285
Q	Tourism	Ecological-Environmental	3.2571
P	Tourism	Economic-Financial	1.4714
J	Tourisim	Socio-Cultural	2.5857

In the table below, the coefficients of the developed criteria calculated as a result of the survey application and the scores of the developed spatial indicators are given.

In this context, the coefficient was calculated for 36 criteria and spatial indicators scoring was determined for 108 indicator.

Table 2. Criteria and indicators developed for the allocation of forest resources to tourism

Criteria and Indicators for the Allocation of Forest Resources to Tourism	Coefficients and Scores
Criterion 1: The benefits of forests to society in terms of the rich biodiversity it contains.	3.6428
Indicator 1: Areas that include common forest types, flora and fauna.	1
Indicator 2: Areas containing rare forest types, mixed forest stands	2
Indicator 3: Areas that contain species in the IUCN conservation lists, Natura 2000 areas, wetlands, special environmental protection areas, national parks, nature park areas, natural monument areas, seed stands, areas containing endemic plant and animal species, cultural diversity elements areas where it leaves traces,	3
Criterion 2: The benefits of forests to society in terms of water production, protection and regulation of water availability, floods and avalanche prevention.	3.9
Indicator 1: Areas where the water supply is sustainable and the forest ecosystem has no effect on this supply, areas that do not have the risk of flooding, overflow and avalanche	1
Indicator 2: Areas where water supply is sustainable and at risk of flood, overflow and avalanche	2
Indicator 3: Areas that are high water consumption, water shortage, drought risk, at risk of flood, overflow and avalanche,	3
Criterion 3: The benefits of forests to society in terms of preventing erosion and protecting soil fertility.	3.8428
Indicator 1: Areas without erosion risk and soil conservation character	1
Indicator 2: Reforestation areas	2
Indicator 3: Areas with soil conservation character, Reforestation areas, erosion areas	3
Criterion 4: The benefits provided to society due to the protection of wildlife and wild animals and hunting services.	3.1285
Indicator 1: Areas that are not special in terms of wildlife and hunting services	1
Indicator 2: Areas where have local hunting resources and local hunting services	2
Indicator 3: Areas where have wildlife protection areas and national/international hunting areas	3
Criterion 5: the benefits provided by forests to society in terms of absorbing polluted air and noise.	3.7142
İndicator 1: Areas where do not present air and noise pollution	1
Indicator 2: Areas where have high air pollution and no noise pollution, or areas where have high noise pollution and no air pollution	2
Indicator 3: Areas where have high air pollution and noise pollution,	3
Criterion 6: The benefits of forests to society in terms of carbon storage and positive impact on climate.	3.6
Indicator 1: Areas where emission breakthroughs are not high, do not have extreme climatic conditions, where the volume of wood and plant-based material stored locally in a unit area (dead and alive cover) is smaller than the average volume in the regional unit area	1
Indicator 2: Areas where the volume of wood and vegetal origin stored locally per unit area (dead and living cover) is greater than the regional unit area, areas with extreme climatic conditions or high emission breakthroughs	2
Indicator 3: Areas where have high emission breakthrough and extreme climatic conditions, Areas where the volume of wood and vegetal origin (dead and living cover) stored locally in a unit area is greater than the volume in the regional unit area	3

(Table 2 Continued)

Criteria and Indicators for the Allocation of Forest Resources to Tourism	Coefficients and Scores
Criterion 7: Benefits of wood raw materials to society.	3.0714
Indicator 1: Areas where wood-based energy consumption is not common and where there is no employment opportunities based on wood raw materials, areas where wood raw material production capacity is low	1
Indicator 2: Existence of forest villages that have obtained legal rights depending on the area to be allocated (according to Articles 31 and 32 of the Forestry Law No. 6831), areas where have normal wood raw material production capacity	2
3.Indicator: Areas where wood is widely used as an energy source, areas with the potential to meet the needs of forest villagers and local people for timber and fuel wood raw materials, areas where have rare and distinctive wood raw materials, areas with high wood raw material production capacity areas of accumulation (wood carving, basket weaving, etc.)	3
Criterion 8: The benefits of products derived from wood (paper, furniture, etc.) to society.	3.3714
Indicator 1: Village and smaller residential areas	1
Indicator 2: Towns	2
Indicator 3: Urban areas	3
Criterion 9: Benefits of non-wood forest products (mushrooms, chestnut, resin, frankincense oil, medicinal and aromatic plants, etc.) to society.	3.1142
Indicator 1: Areas that do not have a potential for non-wood forest products	1
Indicator 2: Areas where non-wood forest products are not traded but are evaluated within the scope of home economy and have cultural accumulation	2
Indicator 3: Areas where non-wood forest products trade is carried out and have cultural accumulation related to non-wood forest products,	3
Criterion 10: The benefits of the regional forest industry to society.	2.6857
Indicator 1: Areas where the forest industry sector does not exist	1
Indicator 2: Areas where the forest industry sector is located but not among the leading sectors in terms of the regional economy	2
Indicator 3: Areas where have widespreadly the forest industry sector and regionally important for employment and the regional economy	3
Criterion 11: The benefits of wood products, products derived from wood, non-wood forest products and forest industry sector in terms of import substitution, export and foreign exchange input.	2.6714
Indicator 1: Areas where the forest industry does not contribute to export and import substitution	1
Indicator 2: Areas where have small and medium-sized enterprise and low export potential	2
Indicator 3: Areas where have a strong export potential of the regional forest industry sector and import-inhibiting product manufacturing is made	3
Criterion 12: The benefits of forests to society with the beauty of natural landscapes	3.7142
Indicator 1: Areas where have awareness in terms of landscape value	1
2. Indicator: Areas that people indirectly benefit from landscape value	2
Indicator 3: Areas where have rare landscape beauty, widely used	3
Criterion 13: Benefits provided to society due to employment created by forests.	2.8428
Indicator 1: Areas where forestry does not provide employment	1
Indicator 2: Areas where forestry creates employment but is not a leader	2
Indicator 3: Areas where forestry leads in employment	3

(Table 2 Continued)

Criteria and Indicators for the Allocation of Forest Resources to Tourism	Coefficients and Scores
Criterion 14: The benefits of subsidies provided by state forestry enterprise	2.9857
Indicator 1: Areas where subsidies are not provided to other sectors and within the scope of Articles 31 and 32 of the Forest Law	1
Indicator 2: Areas with forest villages within the scope of Article 32 of the Forest Law	2
Indicators 3: Areas where fuel and timber needs are provided to forest villages (Articles 31 and 32 of the Forest Law), Areas where subsidized forest products are given to other public institutions	3
Criterion 15: Benefits provided to society from traditional ecological information obtained from forests.	2.7714
Indicator 1: Areas where traditional ecological knowledge based on forest is not directly used	1
Indicator 2: Areas with traditional ecological knowledge based on forest, where this knowledge is directly used in local life	2
Indicator 3: Areas with traditional ecological knowledge based on forests, using their knowledge directly in local life and commercializing this knowledge	3
16. Criterion: Benefits provided by forests to society in terms of positive effects on human health.	3.6
Indicator 1: Areas that provide psychological renewal with fresh air and landscape beauty,	1
Indicator 2: Areas containing therapeutic herbal resources	2
Indicator 3: Areas that have different natural resources for thermal and therapy	3
Criterion 17 : The benefits of forests to society in terms of social stability and preventing migration from rural areas.	2.4
Indicator 1: Areas where forest ecosystem elements have no effect on preventing rural migration	1
Indicator 2: Areas that have migrated but where forest ecosystem elements partially halt migration and have an impact on migration	2
Indicator 3: Areas where there is no change in local population in terms of migration (forest village vb.)	3
Criterion 18: The benefits of forest rangelands to society	2.6857
Indicator 1: Areas where in-forest grazing opportunities are not available	1
Indicator 2: Areas where grazing livestock is carried out within the scope of home economy and where forest grazing is benefited	2
Indicator 3: Areas where grazing livestock is common and has commercial purposes	3
Criterion 19: Benefits to the society in terms of developing the sectors that provide input to tourism.	3.1285
Indicator 1: Areas where sectors that provide inputs for tourism are widely located	1
Indicator 2: Areas where sectors providing inputs for tourism are less developed	2
Indicator 3: Areas where the sectors that will provide input for tourism are not developed	3
Criterion 20: Benefits of tourism to society in terms of being a tool in rural development.	2.6571
Indicator 1: Areas not prioritized in development where rural development is achieved based on tourism	1
Indicator 2: Areas that are in the rural development process and where rural development can be accelerated with tourism	2
Indicator 3: Areas that could not achieve rural development, that have priority in development, where tourism can be the most sustainable development tool	3

(Table 2 Continued)

Criteria and Indicators for the Allocation of Forest Resources to Tourism	Coefficients and Scores
Criterion 21: The benefits of tourism to society in terms of its effect on the balance of payments.	3.2
Indicator 1: Enterprises that make more than 60% of tourism supply on a nationalty scale	1
Indicator 2: Enterprises that will make 70% of the tourism supply on an international scale	2
Indicators 3: Enterprises that will make the entire tourism supply on an international scale	3
Criterion 22: The benefits of tourism to the society in terms of income increase and quality of life.	2.8285
Indicator 1: Enterprises applying the all-inclusive concept, enterprises that have adopted a local labor policy, or those who directly procure their consumables from the manufacturer	1
Indicator 2: Enterprises that apply the half-board concept, Enterprises that have adopted a local labor policy, or those who supply their consumables directly from the manufacturer	2
Indicator 3: Enterprises that apply a bed and breakfast concept, enterprise that have adopted a local workforce policy, those who supply their consumables directly from the manufacturer	3
Criterion 23 : The benefits of tourism to society in terms of creating financial resources for environmental protection	1.8714
Indicator 1: Financial resource allocation to environmental protection for applications within the tourism enterprises	1
Indicator 2: The price policy that has financial instruments for environmental protection	2
Indicator 3: The existence of monetary funds for environmental protection purposes specific to the planned event and the existence of environmental protection projects,	3
Criterion 24: Benefits of tourism in terms of environmental protection	1.7714
Indicator 1: Projects that do not have a negative impact on the forest ecosystem	1
Indicator 2: Projects and activities that can provide the balance of protection and use and rehabilitation by using tourism in areas with conservation problems	2
Indicator 3: Projects with sustainable forest management certificate and sustainable tourism certification, projects with ISO 14001 standard	3
Criterion 25: Benefits to society in terms of employment created by tourism	3.2571
Indicator 1: Areas where unemployment is not high, areas that are not priority development and do not have employment potential for tourism locally	1
Indicator 2: Areas where have high unemployment, non-priority development, areas that can provide local tourism employment potential	2
3. Indicator: Areas that have high unemployment and priority in development, Areas that can provide local tourism employment potential, and will not affect the sustainability of other sectors in terms of employment	3
Criterion 26: The benefits of tourism to society in terms of rest, renewal and health and psychological aspects.	3.0857
Indicator 1: Areas that have high recreational potential (forest, natural landscape etc.)	1
Indicator 2: Areas that have high recreational potential, planned according to carrying capacity	2
Indicator 3: Planned according to carrying capacity, has adopted the management approach not based on demand but according to supply, has a high recreational potential and has natural resources for therapeutic purposes (spa, etc.)	3

(Table 2 Continued)

Criteria and Indicators for the Allocation of Forest Resources to Tourism	Coefficients and Scores
Criterion 27: Benefits of tourism in terms of cultural development.	2.7142
Indicator 1: The use of local cultural motifs and accumulations in enterprise management (folkloric clothes, local foods, etc.)	1
Indicator 2: Employment of the labor force that does not have employment potential in the tourism sector in terms of cultural development through corporate training practices (foreign language education, etc.)	2
Indicator 3: The existence of social policy and financial resources for the implementation and revival of cultural activities specific to the region (festivals, fairs, etc.) within the scope of the event, management policy, contribution to educational activities (school construction, etc.) and the presence of other cultural development tools	3
Criterion 28: Benefits of tourism to society in terms of international promotion.	3.3857
Indicator 1: Local level	1
Indicator 2: National level	2
Indicator 3: International level	3
Criterion 29: Benefits of tourism in terms of contribution to the formation of environmental protection awareness (culture).	2.2142
Indicator 1: Existence of training programs for raising environmental protection awareness within the scope of accommodation activities and their implementation to tourists	1
Indicator 2: Existence and implementation of training programs and projects aimed at raising environmental protection awareness at local level	2
Indicator 3: Existence and implementation of training programs to raise awareness of environmental protection at national level	3
Criterion 30: Public damages caused by cutting down trees, destroying nature and damaging visual values due to tourism activities.	3.1428
Indicator 1: Construction of tourism facilities without cutting trees	1
Indicator 2: The situation that the tourism facility is built by cutting trees at a level that does not disturb the integrity of the forest stand and does not affect the natural regeneration capacity and health of the stand	2
Indicator 3: The situation that tourism facilities are built by cutting trees at a level that will disrupt the integrity of the forest stand and negatively affect the natural regeneration capacity and health of the stand.	3
Criterion 31: Damages to society due to excessive water use caused by tourism activities.	2.7285
Indicator 1: Areas where there is no water scarcity, projects that have high water-saving technologies	1
Indicator 2: Projects that do not have high water-saving technologies in areas where there is no water scarcity,	2
Indicator 3: Projects with technology that do not provide high water savings in areas with water scarcity, projects using large amounts of irrigation water, projects that will affect ground water levels and related areas where the vitality of the forest ecosystem will be endangered	3
Criterion 32: Damages to society due to tourism activities, in terms of preventing the public from enjoying the sea coasts and allocated areas freely.	2.8571
Indicator 1: Projects that do not prevent the free use of the public from the seaside or allocated areas	1
Indicator 2: The situation that the public use is limited due to the use of coasts or allocated areas above the carrying capacity	2
Indicator 3: Prevention of free use of the public from the coasts or allocated areas by using barriers (wire mesh, entrance doors, security guards, sunbed occupation, etc.)	3

(Table 2 Continued)

Criteria and Indicators for the Allocation of Forest Resources to Tourism	Coefficients and Scores
Criterion 33: Harm to society due to traffic and noise that intensify due to tourism activities.	2.0
Indicator 1: Situations that noise pollution from Tourism Activities does not affect local people and wildlife	1
Indicator 2: Situations where noise pollution from tourism activity does not affect local people and affects wildlife	2
Indicator 3: Projects that new roads are built and the public and natural life will be heavily affected by noise	3
Criterion 34: Harm of solid waste and sewage wastes caused by tourism activities to society.	2.5571
Indicator 1: Areas with solid waste disposal facilities and projects with treatment plant	1
Indicator 2: Projects that do not have treatment plant in areas with solid waste disposal facilities, do not throw sewage wastes into natural environments, or have treatment facilities in areas where solid waste disposal facilities are not available	2
Indicator 3: Projects without solid waste disposal facilities and treatment plant, and projects that throw sewage wastes into natural environments	3
Criterion 35: Social damages caused by cultural erosion of the society and traditional cultural loss due to tourism activities.	1.7428
Indicator 1: Projects that use local cultural heritage in tourism activities, develop programs and create resources in line with the protection and maintenance of cultural heritage.	1
Indicator 2: Projects that use local cultural assets in tourism activities or develop programs in line with the preservation and maintenance of cultural assets and implement at least one of the activities of financial resource creation.	2
Indicator 3: Projects that have no activities under this criterion	3
Criterion 36: Damages given to society in terms of increasing forest fire risk.	1.7714
Indicator 1: Areas that have no forest fire risk	1
Indicator 2: In areas that have high forest fire risk, projects that have action plan against fire possibility	2
Indicator 3: In Areas that have high forest fire risk, projects that have not an action plan against the possibility of fire	3

Discussion and Conclusion

In the survey applied in this study, if the approaches that presented to the evaluation of the public and interest groups are evaluated based on the survey findings; Approaches reveal the expectations of society from forest resources in terms of tourism. According to the findings, the first approach was accepted with a rate of 21.42%, the second approach at 0%, and the third approach with a rate of 78.58%. These results can be interpreted as the decisions of different environmentalist perceptions in society. In this context, we can say that the first approach is advocated by deep ecologists and pure nature conservationists. Survey participants who representing this part of the public and interest groups advocate the idea that natural resources should be protected by strict rules and should not be used by humans. That the second approach is not accepted by any public and interest groups shows that capital forces and capitalism cannot do everything they want on forest resources for the sake of development and growth. At the same time, this finding indicates that the current process of allocation of forest resources for tourism purposes is not approved by the society. This indicator indicates that this practice is not in the public interest. The dominant acceptance of the third approach shows that a human-centered approach has been adopted. This result indicates that the society has expectations from forests in terms of tourism function.

As a result, it is understood that these expectations must be met within the scope of sustainability principles and protection-use balance. In order to meet these expectations within the scope of sustainable development, the evidences obtained from the answers given to the questions asked to the public and interest groups in the questionnaire and the evaluation of these evidences also determine the limits of the problem solving process. In this context, if the evidences of the ecological and environmental functions of forest resources are evaluated:

The value attributed to biological diversity in our specific subject is 3.6428. This value shows that the society considers biological diversity very important and useful within the scope of social and intrinsic values. At the same time, this avidence indicates that although the biodiversity function of forests cannot be priced, it has a very high value in the value world of the society. This indicator shows that in the process of allocating forest resources to tourism, the allocation of rich biodiversity areas should not be carried out with priority. In other words, this indicator states that the society's expectations from the tourism function of forests should be met outside the areas that are not important and valuable in terms of biodiversity.

The benefits provided by forest resources in terms of water production and protection of water and the function it undertakes has been the most important function with a value of 3.9 within the scope of the research. This value shows that the primary function in prioritizing the society's expectations from forests is water production.

This situation shows that forest resources, which are special in terms of water production and protection of water existence, prevention of floods and avalanches, should be managed primarily to fulfill these functions. As a result, it appears that the allocation of forest resources, which have functions within the scope of the relevant criterion to tourism should be made provided that the relevant functions of forest resources are not hindered and sustainability is ensured.

The functions undertaken by forest resources in terms of preventing erosion and protecting soil fertility and the benefits they provide to the society have been found very important and beneficial by the public and interest groups. In this context, the value attributed to the relevant criterion is 3.8428. This value shows that the second priority expectation of the society from forest resources is erosion prevention and soil protection. This situation also shows that the tourism function of forest resources should be done in areas that do not have erosion and soil conservation characteristics, and the relevant functions of forest resources should not be blocked.

The function undertaken by forest resources as hosting wildlife protection and hunting services received a value of 3.1285 in the survey application. This value shows that society cares very much about the relevant function of forests. Although a large part of the society does not benefit from the services arising from the relevant function, the preservation of wild animals and their pleasure in knowing their existence is an indication that they perceive natural areas and wildlife as an element that connects people to nature. In this context, planning approaches should be developed to ensure the preservation of the relevant processes in the event that the areas with the relevant function in the allocation of forest resources to tourism are not primarily subject to allocation and there is a necessity.

Society attributed the value of 3.7142 to the function undertaken by forest resources in terms of preventing air pollution and noise, which are negative externalities created by unplanned urbanization, industrialization and modern life. This value is an indication that the relevant function of forest resources is highly regarded and beneficial by the society, as well as an indicator that it is perceived as an important environmental problem by the society in its negative externalities related to the relevant function. In this context, in the allocation of forest resources to tourism, forest resources, which have a priority task in

terms of the relevant function, should not be allocated primarily to tourism. In case of necessity, planning activities should be carried out in order to maintain the relevant functions.

The function undertaken by forests in terms of climate change, which is one of the current environmental problems of our world, and its effects has received a value of 3.6 within the scope of the survey. This value shows that the society attaches great importance to the relevant function and perceives the environmental problems related to the relevant function among the very important problems. In the allocation of forest resources to tourism, the areas that are characteristic in terms of the relevant function should not be subject to allocation as a priority, and planning approaches should be developed in line with the sustainability of the relevant function in case of necessity.

In line with the above expectations, if the findings of the economic-financial functions of forest resources are evaluated within the scope of the survey; The values attributed by the society to the benefit levels provided in terms of wood raw material production function, wood derived products and non-wood forest products, which constitute the economic and financial benefit flows of forest resources and forestry sector; It is 3.0714 for wood production, 3.3714 for wood-derived products, and 3.1142 for non-wood forest products. These values show that the society cares very much about related functions and finds them very useful. In addition, these values show that a forestry policy based on wood production priority is not accepted by the society. As a result, related functions should not be hindered in the allocation of forest resources to tourism and sustainability should be ensured.

The benefits provided to society by the forest industry sector, which develops depending on the existence of forest resources, was among the moderately beneficial group with a value of 2.6857 in the relevant survey. This situation shows that in the process of allocating forest resources to tourism, long-term effects on the forest industry sector should be taken into account. Although the export and foreign exchange input of forestry is not very high according to the calculated figures, the benefits of forestry to the society in terms of export, foreign exchange input and import substitution took place among the moderately beneficial group by taking the value of 2.6714 in the relevant survey. It can be said that this value is very meaningful considering that there is a serious import substitution, especially since the wood raw material produced from the forest resources of the country is used in domestic consumption. This situation indicates the necessity of maintaining the related function in the management of forest resources.

If the survey findings regarding the sociocultural functions of forest resources are evaluated within the scope of the above-mentioned expectations:

The natural landscape beauty of forests and the benefits they provide to society were valued at 3.7142 within the scope of the survey. This value indicates that the public and interest groups consider the related benefit flow of forests very useful. From this indicator, it can be concluded that areas that create awareness in terms of landscape value and have the potential for direct and indirect use of the public can be used in tourism allocations, provided that the balance of protection use is established and that the local people are not prevented from using the relevant areas.

The benefit value obtained from the employment created by the forestry sector has taken the value of 2.8428 within the scope of the survey and entered among the medium useful benefit streams. This value indicates that in tourism allocation of forest resources, employment flows depending on the area to be allocated should be taken into consideration moderately.

The value of benefit obtained from the employment created by the forestry sector took the value of 2.8428 within the scope of the survey and took place among the medium useful benefit flows. This value indicates that

in tourism allocation of forest resources, employment flows depending on the area to be allocated should be taken into consideration moderately.

Benefit flows that consist of subsidies provided by the state forestry enterprises to forest villages and some public institutions and organizations, entered the moderately beneficial group, taking the value of 2.9857 within the scope of the survey. This situation shows that legal restrictions on subsidies should not be created especially in the allocation of forest resources to tourism, and allocation decisions should be taken to protect the subsidy rights of the local people.

Benefits that derived from traditional ecological knowledge based on forest resources got a value of 2.7714 within the scope of the survey. This value shows that this aspect of forest resources, which has contributed to the formation of traditional ecological knowledge and contains objects that enable the use of relevant cultural knowledge in contemporary life, should be taken into account in allocation decisions and the relevant utilization should not be prevented.

The benefits of forest resources in terms of positive effects on health have been valued as 3.6 within the scope of the relevant survey. This value is an indication that the public and interest groups see the relevant function of forests very useful, and also shows the willingness to benefit from this function provided that the balance of protection and use is achieved.

The benefits of forest resources in terms of preventing migration from the countryside and ensuring social stability were valued at 2.4 within the scope of the survey. This value indicates that the public and interest groups consider the relevant benefit flows moderately beneficial. Therefore, relevant social facts should be taken into account in allocating forest resources to tourism.

In-forest rangelands within forest resources are of great importance in rural life, especially for animal husbandry. The benefits provided by forest resources in this direction took the value of 2.6857 within the scope of the questionnaire and entered among the medium-grade benefit group. This situation indicates that such social utilization within forest resources should be taken into account and should not be restricted in relevant allocation decisions.

If we evaluate the findings obtained from the survey on the economic-financial functions of tourism activities that will operate on forest resources within the scope of the expectations stated above:

The benefits of the tourism facilities to be planned on the areas to be allocated to tourism from forest resources to the society in terms of developing the sectors that provide input to tourism have been valued as 3.1285 within the scope of the survey. This value indicates that the socially relevant benefit flows seen as very useful. In the allocation of areas to tourism facilities to be planned on forest resources, the selection of areas that will provide input for tourism and the areas where the relevant sectors are not developed is important in terms of the maximum benefit to be provided.

The benefits of tourism as a tool in rural development got a value of 2.6571 within the scope of the survey. The relevant value indicates that this function of tourism is deemed to be moderately useful. In land allocation, it is important to choose areas with priority for development and high development potential through tourism, in terms of the level of benefit this benefit flow will provide.

The benefits of foreign currencies that obtained from tourism in terms of their effect on the macro economy and the balance of payments have been among the group found very useful, took the value 3.2 in the relevant survey. The maximum benefit provided in this context depends on whether the relevant tourism activities make the tourism supply at national or international level and the foreign trade balance sheet indicators. As a result, maximizing the benefit of the tourism facility to be planned and operated in this context depends on the positive factors affecting the relevant benefit flow.

The benefits provided by tourism to the society in terms of income increase and welfare are included in the moderately beneficial group with 2.8285 values within the scope of the survey. The maximization of the benefits provided within the scope of this function depends on the concept (all-inclusive, full board, half-board, etc.) to be implemented by the enterprises to be operated, the local labor force policy and the local consumption.

The benefit flow that tourism can provide to society by creating financial resources for environmental protection was found to be less useful, taking the value of 1.8714 within the scope of the survey. This value shows that the society does not have a priority expectation from tourism in terms of creating financial resources for environmental protection. Within the scope of the above-mentioned expectations, if the survey findings regarding the benefits that tourism can provide on the ecological-environmental axis are evaluated: Tourism can provide protection with the start of tourism activities in areas whose protection and development are not possible under normal conditions. The public and interest groups attribute a value of 1.7714 to such benefit flows within the scope of the survey. This value shows that the benefit to be obtained from tourism in this context is found to be less useful.

If the survey results regarding the socio-cultural functions of tourism are evaluated within the scope of the above-mentioned expectations: The benefits of employment provided by tourism to the society were among the very beneficial group with a value of 3.2571 within the scope of the survey. Maximization of this value will be possible by allocating forest resources to tourism in regions where have high unemployment rates and tourism employment potential and priority development. The benefits of tourism to society in terms of rest, renewal and health and psychological aspects were valued at 3.0857 within the scope of the survey. This value shows that the society will benefit from the tourism facilities to be established on forest resources in terms of rest, renewal, health and psychological aspects. The maximization of this benefit depends on the conservation and sustainable management of the tourism supply resources (clean air, landscape, suitable carrying capacity, etc.) that create the respective benefit flows. The benefits of tourism in terms of cultural development are thought to be moderately beneficial (2.7142) by the public and interest groups. This value shows that tourism can contribute positively to the cultural development of the society. The maximization of the benefit to the society from the relevant benefit flow is related to activities such as the use of cultural motifs and accumulations in enterprise management, the training of local unqualified human resources, and the support of local or regional festivals, fairs and similar events. The public and interest groups have confirmed the fact that the maximization of the benefit to be obtained from tourism is through publicity by giving a value of 3.3857 in the relevant survey. In this context, increasing the social benefit of tourism activities is related to the fact that the promotional activities are at local, national and international level, and the use of local awareness and cultural motifs as a means of promotion. The benefits of tourism to the society in terms of contributing to the formation of environmental protection awareness were evaluated in the relevant questionnaire 2.2142. This value shows that the public and interest groups consider the activities (education programs, etc.) to be carried out in terms of creating environmental protection awareness of tourism activities moderately useful. In order to maximize the public benefit to be provided within the scope of the related benefit flow; Activities to be implemented with the aim of raising awareness should be carried out within the facility, at local and national level.

Tourism facilities to be planned on forest resources may produce some social damages both during the construction process and during the operation process. If these damages are evaluated within the scope of the survey

results; The value attributed within the scope of the survey to damages that can be caused by cutting down trees for the purpose of providing land for tourism facilities, destruction of nature and visual values is 3.1428. This value shows that the society considers the related damage flows very harmful, that the trees should not be cut down in the allocation of forest resources to tourism, and they want nature and visual values not to be damaged.

A value of 2.7285 was given to the social damages arising from excessive water use that will occur with the activation of tourism facilities. This value indicates that the relevant negative impact is considered moderately harmful by the society. In this context, in order to reduce the negative effects of tourism facilities to be planned on forest resources, it is necessary to use water-saving technologies and an area selection strategy that will not create conflict in water use. The value that given in the scope of the survey is 2.8571 for social damages caused by the construction of tourism builts and restriction of the use of traditionally used areas (beaches, natural areas, etc.). This value indicates that the society considers the related damage flows moderately harmful.

In this context, the ancient uses and values of the local people should be respected in land use and the spatial sizes to be allocated should be planned in consideration of this situation. In short, strategies that do not create conflicts in terms of land use and that add social decision dynamics to the utilization decisions should be developed. Damages that may be caused to society due to noise arising from traffic and recreational activities, which increase depending on the activities of tourism facilities, were included in the medium-level loss group by taking a value of 2.00 within the scope of the survey. In addition to the negative effects of noise pollution on humans, it has been determined that it has significant negative effects on wild animals in natural environments.

For this reason, tourism facilities to be planned on forest resources should take the necessary precautions in order not to create noise pollution. hese measures can be listed as utilizing technological facilities suitable for sound insulation in entertainment units, not destroying wooded areas and forests that may create noise curtains, avoiding road planning strategies that will create noise pollution by developing public transportation strategies, and installing artificial noise barriers when necessary. In the related survey, a value of 2.5571 has been given to social damages arising from solid waste and sewage wastes that will occur as a result of the activities of tourism facilities. This value indicates that the related loss flow is considered moderately harmful. Facilities must manage their solid waste and sewage wastes in a way that does not cause social damage. In this context, treatment and solid waste facilities should be built, or the relevant harmful factors should be removed by moving to such places.

If solution suggestions are given for the ecological-environmental problems determined during the research process;

- Lands that have rich biological diversity should not be subject to allocation.
- Rare areas (In terms of habitat characteristics and stand establishment) should be excluded from the allocation scope.
- In allocation decisions, the regeneration capacity of the dominant ecosystem elements that make up the forest ecosystem should be preserved, sustainability should be guaranteed, and deforestation should not be caused.
- Forest areas with soil conservation character, dune prevention, noise and wind prevention functions should be excluded from the allocation scope.
- In the obligatory tree cuttings, applications should be made within the scope of silvicultural principles that will not damage the stand structure and adversely affect the rejuvenation capacity.
- In constructions, the upper height of the stand should be taken as reference, and care should be taken to ensure that the building materials to be used are of a nature that does not disturb the natural integrity.

- In determining the size of the area to be allocated, care should be taken not to fragment the ecological corridors.
- Road densities should be kept to a minimum in allocated areas, sea transportation on the coastline and alternative transportation methods in mountainous regions should be considered.
- Solid waste disposal facilities should be built before the tourism facilities are put into operation and should be managed in a way that does not harm the environment.
- During the period when tourism facilities are in operation, modifications that will adversely affect the carrying capacity and ecological processes should not be allowed.
- Tree survey plans prepared for allocated areas should be applied to the area periodically and necessary supervision should be provided.
- Genetic pollution should be prevented by not allowing the use of species other than natural vegetation in artificial landscape applications of tourism facilities.

If solution offers are given to the problems identified within the scope of this study in terms of administrative, legal and political aspects;

- Administrative, political and legal problems of other sectors that are in conflict with forest resources should be harmonized on the basis of sustainable development.
- The mandatory authority of the tourism law over the forest law should be legally abolished, within this scope, the tourism law should be rearranged and passed through the parliament, thus ensuring the public benefit of the tourism law in terms of the political process.
- By creating awareness and public opinion about decision processes, active participation of society dynamics in decision processes should be ensured, and the social and political authority gap should be eliminated in this regard.
- The process from allocation of land to the opening of the tourism facilities to be planned on forest resources should be managed with a holistic perspective. In this context, the management of forest resources within the scope of the relevant function should be carried out by the forestry organization in one hand and at a single stage, and administrative and legal processes related to this issue should be developed.
- It should be obligatory to obtain the approval of authorized independent forest engineers for the planning and area management of tourism activities to be planned on forest resources.

If the comments and suggestions made as a result are collected;

Forestry is defined as the totality of activities carried out with the aim of procuring the goods and services that society expects from forests, Within the scope of the research results, it is concluded that a large part of the society has expectations from forests in terms of tourism function and they want to benefit from the tourism function of forests. The managerial processes required to achieve this expectation should be developed by the forestry organization and managed within the scope of forestry. Current practice in Turkey, the allocation of forests to tourism and tourism functions of forests are not managed by the forestry organization to draw attention. This process is managed by the Ministry of Tourism. The management of the decision process on whether forest resources will be allocated to tourism activities to be planned on forest resources and under what conditions should be handed back to the forest organization by law. In this context, necessary changes should be made in the forest law numbered 6831 and tourism law numbered 2634. In the tourism law numbered 2634, there should not be any regulation regarding the allocation of land for tourism enterprises to be built on forests. After the completion of the law changes, the tools of the administrative process should be developed and relevant regulations should be issued within this scope.

The regulations to be prepared should take the allocation model developed in this study as reference and apply it. These regulations; It should be in the content that regulates the works and procedures regarding the determination, inventory and announcement

of forest resources to be subject to allocation for tourism purposes and the principles of the preparation and evaluation of investment projects of investors who will make tourism investments on forest resources to be allocated for tourism purposes. Administrative process must start with inventory of forest resources that have high the tourism potential. Within the scope of the regulation to be prepared, an inventory commission that consists relevant public institutions and organizations, universities, local people and non-governmental organizations should be established under the chairmanship of the Ministry of Forestry. The Commission should carry out the inventory study taking into account the basic constraints determined for the allocation of forest resources to tourism.

Subsequently, the results of the inventory and the identified constraints should be shared with the investors and these areas should be announced to the investors upon request and as the forestry organization deems appropriate. It should be sought for the entrepreneur who will make tourism investments in the relevant field to accept the basic constraints related to the field, and this obligation should be based on a legal basis. Investors who want to invest in the area to be allocated to tourism investments should prepare their investment projects with an approach that includes sustainability principles, criteria and indicators, the projects should be presented to the forestry organization and whether it provides superior public benefit within the scope of the allocation model developed. The area should be allocated to the project that provides the highest public benefit. Why projects that do not provide superior public interest fail should be communicated to the parties in a technical report. Why projects that do not provide superior public interest fail should be communicated to the parties with a technical report. In the allocated area, within the scope of basic constraints, the construction audit should be carried out by the forestry organization until the investment is completed and afterwards. The Ministry of Tourism should have the authority to control whether the restrictions are complied with in terms of tourism management. This process should be managed by organizations that issue independent sustainable tourism certificates, deviations from commitments should be detected and necessary conditions should be fulfilled. The sustainable tourism certificate of the enterprises that do not fulfill the problems in the implementation process should be suspended and tourism activity should be stopped until the sustainability conditions are met.

In terms of forest resources management, the authority and responsibility of the area should be under the Ministry of Forestry, the inspection of the area should be done by independent organizations that issue sustainable forest resources management certificates and the certificates should be renewed periodically. In the process of activity, deviations from sustainable forest resources management should be determined by this means and necessary corrections should be made. Otherwise, the certificate should be suspended and tourism activities should not be allowed in the area until sustainability conditions are met. With the proposed new implementation process, conservation-using balance will be achieved in the allocation of forest resources to tourism and the public benefit generated by both sectors will be benefited from. As the last word; In accordance with the purpose of the research, problems regarding the allocation of forest resources for tourism purposes have been identified, in this context, it will realize the appropriate allocation of resources to be allocated to tourism, ensure the balance of conservation-use, realize sustainable natural resource management and provide superior public interest, a two-sectoral and multi-sectoral It can be said that the allocation model that provides a comprehensive assessment with criteria has been developed. The developed model was applied to Belek tourism center and ılgaz Yıldız Tepe tourism center in order to determine the superior public benefit. Belek tourism center has not

provided superior public benefit by taking 0.9723 value. Ilgaz Yıldıztepe tourism center has provided superior publik benefit by taking 1.4268.

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Evaluating of Physiological and Biochemical Characteristics of Different Provenance in *Pinus nigra* Seedlings

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Abstract

Aim of study: The aim of this study was to compare the physiological and biochemical characteristics of different provenance of two years old Anatolian black pine [*Pinus nigra* Arn. subsp. *pallasiana* (Lamb.) Holmboe] seedlings.

Area of study: The study was conducted in Denizli-Karahasanlı Forest Nursery. It was 450 m a.s.l and the general aspect was northwest.

Material and methods: Bare-root seedlings which were grown in Denizli-Karahasanlı Forest Nursery belonging to three seed stands (Denizli-Buldan, Uşak-Çatak and Çal-İnceler provenances) were compared. Root electrolyte leakage, chlorophyll content (chlorophyll a, chlorophyll b and total chlorophyll), total soluble sugars and water relation parameters [osmotic potential at full turgor ($\psi\pi_{100}$), osmotic potential at turgor loss point ($\psi\pi_{TLP}$), symplastic water at saturated point per dry weight of the shoot (Vo/DW) and the relative water content (RWC)] were determined at the end of the second growing season.

Main results: There was a significant difference between provenance in seedlings as to root electrolyte leakage and chlorophyll content except chlorophyll b. However, there wasn't significantly different between provenances in total soluble sugars and water relation parameters.

Highlights: Stress resistance was similar between provenances according to water relation parameters. In such studies, evaluation of the physiological and biochemical properties of the seedlings with field performances will give better results.

Keywords: Water Relation, Soluble Sugar, Seedling, *Pinus nigra*

Introduction

Turkey is an ecologically rich country with 78 million hectares of land in total. As of 2015, forestlands comprise 28.6% of Turkey's surface area (OGM, 2015). We should afforest degraded forest lands and bare areas to benefit from forests, to increase raw material resources to meet increasing industrial needs, to regulate water resources, and to restore natural balance (Ürgenç, 1986). Afforestation is of paramount importance to prevent deforestation and to allow forests to fulfill their functions (Boydak & Çalışkan, 2014). The Anatolian black pine is one of the important tree species in Turkey. It is a suitable species for afforestation because it expands into the steppe, needs little soil, and has a high tolerance to heat, drought, and winter cold (Saatçioğlu, 1976). It is ubiquitous across 4.2 million hectares in Turkey, except for the Southeastern Anatolia and Eastern Anatolia regions (OGM, 2019).

Seedling quality directly affects plantation success in afforestation and artificial regeneration efforts (Gülseven et al., 2019). Ritchie & Schula (1984) argue that we should know both the morphological and physiological properties of seedlings and make sure that they agree well with each other to get an accurate result in afforestation and artificial regeneration. Also Deligöz & Genç (2010) state that the establishment and growth performance of bare-root seedlings depends on the plantation site's ecological conditions and the seedlings' morphological and physiological quality at the time of planting. The following physiological properties are taken into account to assess seedling performance; carbohydrate reserve in seedlings, chlorophyll content in leaves, cold tolerance, cold and frost damage, dormancy, gas exchange capacity, plant growth hormone content, root growth potential, and water potential (Semerci, 2002). Water potential shows how much water a plant needs Ritchie

& Landis, 2005). The osmotic potential at turgor loss point ($\psi\pi_{TLP}$) is the water potential of a cell when the turgor pressure completely disappears, and plasmolysis begins with the separation of the wall and cell membrane. Therefore, it is a physiological property that plays a crucial role in seedling quality (Dirik, 1999). The root electrolyte leakage (REL) is an important indicator of post-planting survival (Perks et al 2001). Radoğlou (2007) argues that REL can be used to predict the performance of tree seedlings. Carbohydrate reserve is another critical parameter. While adapting to a new environment, the conditions in which seedlings are may not be suitable for net photosynthesis functions. Therefore, seedlings use carbohydrate reserves to continue respiration and repair their damaged tissues (Marshall, 1985). Leaf chlorophyll content provides precious information about the physiological status of plants. It varies both between and within species (Udeagha et al. 2016). This study compared the physiological and biochemical properties of 2 + 0-year-old Anatolian black pine [*Pinus nigra* Arn. subsp. *pallasiana* (Lamb.) Holmboe] seedlings of different provenance grown under the same ecological conditions. We believe that the results will help us select the species of ideal provenances for future afforestation projects, especially in arid and semi-arid regions.

Material and Methods

Material

As a material, 2 + 0-years-old bare-root Anatolian black pine seedlings of Denizli-Buldan, Çal-İnceler, and Uşak-Çatak provenances which grown in the Denizli Forest Nursery Directorate/Karahasanlı Nursery were used. Denizli Forest Nursery Directorate/ Karahasanlı Nursery is located between 37 ° 48' 44'' north latitudes and 29 ° 01' 45'' east longitudes. It is 450 meters above sea level. Its general view is northwest. The annual average temperature is 15 ° C, the annual highest average temperature is 41.2 ° C, the annual lowest average temperature is -11.6 ° C. Annual average rainfall is 496.8 mm. Annual average relative humidity is 59.6% and the lowest relative humidity is 5%. The type of nursery soil ranges from loam, sandy clay, loam and sandy loam. Soils are rich in nitrogen according to soil analysis (Anonim, 2006).

Method

Anatolian black pine seedlings belonging to three different provenances were lifted at the end of the second growing period in Karahasanlı Nursery. The lifted of the seedlings was carried out without damaging the seedlings while the soil was in tilt condition. After lifted, the seedlings were washed in tap water to remove soil residues from their roots. Then, the seedlings were put in polyethylene bags and brought to Isparta University of Applied Sciences, Faculty of Forestry laboratory. Water relations parameters [osmotic potential at turgor loss point ($\psi\pi_{TLP}$), osmotic potential at full turgor ($\psi\pi_{100}$), symplastic water at saturated point per dry weight of the shoot, (V_0/DW), relative water content (RWC)], root electrolyte leakage (REL), total soluble sugar (TSS) and chlorophyll content (Chl a, Chl b and Chl a+b) were determined.

Water Relations

To measure the plant water potential components, the pressure chamber technique and pressure chamber device found in by Scholander et al (1965) were used. Selected seedlings were cut from the root collar and fresh weights of shoot samples were measured on the scale (0.0001 g). The saturated weight of the shoot samples was determined by keeping them in pure water for 24 hours. Measurements were repeated with pressure levels of 0.3 MPa in 3 shoots, which were considered to be fully saturated (if the first measured water potential value was greater than -0.15 MPa) from the shoot samples until 25 points were taken if necessary and then the pressure-volume curve has been created. With the help of P-V curve, $\psi\pi_{TLP}$ and $\psi\pi_{100}$ were calculated. In addition, Vo/DW and RWC value has been calculated (Ritchie, 1984; Dirik, 1999).

Root Electrolyte Leakage

Root electrolyte leakage (REL) was determined by McKay (1992) method. Sample fresh roots weight ranged from 0.2 g to 0.5 g were cut from mid-way down the

system of the rinsed roots. After samples were added to glass bottles containing 16 ml distilled water. Then the samples were kept in the dark at room temperature for 24 h. The conductivity of the solution was measured using a conductivity meter after 24 h and again after autoclaving (110 °C for 10 min).

Total Soluble Sugar

The total carbohydrate content of the samples was made using the phenol sulfuric acid method according to Dubois et al. (1956).

Pigments

Photosynthetic pigments (Chl a, Chl b, Chl a+b) were determined according to Arnon (1949) method. The absorbance of the samples was measured at 450, 645 and 663 nm with a spectrophotometer.

Data

The data obtained were evaluated in SPSS 25.0 for windows package program. In order to compare the physiological and biochemical characteristics of Anatolian black pine seedlings of different provenances, variance analysis was determined for each characteristic separately. If there was a difference, the Duncan test was performed.

Results

The water potential components ($\psi\pi_{TLP}$, $\psi\pi_{100}$, V0/DW, and RWC) were obtained using the pressure-volume (P-V) curve method (Table 1). The seedlings of Denizli Buldan and Usak-Çatak provenances had $\psi\pi_{TLP}$ of -2.87 MPa and -3.02 MPa, respectively. The $\psi\pi_{100}$ ranged from -1.53 MPa to -1.57 MPa, Vo/DW from 0.56 to 0.75, and RWC from 93.30% to 93.63%. The analysis of variance did not show any significant difference in $\psi\pi_{TLP}$, $\psi\pi_{100}$, V0/DW, and RWC between the three provenances (Table 1).

Denizli-Buldan, Çal-İnceler, and Uşak-Çatak seedlings had a REL of 42%, 63%, and 52%, respectively. Cal-İnceler seedling had a significantly higher REL than Denizli -Buldan seedling (Figure 1). In Figure 2, there was no significant difference in total carbohydrate content between seedlings ($p>0.05$). Denizli-Buldan, Çal-İnceler, and Uşak-Çatak seedlings had a total carbohydrate content of 65 mg/g, 69 mg/g, and 75 mg/g, respectively.

Table 1. Water potential components of Anatolian black pine seedlings in different provenances

Provenances	$\psi_{\pi TLP}$ (MPa)	$\psi_{\pi 100}$ (MPa)	Vo/DW	RWC (%)
Denizli-Buldan	2.80±0.03a	1.54±0.16a	0.75±0.08a	93.31±0.62a
Çal-İnceler	2.87±0.07a	1.57±0.18a	0.65±0.10a	93.63±1.06a
Uşak-Çatak	3.02±0.11a	1.53±0.07a	0.56±0.06a	93.30±0.96a

Similar letters indicate similar groups ($p>0.05$).

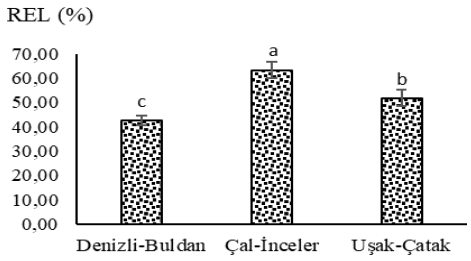

Figure 1. Root electrolyte leakage (REL) value of Anatolian black pine seedlings in different provenances (Different letters indicate different groups, $p<0.05$)

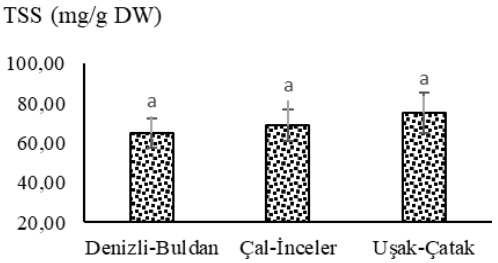

Figure 2. Total soluble sugar content (TSS) of Anatolian black pine seedlings in different provenances (Similar letters indicate similar groups, $p>0.05$)

There was a significant difference in chlorophyll a and total chlorophyll content content between seedlings ($p<0.05$). Çal-İnceler seedling had the highest chlorophyll a and total chlorophyll content. On the other hand, there was no significant difference in chlorophyll b content between seedlings ($p>0.05$; Figure 3).

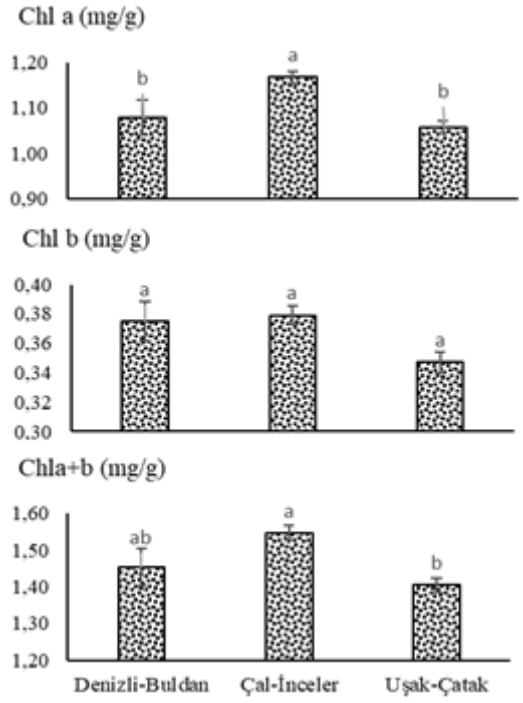

Figure 3. Photosynthetic pigment content (Chl a, Chl b, Chl a+b) of Anatolian black pine seedlings in different provenances (Similar letters indicate similar groups, $p>0.05$; Different letters indicate different groups, $p<0.05$)

Discussion and Conclusions

The $\psi\pi_{TLP}$ depends on the species of tree, season, temperature, nutritional status, and times of the day. Therefore, the P-V curve method should be used to determine $\psi\pi_{TLP}$ for each tree species, and data should be used for plantation efforts (Yahyaoğlu, 1987). The 2 + 0-year-old Anatolian black pine seedlings of different provenances had a $\psi\pi_{TLP}$ of -2.80 MPa to -3.02 MPa in December. Deligöz & Öztürk (2018) found that *Pinus brutia* Ten. seedlings from different seed orchards had change $\psi\pi_{TLP}$ between -2.80 MPa to -3.20 MPa in November. Dirik (1999) reported that the $\psi\pi_{TLP}$ of Anatolian black pine seedlings started to decline in November, reached its lowest level in mid-January, and started to rise again in February and peaked in March. Denizli-Buldan, Çal-İnceler, and Uşak-Çatak seedlings had similar $\psi\pi_{100}$ values. However, $\psi\pi_{100}$ was -1.5 MPa higher than the $\psi\pi_{TLP}$, which was also the case in *Pinus brutia* (Dirik, 2000) and *Cedrus libani* (Semerci, 2002). Çalıkoglu (2002) argues that plants with low $\psi\pi_{100}$ reach plasmolysis, that is, $\psi\pi_{TLP}$, late. There was no significant difference in $\psi\pi_{TLP}$ and $\psi\pi_{100}$ between seedlings ($p>0.05$). Dirik (2000), states that Vo/DW varies across seedlings, but it is generally higher in seedlings with low $\psi\pi_{TLP}$. There was no significant difference in Vo/DW and RWC between seedlings. As a general rule, 90% < RWC < 100% is about the closing of the stomatal pore, cellular enlargement, and a reduction in growth (Gonzáles & Gonzáles-Vilar, 2001). RWC is an important indicator of water status in plants as it points to the balance between water supply in the leaf tissue and the transpiration rate (Lugojan & Ciulca, 2011).

REL may play an important role in plantation performance (Davis & Jacobs, 2005). In this study, there was a significant difference in REL between seedlings. Çal-İnceler seedling had the highest REL. REL shows the health and function of root cell membranes (Ritchie et al., 2010), and therefore, it is an indicator of the semi-permeability of cell membranes (McKay, 1998) and root injury, and thus, quality. Low REL indicates high root viability (Ritchie et al., 2010).

Carbohydrate reserves have important functions in plants. Newly planted seedlings cannot yet photosynthesize enough, and therefore, they use carbohydrate reserves to grow new roots. In other words, the positive effect of the carbohydrate content is not negligible, especially in newly planted bare-root seedlings (Wang, 1998). There was no significant difference in total carbohydrate content between seedlings. However, there was a significant difference in all chlorophyll contents, except chlorophyll b, between seedlings. Çal-İnceler seedling had the highest chlorophyll a and total chlorophyll contents. Chlorophyll is an important photosynthetic pigment for the plant, largely determining

photosynthetic capacity and plant growth (Li et al., 2018).

In this study, some physiological and biochemical characteristics were compared in 2 + 0-year-old Anatolian black pine seedlings of three different provenances. Denizli-Buldan and Usak-Catak seedlings had lower REL and chlorophyll pigment content than Çal-İnceler seedling. Although $\psi\pi_{TLP}$ was ranged from -2.80 MPa to -3.02 MPa, stress resistance was similar between provenances. However, Bayar & Deligöz (2017) found that morphological properties of seedlings with the same provenances were different. But, in such studies, evaluation of the physiological and biochemical characteristics of the seedlings with field performances will give better results.

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Investigation of Green Urban Area Spread Quality in Oltanbey District of Gumushane Province

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Abstract

Aim of study: In this study, Oltanbey neighborhood's green area distribution were examined that it's a new settlement area of Gumushane province. It is to determine the current situation and improve the green areas plans. Changes in the urbanization process for the province accelerated in 2008 with the establishment of the university. It is changes in the population growth necessitated new structuring due to the building which did not meet the needs in the vision of modern city.

Area of study: In the Gumushane where topography is of great importance, Oltanbey neighborhood has an important position in the transportation line that requires aesthetic concern at the entrance of the Gumushane city.

Material and methods: Data were made using satellite images, topographic maps and city adjacent maps of Gumushane city settlement areas. Green areas and settlements were determined from the images and their areas were found numerically. Analyzes were made in GIS environment. Old historical camera photographs and current photographs were compared.

Main results: As a result of the study, it was found that the physical usage of the region did not meet the green area requirement per person. In addition to, in the development plans created in this direction, it was determined that the green area approach was inadequate and the region had suitable extension characteristics to increase it. The data obtained in this study are thought to shed light on the ongoing studies in the region.

Highlights: It had been determination of the green texture of the neighborhoods in Gumushane city center. It had been comparison of residential areas (old and new) with green texture with building areas.

Keywords: City Formation, Green Space Quality, Oltanbey Neighborhood.

Introduction

Today, rapid and excessive growth is occurring not only in big cities but also in developing cities. As a result of immigration and uncontrolled growth, we encounter urban design problems. In general, we can count infrastructure, housing needs, transportation, climate and geological reasons among these problems.

It is observed that the phenomenon of rapid urbanization experienced in our country for the last thirty years has a negative dimension, and social life is badly affected by the physical environment that has emerged. (Güler, 1997).

In addition to providing physical activity for city residents, the green area also has positive effects on mental health (Wolch et al., 2014).

Irregular urban formations have emerged as an important problem of administrators in the twentieth century. Industrialization has caused unplanned urbanization, rapid migration and health problems (Alsaç, 1993).

Urban green areas such as parks, urban forests and gardens are important parts of the ecosystem. Due to the fact that the city of Gumushane is a developing province with zoning planning studies, the need for green space in the city center arises in addition to the construction.

The city plans, the formation of urban environment in Turkey, a new lifestyle with the protection of the natural environment is one of the main tools in the creation. Frequent changes in Turkish political life have had important effects on urban planning and implementation. Migration towards big cities determined the urbanization process (Tunçel, 2005). In the early years of the Republic, modern principles and methods were adopted

in city planning. It was important because it guided the next studies (Alsaç, 1993).

Turkey, consists of seven geographical regions and between these regions are largely economic, social and cultural development level differences.

Urban formations are of great importance in preventing these level differences. The application method called zoning in urban planning applications gained importance in urban arrangements after 1960, when industrialization accelerated. It is divided into regions such as residential area, city center, green areas (Alsaç, 1993).

Material and Methods

Material

Within the scope of the study, urban structuring studies of Oltanbey District, which was opened to reconstruction in Gumushane province, were examined. As data for the study; satellite images, topographic maps and city development maps were used (Figure 1).

Gumushane can be divided into two as old and new settlements. Considering its historical process, before the Republic, Old Süleymaniye was the first settlement area, after which a new settlement area was established along the Harşit Stream. The geological structure of the area was formed on a large granite mass (Çakır et al., 2019).

The province has a sloping and mountainous terrain between the Eastern Anatolia and the Black Sea region. When the existing zoning plans are examined, it is seen that the topography of the land is formed according to its geological condition (Figure 2).

Oltanbey neighborhood area is 53.54 hectares. In the research area, there are five large sites, two schools, one hostel, three institutional buildings, and one museum (Figure 3). Most of the area is pasture and rocky.

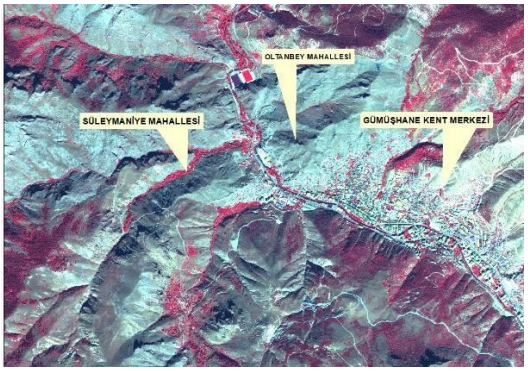

Figure 1. Study area

In the zoning law published in the Official Gazette dated September 2, 1999 and numbered 23804, the amount of green space required per person is given in table 1 and 2 (Anonymous, 2000).

Figure 2. View of city development plan

Table 1. Zoning information in Law 23803

Building Status	Number
Unknown	24
Total Construction	72
Build	13
Settling	34
Burning Destroyed Building	1
Average Floor Information	8
Street	14
Museum	1
Library	1
Mosque	1

Table 2. Active Green Area

Population	0-15.000	15.000-45.000	45.000-100.000	100.000+
Active Green Area	10 m^2/ person	10 m^2/ person	10 m^2/ person	10 m^2/ person

Method

Green areas and settlements were determined from the images and their areas were found numerically. Analyzes were made in GIS environment. Old and current photos are compared together.

Results and Discussion

The obstacle of the land causes difficulties in city construction. Green area development has been very limited between buildings. In addition, the amount of green space is increased with large parks and gardens.

Green texture has decreased around the buildings. In the past settlement, it was observed that the houses around the Harşit stream were up to two floors with gardens. Nowadays, there is less green texture next to multi-stored buildings in the same area.

A new building has been instruction since 2008. While there are places to meet the need for parking in the gardens of the newly built sites, but there is no green space to meet the need for parks and playgrounds

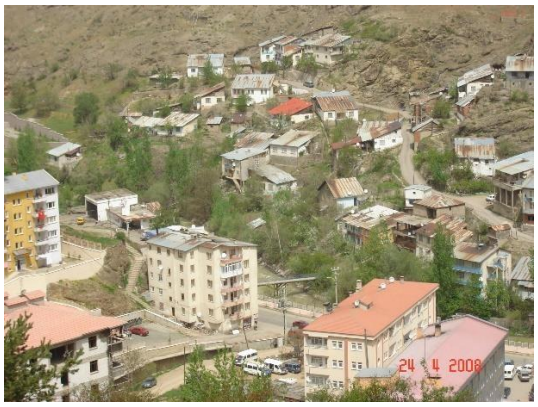

Figure 3. Oltanbey Neighborhood image 2008

Figure 4. Oltanbey Neighborhood image 2020

The increase in buildings in the Oltanbey neighborhood affected the population growth. While the population of Oltanbey neighborhood was changed from 195 to 2.373 people in 2013-2019 (Table 3) (TUIK, 2020). This population is 1.248 men and 1.125 women. The increase rate compared to previous years is %10.84.

Table 3. Demographic changes Oltanbey neighborhood

Year	Total Population
2019	2.373
2018	2.141
2017	2.606
2016	1.464
2015	1.063
2014	359
2013	195

Between 2008 and 2020 population rates was drastically increased in the region. Building was vertical architecture. As a result of these changes, the need for green space per person cannot be met.

Oltanbey neighborhood is of great importance in terms of its aesthetic value due to its location at the entrance of Trabzon road of Gumushane (Figure 5). When the zoning status is examined, it is seen that new construction continues rapidly for human life and needs. It has been determined that the area needs to be reconsidered within the scope of urban planning. Various green habitats and parks should be included in these plans. The legal element that guides the formation of green living areas is detailed in the zoning legislation.

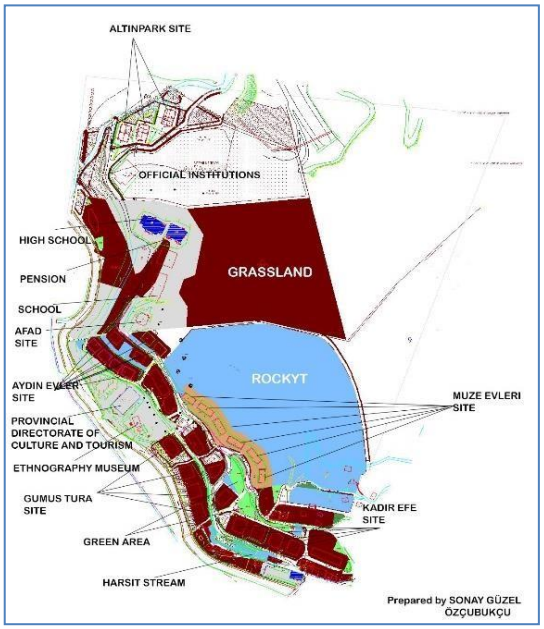

Figure 5. Oltanbey Neighborhood Settlement Map

Since the Oltanbey neighborhood has a size of 53.54 ha, the amount of active green areas that should fall to 2.373 people is 23.730 m^2.

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Determination of Existing Forest Roads Adequacy to Manage Forest Area (Daday Çamlıbel Forest Sub-District Directorate)

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Abstract

Aim of study: To determined the condition of exploitation of forests with forest road networks of the Çamlıbel Forest Sub-District Directorate spatially with GIS (Geographic Information Systems). and for the forest areas that could not be to exploitation, new roads were proposed to exploit it.

Area of study: Daday Çamlıbel Forest Sub-District Directorate is chosen as a sample study area.

Material and methods: The digital terrain model of the area was created by using the "Arc Toolbox - 3D Analyst Tools - Data Management - TIN - Create TIN" commands in order to determine the areas where the existing highway, forest road and village roads belonging to forest sub-district directorate will exploit forest area. Buffer zones have been created by applying a 250 m wide "Geoprocessing-buffer" analysis on the upper part of the slope of all existing roads that exploit the forest by using the TIN layer, or on both sides of the ridge roads and flat areas. Thus, the areas where the existing roads exploited were determined. With the stand map, the layers exploited were overlapped by using the "Geoprocessing-intersect" command, and it was determined how much forest area was exploited by the existing roads. Thus, were determined the parts of the forest area that are not exploited. The road layer which follows to be planned has been created to plan new roads that will exploit areas that have not been exploited. New road routes have been drawn in the area, taking into consideration forest areas not exploited.

Main results: it has been determined that the Çamlıbel Forest Sub-District Directorate, with a size of 10017.7 hectares, 5644.2 ha (74.8%) of the 7544.1 ha forest area has been exploited by existing roads. With the new 15+845 km forest roads planned in GIS, for Çamlıbel Forest Sub-District Directorate 439.8 ha forest area will be exploited for further forestry purposes. In case these new roads are built, 6087 ha of Çamlıbel Forest Sub-District Directorate will be exploited to serve the forestry purposes and the percentage of the exploited area will be 80.7%.

Highlights: With the proposed 9 forest road for the study case, more forest area will be exploited for forestry purposes.

Keywords: Forest Road, Çamlıbel Forest Sub-District Directorate, GIS, CBS

Introduction

By exploiting forests for exploitation, forest roads serve to protect them and carry out forestry activities, ensuring the transport of various forest products, allowing people to work, live, and carry out recreational activities in the forest; these technical and geometric costs are facilities with distinct characteristics, as well as economic, ecological and social characteristics (Eker & Ada, 2011, Keller & Sherar, 2004, Deegen et al., 2011; Picchio et al., 2018).

Forest roads are the most important forestry infrastructure for forest services. However, these are complex and expensive structures that can cause permanent damage to forest ecology. Despite this, the idea of exploitation with forest road networks in order to make production-oriented use of forests; technological solutions should be implemented to take care to protect the natural balance of forests and ensure their continued benefit. (Çalışkan & Çağlar, 2010).

Regarding the determination of the intended road routes; planning the roads that will provide high benefits for functional forestry, will contribute to the development of villagers living in and around the forest, have the lowest construction-maintenance costs, can be suitable for continuous transport, minimize forest land degradation, and have fewer environmental damage those are the most important factors to consider.

As in all engineering studies, it is important that the roads which will be planned and later built to be economical, safe, and also

suitable for nature (Hasdemir & Demir, 2000; Erdaş, 1986). In our country, forest roads must not only be planned according to production functions, plans must be made taking into consideration of all forest functions (Gümüş et al., 2008).

With this study case, the condition of exploitation of forests with forest road networks of the Çamlıbel Forest Sub-District Directorate was assessed. In this context, forest areas exploited with existing roads and planned were determined spatially and recommendations of optimal roads were presented for areas that could not be exploited Thus, in the example of the Çamlıbel Forest Sub-District Directorate, areas exploited and by forest roads were determined in the GIS database, and these new roads were proposed.

Material and Methods

Material

Çamlıbel Forest Sub-District Directorate connected to Daday Forest Operation Directorate, Kastamonu Regional Directorate of Forestry has been chosen as a study case (Figure 1).

Figure 1. Location of the study area

Çamlıbel Forest Sub-District Directorate; is located in the maps Kastamonu -F30b1, F30b2, F30b3, F30b4 and geographically it is located 33 ° 16'06 " - 33 ° 26'29 " east longitude and 41 ° 19'58 " - 41 ° 27'07 " north latitude.

Tree species such as Pine (*Pinus nigra*), Scots pine (*Pinus sylvestris*), beech (*Fagus orientalis*), oak (species: *Quercus sessiliflora, Quercus petrea, Quercus robur and Quercus ilex)*, fir *(Abies) nordmanniana supsp. Bornmüllerina*), hornbeam (*Carpinus betulus*), poplar (*Populus tremula*) can be found in the forest. The planning unit, which was established on 22.02.2008, consists 5596.7 ha forest area and 439.8 ha bare area, and total area is 6036.5 ha.

Method

The study primarily provided the existing road network plan of the Çamlıbel Forest Sub-District Directorate, standard topographic maps at 1/25000 scale of the area and numerical contour lines of these maps. Using ArcGIS software, the level lines of the study area were brought together next to the topographic map and combined using the "Geoprocessing-Merge" command.

The total length of the road within Çamlıbel Forest Sub-District Directorate is 230236 + 34 km, of which 10314 + 11 km is highway (TKY), 151653 + 45 km is forest road and 68268 + 78 km is village road.

Using the maps included in the management plan, the study area was divided into 4 land use classes: (1) Forest area- (2) Forest soil - (3) Agriculture area - (4) Residential areas. In Figure 2, the existing roads are shown on the map of the Çamlıbel Forest Sub-District Directorate.

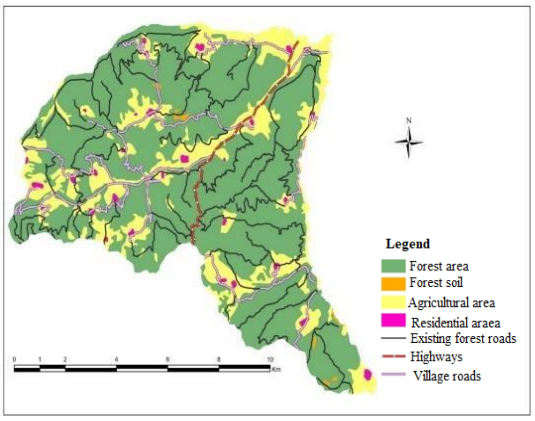


Figure 2. Existing roads are shown on the map of the Çamlıbel Forest Sub-District Directorate

The digital terrain model of the area was created by using the "Arc Toolbox - 3D Analyst Tools - Data Management - TIN - Create TIN" commands in order to determine the areas where the existing highway, forest road and village roads belonging to forest sub-

district directorate will exploit forest area (Figure 3).

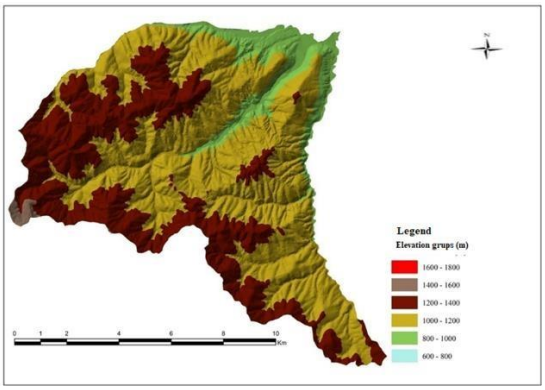


Figure 3. Digital elevation model map of the Çamlıbel Forest Sub-District Directorate

Buffer zones have been created by applying a 250 m wide "Geoprocessing-buffer" analysis on the upper part of the slope of all existing roads that exploit the forest by using the TIN layer, or on both sides of the ridge roads and flat areas. Thus, the areas where the existing roads exploited were determined. The buffer areas created are combined with the "merge" command and transformed into a single layer.

With the stand map, the layers exploited were overlapped by using the "Geoprocessing-intersect" command, and it was determined how much forest area was exploited by the existing roads. Thus, were determined the parts of the forest area that are not exploited.

The road layer which follows to be planned has been created to plan new roads that will exploit areas that have not been exploited. New road routes have been drawn in the area, taking into consideration forest areas not exploited.

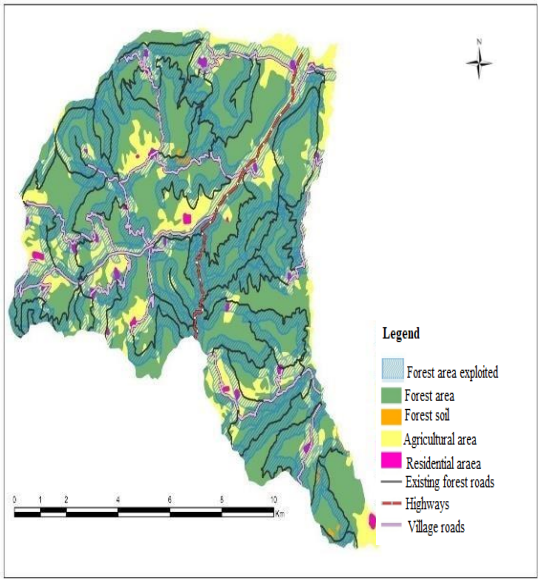
While planning these roads, exploitation of maximum forest area with the minimum road length has been considered. The areas exploited by each new road crossing were determined both numerically and positionally, throwing a 250 m wide buffer on the new planned roads, remaining again above the slope of the forest area. These areas created for new paths have been transformed into a single layer with the "Merge" command.

Çamlıbel Forest Sub-District Directorate base map and areas exploited were run with the "intersect" command, so the areas exploited by the newly planned roads were determined as a numerical value and by location.

Results and Discussion

The total forest area of the Çamlıbel Forest Sub-District Directorate is 7544.1 ha and there is a total of 151653 + 45 km of roads in the area. These roads were built for the exploitation of 5647.2 ha of forest area, and with the existing roads 74.8% of the forest area of the Çamlıbel Forest Sub-District Directorate was exploited. Figure 4 shows the areas exploited by the existing roads of the Çamlıbel Forest Sub-District Directorate.

Figure 4. Existing roads and forest areas that these roads exploit



As a result, 25.2% of the forest area of the Çamlıbel Forest Sub-District Directorate has not been exploited and there is no road network to carry out forestry activities, especially production, in these areas. For this reason, it is necessary to plan new forest roads for forest areas that cannot be exploited.

In the study, in addition to the existing roads in the Çamlıbel Forest Sub-District Directorate, 9 new forest roads were proposed (P1, P2, P3, P4, P5, P6, P7, P8, P9). The new roads, which are expected to exploit the maximum forest area with a minimum length of 15 + 845 km, are planned in the ArcGIS program. The length belonging to each road

and the data on the exploitation of the forest area are given in table 1.

Table 1. The length belonging to each road planned, and forest area exploited

Planned Road code	Length (km)	Forest area exploited (ha)
P1	2+073	52
P2	2+361	64
P3	1+855	66
P4	1+514	54
P5	1+250	39
P6	1+240	34
P7	1+780	49
P8	1+870	52
P9	1+898	54
Total	15+845	467

In the Çamlıbel Forest Sub-District Directorate, 9 new forest roads were planned with a total of 15 + 845 km, taking into account the shortest road length and exploiting not exploited forest areas for operation as much as possible.

Conclusion

Ensuring the sustainability of forests is one of the main principles of forestry. In order to manage forest areas, it is necessary to plan and make the optimal transport to forest areas. While we plan forest roads, which play the most important role in exploiting of forest areas, we should take care to have the shortest roads for less damaged to nature and cover the largest area for exploitation.

With the study, the current road network plan of the Çamlıbel Forest Sub-District Directorate and how much of the forest area can be reached in aerial and spatial terms were mapped. The forest areas that could not be exploited for forestry activities and production planning were again determined spatially and aerially in the GIS program and the best and shortest path suggestions were developed to exploited these areas. Thus, the ratio between the area in which exploitation and production activities can take place in the forest areas of the Çamlıbel Forest Sub-District Directorate was tried to be maximized with 9 new forest roads.

The total amount of road (highway, village road and forest road) within the borders of Çamlıbel forest sub-district directorate is 230 235 km. 151653 + 45 km of these roads pass through forest areas, and these roads exploit the forest areas for exploitation. With the existing roads, 5647.2 ha (74.8%) of the 7544.1 ha forest area has been exploited and 1896.9 ha forest area (25.2% of the forest area) has not been exploited to.

With the proposed 9 forest road for the study case, a total of 15 + 845 km road was planned, and if these roads are constructed, an additional 439.8 ha of forest area will be exploited for forestry purposes. Thus, 6087 hectares (80.7%) of the forested areas of the Çamlıbel Forest Sub-District Directorate will be exploited (Figure 5).

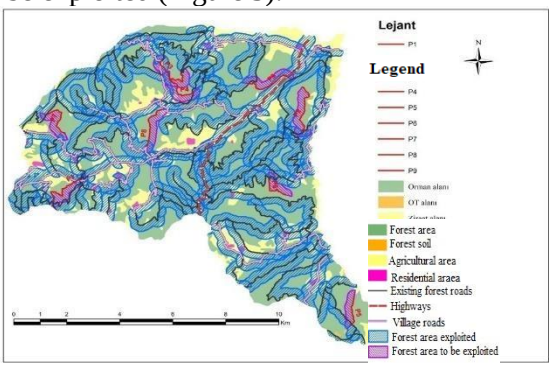


Figure 5. The existing, new planned roads and the areas put into operation by the roads on the land use map

Thus, approximately 6% more forest area will be exploited with only 15 + 845 km forest road. This study is a method applicable to other forest sub-district directorate.

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Investigation of Functional Allowable Cut Amounts for Kastamonu Regional Directorate of Forestry

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Abstract

Aim of study: In this study, it is aimed to evaluate and to compare the management purposes and functional allowable cut amounts of planning units in Kastamonu Regional Directorate of Forestry.

Area of study: This study has been carried out for Kastamonu Regional Directorate of Forestry, which has 22 forest enterprises and 182 planning units.

Material and methods: The basic data required in the study were obtained from the current forest management plans used for the management of the planning units within the Kastamonu Regional Directorate of Forestry. Distributions of area, growing stock, increment, and allowable cut for management classes were taken from management plans.

Main results: All forest ecosystems in Kastamonu region have been managed with multiple-use forest management approach. With this approach, 54% of the regional forests are divided into economical (0.67 million ha), 38% ecological (0.47 million ha) and 8% socio-cultural (0.10 million ha) functions. According to the management plans of planning units in the region, the total allowable cuts for economical, ecological and socio-cultural functioned forests are 48.2%, 17.0% and 22.9% of the volume increment, respectively.

Highlights: It is planned that 38.9% of the total increment of Kastamonu forests, according to the forest management plans, will be harvested as allowable cut. Forests were operated under 10 functions with 46 management purposes. The management purpose of high-quality wood production was only available in Türkeli Forest Enterprise.

Keywords: Multiple-use Planning, Functional Allowable Cut, Increment.

Introduction

Developments related to the forest planning in Turkey took place concurrently with the developments in the world (Asan, 2010). In the early periods of planned forestry approach, forests were managed with classical forest management plans that only consider the wood production purpose and the future status and capacity of the forests were not taken into account. Later, the principle of sustainability came to the fore with the idea that wood production is a time-dependent process and that the wood raw material needs of future generations should also be met without decreasing. In the following process, the importance of other products and services other than wood was also understood and the multiple-use planning approach emerged (Yolasığmaz et al., 2006). Multiple-use planning of forest resources has become mandatory as the benefits and functions expected from forests gradually diversify and increase (Asan and Yeşil, 1993). As a result of this obligation, Turkey forests began to be managed with multiple-use forest planning policy since the early 2000s (General Directorate of Forestry, 2008).

According to the multiple-use planning approach, forests are grouped as economical, ecological and socio-cultural functional forests. The demands and needs of the society from forests have increased and diversified, and almost all functions of forests are used as much as possible. This situation forces both planner and manager of forests to create combinations of functions and objectives and to decide on the most appropriate from various combinations and alternatives. When the priorities of the functions of the forests are determined, the management purposes come out (Asan, 1990; Eraslan, 1989). The main consideration in determining the management purposes is to select and rank what society needs among the various benefits and functions offered by forests. In short,

management purpose means the forest function to be used (Asan, 1990).

Forests serve forest products production, nature protection, erosion control, climate control, hydrological, public health, aesthetics, ecotourism and recreation, national defense and scientific functions under their main economical, ecological and socio-cultural functions (Çakır, 2004). Forests are operated for business purposes related to these functions.

Although functional management class distinction is essential for multiple-use forest management plans, it is not sufficient by itself. In order to realize the multiple-use and for the forest management plan to be functional, allowable cuts to be made from management classes should also be functional. The technical success of a management plan in terms of planning procedure depends on the best understanding of the management purpose combinations expected from the planned forest and reflecting this on the silvicultural operations to be applied and the cuts to be extracted as a result of these processes. In a multiple-use forest management plan, it is necessary to firstly separate the management classes functionally and then determine the allowable cut amounts determined for each of these classes in accordance with their functional purposes (Asan, 1990). In terms of forest management, allowable cut is the amount of volume to be extracted as a result of silvicultural interventions to be applied to each stand that constitutes the plan unit. If regeneration is to be applied to a stand, this amount will equal the sum of the growing stock of that stand and the progressively decreasing increment of that volume and is called the final allowable cut. If tending (thinning) cuttings are to be implemented, it is taken as thinning allowable cut in varying amounts according to the form and severity of the silvicultural intervention determined according to the stand age, and actual and purpose establishment of the stand (Asan, 1990).

In this study, it is aimed to investigate the area, growing stock, increment and allowable cuts of planning units located in Kastamonu Regional Directorate of Forestry (Kastamonu RDF) according to the multiple-use criteria and to compare allowable cut amounts relatively with volume increments. In this context, forest enterprises and planning units of Kastamonu RDF were evaluated in detail.

Material and Methods

This study covers Kastamonu RDF forests managed with multiple-use forest management plans. Nearly two thirds (65.5%) of Kastamonu RDF is covered by forests, this area corresponds to approximately 1.24 million ha of forests. These forests constitute 5.5% of total forests and 8% of productive forests of Turkey. According to the General Directorate of Forestry (2019) statistics, Total growing stock, volume increment and allowable cut of Kastamonu RDF consist of 11.8%, 12.4% and 11.4% of national total amounts, respectively (Table 1).

Kastamonu RDF includes 22 forest enterprises (FE) and 182 planning units (PU). The number of PUs was 124 until 2019, and this number increased to 182 as a result of the reorganizing of PUs. However, after the reorganization, it has been decided that management plans of PUs will be used until the expiry of the usage period instead of the renewal of them. Therefore, the administration of 182 PUs has still been carried out with 124 forest management plans. Within the scope of the study, 124 forest management plan data covering Kastamonu RDF forests were used as the main material. The areas, growing stocks, increments and allowable cuts of the management classes in the PUs were obtained from forest management plans. The aforementioned data were collected on the basis of planning units, thus total values of PUs, FEs and Kastamonu RDF were obtained. The total allowable cut values determined by summing the final and thinning cuts were proportioned to the volume increments. With the obtained values, it was discussed how much of the increment is planned to be taken from forests as allowable cut and the compatibility of allowable cut amounts to the multiple-use forest management planning technique. For this purpose, three tables (*i.* Distribution of areas by management classes, *ii.* Distribution of growing stocks and increments by management classes, and *iii.* Table of Distribution of regeneration areas and

allowable cuts by management classes) included in the forest management plans were used. In addition, the functions and management purposes offered by Kastamonu RDF forests and the amount of allowable cuts in forest management plans were examined according to the legal legislation regulating the implementation of forest management plans.

Table 1. Basic information for study area (General Directorate of Forestry, 2019)

	Total Area (ha)	Forest Area (ha)	Growing Stock (m^3)	Volume Increment (m^3)	Allowable Cut (m^3)
Turkey	78.004.644	22.740.297	1.660.618.742	46.160.529	19.014.320
Kastamonu	1.911.111	1.239.498	196.630.231	5.727.464	2.166.348
%	2.4	5.5	11.8	12.4	11.4

Results and Discussion

Allowable cut amount of Turkey forests are 19.014.320 m^3 for high forests, including 17.514.211 m^3 for even-aged (7.676.649 m^3 as final and 9.837.562 m^3 as thinning allowable cuts) and 1.500.109 m^3 for uneven-aged stands, and 936.068 m^3 for coppice forests. The total allowable cut of Kastamonu RDF high forests is 2.166.348 m^3 corresponding 11.4% of total allowable cut amount of high forests in Turkey. Kastamonu RDF meets 432.082 m^3 (5.6%) of final and 1.734.266 m^3 (15.3%) of thinning allowable cut amounts of Turkey. Thinning cut amount consists of two parts related to even- and uneven-aged stands, and Kastamonu RDF has 1.089.956 m^3 (11.1% of Turkey total) and 644.310 m^3 (43.0% of Turkey total) thinning cuts for even- and uneven-aged stands, respectively (General Directorate of Forestry, 2019). There are no coppice forests in Kastamonu RDF.

According to the data obtained from forest management plans, the areal ratios of economical, ecological and socio-cultural functioned forests of Kastamonu RDF are 53.7% (666.274 ha), 38.0% (470.785 ha) and 8.3% (102.439 ha), respectively. For economical, ecological and socio-cultural functioned forests, decided allowable final cuts are 424.528 m^3, 4.222 m^3 and 3.332 m^3, and decided thinning cuts are 1.425.215 m^3, 230.749 m^3 and 78.302 m^3, respectively. "*Allowable cut/Increment*" ratios of economical, ecological and socio-cultural functioned forests are 48.2%, 17.0% and 22.9%, respectively (Table 2).

Kastamonu RDF forests contain forest products production, nature protection, erosion control, climate control, hydrologic, ecotourism and recreation, aesthetics, public health, scientific, national defense and cadastral functions. 54.0% of Kastamonu RDF forests serve for forest products production, 23.1% for erosion control, 14.2% for nature protection and the remaining 8.7% for other functions. "*Allowable cut/Increment*" ratios are 48.2% for forest products production functioned forests, 21.2, 13.5 and 14.0% for nature protection, erosion control and climate control functioned forests, and 27.5, 44.0, 14.9, 13.5, 40.7 and 20.8% for hydrological, ecotourism and recreation, aesthetics, public health, scientific and national defense functioned forests, respectively. As total, decided total allowable cut amount is 38.8% of the volume increment in Kastamonu RDF forests (Table 3).

The area, increment and allowable cut amounts of 22 FEs constituting Kastamonu RDF are given in Table 4. In terms of economical functioned forests, Taşköprü FE stands out with its 93.896 ha area and 476.790 m^3 volume increment, and Ayancık FE with 165.829 m^3 allowable cut. Among the ecological functioned forests, Tosya FE in terms of area with 53.117 ha, İnebolu FE in terms of increment with 143.869 m^3 and Karadere FE in terms of allowable cut amount with 38.443 m^3 draw attention. Among the socio-cultural functioned forests, Durağan FE has the highest area with 21.569 ha, Cide FE has highest increment with 54.962 m^3 and Araç FE has highest allowable cut with 15.777 m^3. "*Allowable cut/Increment*" ratios are 59.5, 55.0, 54.9, 50.6 and 50.3% for Türkeli, İhsangazi, Ayancık, Boyabat and Sinop FEs.

Table 2. Distribution of allowable cut amounts in Kastamonu RDF according to main functions

Main Function	Area (ha)	Allowable Cut (m³)			Increment (m³)	Allowable Cut/Increment Ratio (%)
		Final	Thinning	Total		
Economical	666.274	424.528	1.425.215	1.849.743	3.834.974	48.2
Ecological	470.785	4.222	230.749	234.971	1.383.928	17.0
Socio-cultural	102.439	3.332	78.302	81.634	357.059	22.9
Total	1.239.498	432.082	1.734.266	2.166.348	5.575.961	38.9

Table 3. Distribution of allowable cut amounts in Kastamonu RDF according to functions

Main Function	Function	Area (ha)	Allowable Cut (m³)			Increment (m³)	Allowable Cut/Increment Ratio (%)
			Final	Thinning	Total		
Economical	Forest products production	666.274	424.528	1.425.215	1.849.743	3.834.974	48.2
	Total	666.274	424.528	1.425.215	1.849.743	3.834.974	48.2
Ecological	Nature protection	174.899	2.533	123.149	125.682	594.008	21.2
	Erosion control	284.478	116	104.773	104.889	775.112	13.5
	Climate control	5.457	-	2.075	2.075	14.808	14.0
	Undetermined*	5.951	1.573	752	2.325	-	-
	Total	470.785	4.222	230.749	234.971	1.383.928	17.0
Socio-cultural	Hydrologic	53.366	2.519	40.013	42.532	154.433	27.5
	Ecotourism and Recreation	7.988	813	13.665	14.478	32.872	44.0
	Aesthetics	36.942	-	23.394	23.394	156.786	14.9
	Public health	2.540	-	996	996	7.360	13.5
	Scientific	76	-	218	218	535	40.7
	National defense	23	-	16	6	77	20.8
	Cadastral	1.504	-	-	-	4.996	-
	Total	102.439	3.332	78.302	81.634	357.059	22.9
Total		1.233.547	430.509	1.733.514	2.164.023	5.575.961	38.8

**It is caused by discrepancies between the data from General Directorate of Forestry (2019) and the data from management plans.*

Management purposes for Kastamonu RDF forests are given in Table 5. 50.9% of Kastamonu RDF forests are managed with industrial wood production, and 22.1, 5.6, 3.3, 2.6, 2.5, 2,4 and 2.2% for soil protection, poor site areas, nature protection, aesthetic look, domestic water conservation, wildlife development and high-quality wood production management purposes, respectively. Remaining 8.5% are managed with the other purposes. While 90.1% of total final allowable cut is for industrial wood production forests, 8.5% for high-quality wood production and remaining 1.4% for the other management purposes. 78.7% of total thinning cut is for industrial wood production purposed forests, while 5.8, 4.4, 3.2 and 7.9% for soil protection, wildlife development, high-quality wood production and other purposes, respectively. As total allowable cut, 81.0% of total amount is reserved for industrial wood production, 4.7% for soil protection, 4.3% for high-quality wood production, 3.6% for wildlife development and remaining 6.4% for other management purposes.

"*Allowable cut/Increment*" ratios for high-quality wood production, industrial wood production, hunting grounds, wildlife development, domestic water conservation, drinking water conservation, ecosystem improvement, hiking areas and education are 68.6, 47.6, 57.5, 49.1, 30.1, 31.3, 30.7, 43.2 and 40.7%, respectively (Table 5).

All FEs except Türkeli have forests purposed for industrial wood production. Türkeli FE has high-quality wood production purpose. Among the FEs had industrial wood production forests, maximum "*Allowable cut/Increment*" ratio belongs to Ayancık FE with 67.1% (165.829 m^3). When evaluated in general, 47.6% of the total increment of industrial wood production purposed forests of 21 FEs were decided as allowable cut. This ratio is 68.6% for high-quality wood production purposed forests of Türkeli FE and 26.7% for firewood production purposed forests of Taşköprü FE (Table 6).

In nature protection functioned forests of Kastamonu FE, 59.9% of the increment were decided as allowable cut amount. For erosion control functioned forests, Ayancık FE has the maximum "*Allowable cut/Increment*" ratio with 25.3%. Considering the erosion risk, it is expected that the amount of allowable cut will have low values (Table 7).

Durağan FE has the maximum area within 14 FEs had hydrologic functioned forests with 15.714 ha, and the final allowable cut is decided only for Daday, Durağan, Kastamonu and Tosya FEs. For ecotourism and recreation function, Araç FE has the maximum "*Allowable cut/Increment*" ratio with 60.6% (Table 8).

Table 4. Distribution of allowable cut amounts in forest enterprises according to main functions

Forest Enterprise	Economical Functions			Ecological Functions			Socio-cultural Functions			Total			Allowable Cut/Increment Ratio (%)
	Area (ha)	Allowable Cut (m³)	Increment (m³)	Area (ha)	Allowable Cut (m³)	Increment (m³)	Area (ha)	Allowable Cut (m³)	Increment (m³)	Area (ha)	Allowable Cut (m³)	Increment (m³)	
Ayancık	38.743	165.829	246.978	12.332	17.328	68.298	7.987	7.519	31.770	59.058	190.676	347.046	54.94
Boyabat	56.153	154.364	254.772	50.595	9.366	61.727	7.987	4.523	16.228	114.736	168.253	332.727	50.57
Karadere	32.843	110.036	261.935	28.391	38.443	112.457	403	2.073	3.317	61.638	150.552	377.709	39.86
Taşköprü	93.896	144.061	476.790	11.739	768	13.181	7.884	32	2.036	113.518	144.861	492.007	29.44
Daday	50.132	120.417	280.133	12.818	3.211	31.580	4.752	11.797	32.520	67.703	135.425	344.233	39.34
Küre	52.718	117.214	269.918	16.664	11.367	56.186	4.312	4.556	16.829	73.693	133.137	342.933	38.82
Araç	29.397	95.091	158.907	19.568	5.998	51.371	6.316	15.777	33.862	55.281	116.866	244.140	47.87
Türkeli	27.433	93.023	135.567	6.057	4.556	28.231	33	-	95	33.523	97.579	163.893	59.54
Kastamonu	30.047	56.400	119.296	24.848	34.454	64.684	5.344	6.313	18.458	60.239	97.167	202.438	48.00
Tosya	26.003	80.680	162.578	53.117	13.058	124.263	3.193	3.361	16.460	82.313	97.099	303.301	32.01
İnebolu	18.028	72.909	146.693	31.731	16.969	143.869	-	-	-	49.759	89.878	290.562	30.93
Cide	21.246	68.429	155.944	15.572	14.567	99.792	14.660	6.488	54.962	51.478	89.484	310.698	28.80
Sinop	21.540	79.740	137.284	7.567	6.039	30.908	929	1.095	4.447	30.037	86.874	172.639	50.32
Azdavay	35.947	75.961	228.767	7.034	1.258	24.699	6.941	5.491	33.103	49.922	82.710	286.569	28.86
Samatlar	14.487	66.772	101.813	34.035	10.994	77.590	627	320	2.743	49.149	78.086	182.146	42.87
İhsangazi	13.879	66.566	85.671	17.660	6.394	44.477	1.194	696	3.795	32.733	73.656	133.943	54.99
Gerze	17.408	59.813	119.079	34.673	8.783	111.856	1.050	1.252	4.684	53.131	69.848	235.619	29.64
Hanönü	21.544	54.599	117.647	11.235	2.258	25.527	-	-	-	32.779	56.857	143.174	39.71
Durağan	21.166	47.050	99.703	33.849	3.713	58.790	21.569	4.600	43.334	76.585	55.363	201.827	27.43
Pınarbaşı	22.594	41.875	140.881	13.283	7.250	48.997	4.327	4.626	26.737	40.204	53.751	216.615	24.81
Çatalzeytin	8.859	38.020	60.903	11.124	9.751	50.259	1.166	688	4.594	21.149	48.459	115.756	41.86
Bozkurt	12.209	40.894	73.715	10.941	6.120	55.186	1.770	427	7.085	24.920	47.441	135.986	34.89
Total	666.274	1.849.743	3.834.974	464.834	232.646	1.383.928	102.439	81.634	357.059	1.233.547	2.164.022	5.575.961	38.81

Table 5. Distribution of allowable cut amounts in Kastamonu RDF according to management purposes

Main Function	Function	Management Purpose	Area (ha)	Allowable Cut (m³)			Increment (m³)	Allowable Cut/Increment Ratio (%)
				Final	Thinning	Total		
Economical	Forest products production	Industrial wood production	627.815	387.724	1.364.551	1.752.275	3.682.609	47.6
		High-quality wood production	27.433	36.804	56.219	93.023	135.567	68.6
		Firewood production	10.731	-	4.445	4.445	16.635	26.7
		Honey production	214	-	-	-	125	-
		Other	81	-	-	-	38	-
		Total	666.274	424.528	1.425.215	1.849.743	3.834.974	48.2
Ecological	Nature protection	Areas with poor site	68.656	-	11.822	11.822	107.540	11.0
		Nature protection	40.755	1.063	15.766	16.829	169.113	10.0
		Wildlife development	29.971	1.470	76.515	77.985	158.720	49.1
		Protection from social pressure	18.758	-	8.581	8.581	68.178	12.6
		Wildlife management	5.815	-	5.690	5.690	35.391	16.1
		Gene protection	3.593	-	1.528	1.528	22.966	6.7
		Protection forests	1.609	-	173	173	5.734	3.0
		Ecosystem improvement	1.722	-	2.310	2.310	8.092	28.5
		Seed stands	1.417	-	18	18	8.479	0.2
		Alpine zone	969	-	530	530	4.797	11.0
		Wetland protection	744	-	182	182	2.443	7.4
		Biodiversity conservation	444	-	-	-	66	-
		Succession Monitoring	204	-	-	-	1.362	-
		Natural parks	116	-	34	34	783	4.3
		Old-growth forests	71	-	-	-	319	-
		Seed orchards	27	-	-	-	12	-
		Historical site	19	-	-	-	6	-
		Natural monument	10	-	-	-	7	-
		Total	174.899	2.533	123.149	125.682	594.008	21.2
	Erosion control	Soil protection	272.509	116	100.739	100.855	752.557	13.4
		Flood prevention	5.545	-	3.257	3.257	16.843	19.3
		Rock and stone prevention	608	-	770	770	5.335	14.4
		Avalanche prevention	117	-	-	-	281	-
		Other	5.700	-	7	7	96	7.3
		Total	284.478	116	104.773	104.889	775.112	13.5
	Climate	Climate control	5.457	-	2.075	2.075	14.808	14.0
	Total		464.834	2.649	229.997	232.646	1.383.928	16.8
Socio-cultural	Hydrologic	Domestic water conservation	31.052	1.610	26.672	28.282	93.914	30.1
		Water resources protection	19.165	909	10.232	11.141	50.577	22.0
		Drinking water conservation	3.148	-	3.109	3.109	9.942	31.3
		Total	53.366	2.519	40.013	42.532	154.433	27.5
	Ecotourism and Recreation	Hunting grounds	5.711	813	12.073	12.886	22.403	57.5
		Recreation	1.384	-	498	498	5.994	8.3
		Tourism	662	-	669	669	3.402	19.7
		Hiking areas	179	-	425	425	984	43.2
		Climbing areas	53	-	-	-	89	-
		Total	7.988	813	13.665	14.478	32.872	44.1
	Aesthetic	Aesthetic look	31.515	-	20.572	20.572	133.807	15.4
		Aesthetic road protection	5.426	-	2.822	2.822	22.979	12.3
		Total	36.942	-	23.394	23.394	156.786	14.9
	Public health	Air pollution prevention	2.094	-	283	283	3.967	7.1
		Protecting health institutions	359	-	687	687	2.797	24.6
		Urban forests	87	-	26	26	596	4.4
		Total	2.541	-	996	996	7.360	13.5
	Science	Education	76	-	218	218	535	40.8
	Defense	Military zone	23	-	16	16	77	20.8
	Other	Cadastral	1.504	-	-	-	4.996	-
	Total		102.439	3.332	78.302	81.634	357.059	22.9
Total			1.233.547	430.509	1.733.513	2.164.022	5.575.961	38.8

Table 6. Distribution of allowable cut amounts according to management purposes within economical functions

Forest Enterprise	Area (ha)	Growing Stock (m³)	Increment (m³)	Allowable Cut (m³)			Allowable Cut/Increment Ratio (%)
				Final	Thinning	Total	
INDUSTRIAL WOOD PRODUCTION							
Taşköprü	83.165	12.110.688	460.155	35.789	103.827	139.616	30.3
Daday	50.132	9.810.087	280.133	25.184	95.233	120.417	43.0
Küre	52.718	8.417.973	269.918	-	117.214	117.214	43.4
Karadere	32.843	7.589.244	261.935	23.643	86.393	110.036	42.0
Boyabat	56.153	7.652.749	254.772	52.223	102.141	154.364	60.6
Ayancık	38.743	12.887.519	246.978	29.246	136.583	165.829	67.1
Azdavay	35.947	8.444.470	228.767	9.292	66.669	75.961	33.2
Tosya	25.975	5.852.874	162.578	19.097	61.583	80.680	49.6
Araç	29.183	7.304.211	158.782	23.690	71.401	95.091	59.9
Cide	21.246	4.797.323	155.944	10.301	58.128	68.429	43.9
İnebolu	18.028	4.910.032	146.693	14.789	58.120	72.909	49.7
Pınarbaşı	22.594	4.725.798	140.881	9.398	32.477	41.875	29.7
Sinop	21.541	4.284.184	137.284	40.977	38.763	79.740	58.1
Kastamonu	29.994	3.984.384	119.258	8.311	48.089	56.400	47.3
Gerze	17.408	3.786.345	119.079	9.428	50.385	59.813	50.2
Hanönü	21.544	4.412.842	117.647	11.872	42.727	54.599	46.4
Samatlar	14.487	3.859.305	101.813	17.377	49.395	66.772	65.6
Durağan	21.166	3.175.206	99.703	13.131	33.919	47.050	47.2
İhsangazi	13.879	3.555.701	85.671	19.401	47.165	66.566	77.7
Bozkurt	12.209	2.672.388	73.715	7.252	33.642	40.894	55.5
Çatalzeytin	8.859	3.057.401	60.903	7.323	30.697	38.020	62.4
Total	627.815	127.290.724	3.682.609	387.724	1.364.551	1.752.275	47.6
HIGH QUALITY WOOD PRODUCTION							
Türkeli	27.433	6.875.935	135.567	36.804	56.219	93.023	68.6
FIREWOOD PRODUCTION							
Taşköprü	10.731	280.994	16.635	-	4.445	4.445	26.7
HONEY PRODUCTION							
Araç	214	2.275	125	-	-	-	-
OTHER							
Kastamonu	53	965	38	-	-	-	-
Tosya	28	-	-	-	-	-	-
Total	81	965	38				-

Table 7. Distribution of allowable cut amounts according to management purposes within ecological functions

Forest Enterprise	Area (ha)	Growing Stock (m³)	Increment (m³)	Allowable Cut (m³)			Allowable Cut/Increment Ratio (%)
				Final	Thinning	Total	
NATURE PROTECTION							
Araç	2.816	568.939	13.165	-	1.223	1.223	9.3
Ayancık	2.265	611.519	12.035	1.063	2.035	3.098	25.7
Azdavay	2.338	275.839	6.488	-	194	194	3.0
Boyabat	7.088	264.195	9.886	-	918	918	9.3
Bozkurt	7.855	1.599.117	41.552	-	6.073	6.073	14.6
Cide	14.956	2.761.869	94.588	-	13.841	13.841	14.6
Çatalzeytin	3.191	799.365	15.648	-	2.507	2.507	16.0
Daday	6.543	581.020	18.975	-	1.316	1.316	6.9
Durağan	6.222	309.251	11.786	-	365	365	3.1
Gerze	5.784	453.974	21.640	-	617	617	2.9
Hanönü	158	41.106	1.164	-	-	-	-
İhsangazi	11.008	1.157.334	31.339	-	4.295	4.295	13.7
İnebolu	1.052	196.251	5.446	-	553	553	10.2
Karadere	15.350	2.963.120	75.179	1.168	33.375	34.543	45.9
Kastamonu	21.518	2.501.099	55.913	302	33.211	33.513	59.9
Küre	12.531	1.372.503	46.617	-	9.564	9.564	20.5
Pınarbaşı	12.314	1.585.207	44.564	-	7.121	7.121	16.0
Samatlar	13.009	709.980	21.625	-	2.695	2.695	12.5
Sinop	3.715	487.685	14.415	-	2.012	2.012	14.0
Taşköprü	9.871	164.580	7.675	-	336	336	4.4
Tosya	14.346	1.347.138	40.145	-	898	898	2.2
Türkeli	971	205.490	4.163	-	-	-	-
Total	174.899	20.956.581	594.008	2.533	123.149	125.682	21.2
EROSION CONTROL							
Araç	16.752	1.397.027	38.206	-	4.775	4.775	12.5
Ayancık	10.067	1.943.707	56263	-	14.230	14.230	25.3
Azdavay	4.696	505.048	18.211	-	1.064	1.064	5.8
Boyabat	42.648	1.153.826	51.355	-	8.359	8.359	16.3
Bozkurt	3.086	508.699	13.634	47	-	47	0.3
Cide	616	159.396	5.204	-	726	726	14.0
Çatalzeytin	6.200	1.175.663	28.838	-	6.438	6.438	22.3
Daday	6.275	372.754	12.605	69	1.826	1.895	15.0
Durağan	27.051	1.181.433	45.054	-	3.106	3.106	6.9
Gerze	28.889	2.260.719	90.216	-	8.166	8.166	9.1
Hanönü	11.077	624.985	24.363	-	2.258	2.258	9.3
İhsangazi	6.653	443.177	13.138	-	2.099	2.099	16.0
İnebolu	30.679	4.489.745	138.423	-	16.416	16.416	11.9
Karadere	13.041	842.806	37.278	-	3.900	3.900	10.5
Kastamonu	3.330	290.303	8.771	-	941	941	10.7
Küre	4.133	297.674	9.569	-	1.803	1.803	18.8
Pınarbaşı	969	149.314	4.433	-	129	129	2.9
Samatlar	18.739	1.500.207	49.366	-	7.361	7.361	14.9
Sinop	3.852	562.904	16.493	-	4.027	4.027	24.4
Taşköprü	1.868	138.456	5.506	-	432	432	7.8
Tosya	38.770	2.810.196	84.118	-	12.160	12.160	14.5
Türkeli	5.086	1.175.831	24.068	-	4.557	4.557	18.9
Total	284.478	24.700.077	775.112	116	104.773	104.889	13.5
CLIMATE CONTROL							
Boyabat	859	11.834	486	-	89	89	18.3
Çatalzeytin	1.733	198.602	5.773	-	806	806	14.0
Durağan	577	27.791	1.950	-	242	242	12.4
Samatlar	2.288	187.009	6.599	-	938	938	14.2
Total	5.457	425.236	14.808	-	2.075	2.075	14.0

Table 8. Distribution of allowable cut amounts according to management purposes within socio-cultural functions

Forest Enterprise	Area (ha)	Growing Stock (m³)	Increment (m³)	Allowable Cut (m³)			Allowable Cut/Increment Ratio (%)
				Final	Thinning	Total	
HYDROLOGIC							
Araç	1.241	233.991	6.060	-	1.265	1.265	20.9
Ayancık	7.128	1.061.606	27.040	-	6.447	6.447	23.8
Azdavay	121	5.290	296	-	50	50	16.9
Boyabat	5.562	297.428	11.687	-	3.437	3.437	29.4
Çatalzeytin	98	11.136	263	-	-	-	-
Daday	4.085	904.759	28.686	952	10.073	11.025	38.4
Durağan	15.714	737.615	30.045	401	4.080	4.481	14.9
Gerze	705	93.003	4.084	-	1.201	1.201	29.4
Karadere	386	125.572	3.219	-	2.069	2.069	64.3
Kastamonu	4.392	477.381	14.331	257	5.505	5.762	40.2
Küre	3.157	249.979	11.170	-	3.337	3.337	29.9
Sinop	102	12.507	371	-	79	79	21.3
Taşköprü	7.726	38.636	1.987	-	31	31	1.6
Tosya	2.950	494.014	15.194	909	2.439	3.348	22.0
Total	53.366	4.742.917	154.433	2.519	40.013	42.532	27.5
PUBLIC HEALTH							
Ayancık	11	1.390	53	-	10	10	18.9
Bozkurt	253	55.324	1.375	-	191	191	13.9
Daday	359	84.982	2.797	-	687	687	24.6
Durağan	1.841	41.713	2.592	-	92	92	3.5
Kastamonu	36	4.479	154	-	-	-	-
Sinop	41	6.936	389	-	16	16	4.1
Total	2.541	194.824	7.360	-	996	996	13.5
ECOTOURISM AND RECREATION							
Araç	2.960	1.120.464	21.290	813	12.095	12.908	60.6
Boyabat	1.540	48.963	1.895	-	50	50	2.6
Bozkurt	22	6.192	146	-	-	-	-
Cide	287	78.955	1.962	-	604	604	30.8
Çatalzeytin	929	140.524	4.098	-	688	688	16.8
Daday	8	2.211	56	-	17	17	30.4
Durağan	1.543	17.878	842	-	27	27	3.2
Gerze	38	3.688	136	-	13	13	9.6
Kastamonu	7	1.328	45	-	-	-	-
Küre	117	13.605	400	-	-	-	-
Pınarbaşı	20	7.361	209	-	60	60	28.7
Sinop	85	12.030	380	-	97	97	25.5
Taşköprü	158	1.682	49	-	1	1	2.0
Tosya	243	46.999	1.266	-	13	13	1.0
Türkeli	33	3.634	95	-	-	-	-
Total	7.988	1.505.514	32.869	813	13.665	14.478	44.0
AESTHETICS							
Araç	2.115	232.392	6.512	-	1.604	1.604	24.6
Ayancık	822	76.108	4.600	-	1.046	1.046	22.7
Azdavay	6.820	1.078.563	32.807	-	5.441	5.441	16.6
Boyabat	885	41.142	2.646	-	1.036	1.036	39.2
Bozkurt	54	10.103	266	-	18	18	6.8
Cide	14.373	1.517.006	53.000	-	5.884	5.884	11.1
Daday	301	21.295	981	-	68	68	6.9
Durağan	2.472	214.823	9.855	-	-	-	-
Gerze	307	11.787	464	-	38	38	8.2
İhsangazi	1.194	131.171	3.795	-	696	696	18.3
Karadere	17	1.628	98	-	4	4	4.1
Kastamonu	909	98.006	3.928	-	551	551	14.0
Küre	1.038	140.833	5.259	-	1.219	1.219	23.2
Pınarbaşı	4.307	782.767	26.528	-	4.566	4.566	17.2
Samatlar	627	64.175	2.743	-	320	320	11.7
Sinop	700	111.911	3.307	-	903	903	27.3
Total	36.942	4.595.971	156.789	-	23.394	23.394	14.9
SCIENCE							
Bozkurt	76.2	21.265	535	-	218	218	40.7
DEFENSE							
Ayancık	23	1.443	77	-	16	16	20.8
OTHER							
Bozkurt	1.365	189.078	4.763	-	-	-	-
Çatalzeytin	139	7.831	233	-	-	-	-
Total	1504	196.909	4996	-	-	-	-

Conclusion

Kastamonu RDF forests are managed with multiple-use forest planning approach with three main functions as economical, ecological and socio-cultural. 54% of the Kastamonu RDF forests are managed with economical functions, and 38% for ecological and 8% socio-cultural ones. High-quality wood production purpose is only found in Türkeli FE. Considering the productivity of Kastamonu RDF forests, this management purpose should not be ignored. This detail should be included in the future management plans. It has been revealed that 48.2% of the total increment is taken as allowable cut in forest products production functioned forests. This amount is in compliance with legal regulations, and it can be increased if the conditions are suitable. Hydrologic functioned forests are important for all living beings. While preparing forest management plans, even though there is no waterbed and passage in the area, it is requested that forests include hydrologic function as well. However, there are no hydrologic functioned forests in Bozkurt, Cide, Hanönü, İhsangazi, İnebolu, Pınarbaşı, Samatlar and Türkeli FEs. In order to establish non-dense open forests, 44.1% of increment were decided as allowable cut in ecotourism and recreation functioned forests. Silvicultural treatments and their intensity are decided according to objective of scientific studies in scientific functioned forests. In Kastamonu RDF, 40.8% of increment were decided as allowable cut in scientific functioned forests. It is planned that taking 57.5% and 49.1% of increment as allowable cut for hunting grounds and wildlife development functioned forest, respectively. For these functions, forests should be planned according to wildlife requirements. Intensive forest management activities are not recommended. For the forests for hiking purpose, 43.2% of increment is planned as allowable cut. The expectation of people from this kind of forests are natural, beautiful and well-maintained forests.

Forest planning and management activities in future should take into consideration multiple-use planning requirements for natural life as well as people. Management purposes should also be decided carefully.

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The Impact of Industry 4.0 on Forest Products Industry

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Abstract

Aim of study: In the present work, it was aimed to determine the impacts of 4th industrial revolution on forest products industry.

Area of study: The scope of this research primarily concerns with wood-based products, non-wood forest products were excluded.

Material and methods: A comprehensive literature review was conducted and the findings were interpreted.

Main results: The industry 4.0 can make the manufacturing companies more efficient and profitable with fewer employees. In the forestry sector, automation and industrial optimization provide great advantages in terms of performance and production gain.

Highlights: Digitalization should be a must for the forest-based industries.

Keywords: Industry 4.0, Forest Products Industry, Wood-based Products.

Introduction

Industry is the part of an economy that produces material goods which are highly mechanized and automatized (Lasi et al., 2014). Since the first Industrial Revolution, following revolutions have resulted in manufacturing, from water and steam-powered machines to electrical and digital automated production which makes the manufacturing process more complicated, automatic and sustainable so that people can operate machines simply, efficiently and persistently (Qin et al., 2016). The term Industry 4.0 stands for the fourth industrial revolution. Industry 4.0 was initially introduced during the Hannover Fair in 2011; afterwards, it was officially announced in 2013 as a German strategic initiative to take a pioneering role in industries which are currently revolutionizing the manufacturing sector (Xu et al., 2018).

Industry 4.0 is an approach based on the integration of the business and manufacturing processes, as well as the integration of all actors in the company's value chain such as suppliers and customers. The technical aspect of this approach is the application of the generic concepts of Cyber-Physical Systems (CPS) and industrial Internet of Things (IoT) to the industrial production systems. The execution system of Industry 4.0 is therefore based on the connections of CPS building blocks. These blocks are embedded systems with decentralized control and advanced connectivity that are collecting and exchanging real-time information with the goal of identifying, locating, tracking, monitoring and optimizing the production processes (Rojko, 2017); for details about the utilization of system see therein.

Over the last few years, Industry 4.0 has emerged as an up-and-coming technology framework used for integrating and extending manufacturing processes (Xu et al., 2018). A growing number of enterprises worldwide have explored the benefits of digitizing and adopted industry 4.0 to be able to be one of the leading digital enterprises in tomorrow's complex industrial ecosystems (URL-2, 2016).

In the global economy and business operations, industry 4.0 is needed to dramatically increase the overall level of industrialization, informatization and manufacturing digitization to achieve greater efficiency, competency and competitiveness (Xu et al., 2018).

Behind the scenes of the world's leading industrial and manufacturing companies, a profound digital transformation is now underway. The forest and wood related sectors are no exception (URL-2, 2016). This new, digital industrial revolution holds the promise of increased flexibility in

manufacturing, mass customization, increased speed, better quality and improved productivity however to capture these benefits enterprises will need to do some investments (URL-1, 2017). The present study intended to illuminate the industry 4.0 transition process of forestry related sectors with an integrative literature review.

Material and Methods

Material

First, the present work mainly focuses on wood-based products and furniture industry. Second, it excludes not only non-wood forest products but also any material used for energy purposes.

According to the Food and Agriculture Organization of The United Nations (FAO)Yearbook of Forest Products 2016, the names of individual forest products and product aggregates are listed as follows: Industrial Roundwood, Sawnwood, Wood-Based Panels, Fibre Furnish, Paper and Paper Board, Wood Fuel, Charcoal and Pellets (FAO, 2018). Considering the structural situation of above-mentioned manufacturing industries and the industry 4.0 concept; wood-based panel and furniture industries stand out as the most industry 4.0 friendly industries. Also, regarding that the wood-based panel and furniture industries hold an important part in Turkey's economy (Koç et al., 2017) they have been chosen as the main focal point of the present study. The wood-based panels category is an aggregate category. In the production and trade statistics, it represents the sum of: veneer sheets, plywood, particle board, and fibreboard (FAO, 2018).

Method

The methodology adopted in the present study is based upon the literature review. It is possible to broadly describe a literature review as a more or less systematic way of collecting and synthesizing previous research (Snyder, 2019). An effective review creates a firm foundation for advancing knowledge and facilitating theory development (Webster & Watson, 2002). A literature review surveys the state of knowledge on a particular topic. Such reviews may provide useful overviews and integrations of an area (Baumeister & Leary, 1997). One of the main goals of this study is paving the way to the integration of industry 4.0 into the forest products industry. Therefore, the literature review was adopted as the research method.

Over the years, many types of literature reviews have emerged (Arshed & Danson, 2015). The integrative literature review approach was adopted for the present research. Under the right circumstances, any of the review approaches can be of significant help to answer a particular research question (Snyder, 2019). In the integrative literature review, the representative literature on a topic is reviewed, criticized, synthesized, and new frameworks and perspectives on the topic are generated (Torraco, 2005). The integrative review method can be beneficial when the purpose of the review is not to cover all articles ever published on the topic but to combine perspectives to create new theoretical models (Snyder, 2019). This function of integrative reviews and the purpose of the study have matched perfectly. Hence, integrative literature review method was particularly preferred.

Integrative literature reviews are mostly used to address mature or new, emerging topics. For newly emerging topics, the purpose is to create initial or preliminary conceptualizations and theoretical models, not to review old models: An integrative literature review is helpful to bring together individual pieces of literature and to analyze them for identifying the insights and perspectives they offer, as well as the deficiencies, omissions, inaccuracies, and other problems that are inevitable with recently published literature on a new phenomenon (Snyder, 2019; Torraco, 2016). Integrative literature reviews of mature topics are also beneficial to review and criticize the literature that has emerged since the last comprehensive literature review on the topic (Torraco, 2016).

Some examples of this type of review can be identified in the literature (e.g., Porras & Robertson, 1987; Bailey & Kurland, 2002; Covington, 2000; Edwards & Rothbard, 2000).

To be able to do the integrative literature review; the present study utilized the following processes: data collection, analysis and findings synthesis (Bartlett & Bartlett, 2011). Data were collected using internet

search engines (e.g., Google.com) and various online library databases such as ScienceDirect, Proquest, JSTOR, EBSCOHost, Business Source Premier, and Google Scholar. Keywords used in searching for existing research literature were industry 4.0, forest products, forestry, and digitalization. Only studies related to forest products industry were investigated in this review.

Results and Discussion

In the furniture manufacturing industry, there are many common problems. Such as low efficiency of resource use, great pressure of the environment, high labor cost. To be able to overcome these obstacles the intelligent manufacturing seems like the inevitable trend of the future furniture manufacturing industry. "Industrial 4.0" has the necessary advantages, such as high efficiency of resource allocation, quick response to market demand, low labor cost and logistics cost (Wang et al., 2017).

There are some challenges in implementation and adoption of a new technology (Müller et al., 2019). As an organizational change, these process poses challenges of both, technical and socio-economic nature (Chesbrough, 2010). Especially in the case of Industry 4.0, these challenges are high (Brettel et al., 2014).

As above mentioned, various technical challenges come along with the industry 4.0 applications in forestry. The introduction of data standards within production processes and beyond is one of these challenges. Industry 4.0 aims increased interconnection between different organizations (Müller et al., 2019). Without standards as a common language, this connection is impossible (Weyer et al., 2015). In the forest sector, different data standards already have been developed to improve data exchange, e.g. ELDATsmart (Kopetzky, 2017), StanForD (Möller et al., 2011). Although the existing standards, today, data along the wood supply chain are not being easily accessible at the national or international level (Müller et al., 2019).

The security of IT-systems as well as data protection is another difficulty of industry 4.0. Trust in cloud technology very much depends on the trust of the users in data protection and therefore has not only a technical but also policy dimension (Kagermann et al., 2013). Sufficient broadband internet infrastructure is necessary for a successful Industry 4.0 implementation and for the continuity of the usability of its applications. Hence, decision-makers are being hesitant about taking the risks by being skeptical of temporary break-downs or product quality loses (Wee et al., 2015). The forestry sector, characterized by long- term capital commitments, might be more hesitant than others at this point. To cope with this hesitation, it is an important task of applied research to demonstrate, e.g. in form of case studies, how high the added value of Industry 4.0 applications can be (Müller, 2019). Another forestry specific challenge is the complexity of the forest stand itself.

A major challenge of the forestry sector is its high stakeholder fragmentation. Forest owners, forest enterprises, harvesting contractors, timber transport contractors and customers must increase their collaboration not only with each other but also with players from other industry sectors and support early stages of innovation processes (Kubeczko et al., 2006).

In transition to industry 4.0 due to changing work environments and work organization losses of jobs are feared on the labor side. Labor qualification is another labor specific challenge. Forest enterprises mostly have not yet sufficiently qualified their workforce for new digital applications (Ittermann et al., 2015; Kagermann et al., 2013; White et al., 2016). In fact, in all sectors qualifying labor is important however in forestry which is one of the traditional sectors, qualification needs likely to be higher than in advanced industries e.g., in the automotive sector (Kagermann et al., 2013; Müller et al., 2019).

The findings of Industry 4.0 for Wood and Furniture Manufacturers Project (IN4WOOD) support the findings of researchers in the existing literature. According to their research conducted in partner countries in Europe it was found that the specific national sectoral features are found distinctive for the various levels of implementation of technologies: E.g., medium to large-sized companies in Germany are much more focused on the

application of technologies in the production process with attention to automation and robotics; whereas than small and medium enterprises (SMEs) in UK and Spain which have a higher focus on the entire manufacturing process including logistics and delivery; and SMEs in Italy concentrate on the application of technologies to other essential business support functions and processes including marketing, sales and after-sales, rather than the production process (URL-1, 2017).

In addition, results of URL-1, (2017) evidence a lack of digital business strategy among furniture industries, especially SMEs, demonstrating a poor involvement in the Internet of Things and in the use of cloud solutions. It was stated in the report that the biggest barrier for the implementation of Industry 4.0 technologies in all these contexts is the lack of knowledge and skills among staff, along with insufficient training in the topic and the high cost of implementing such technologies. Generally, it is evident that National Profiles, even if they are periodically revised, are in all countries, related to traditional competences. They rarely consider or include the advanced competencies and skills relating to Industry 4.0 technologies that are demanded from the future labour force (URL-1, 2017).

The possible benefits of forestry's transition to Industry 4.0 can be as follows: High resolution scanning for forest inventory, optimized and efficient harvesting with reduced impacts on ecosystem, timber logistics with better communication, Increasing safety in forestry, automation, higher machine use and less downtime in sawmilling, lesser stocks, enhanced grading, traceability, customization, flexible products, computational design, rapid prototyping in wood constructions, robotics for assembly, engineered wood products in better quality, fully connected smart factories, mass customization for furniture factories, virtual augmented reality for customer design, value chain integration: collaboration of manufacturers and suppliers, high end smart equitment to increase efficiency in paper industry, smart energy management and smart products (Kies & Kleinschmit 2018).

Conclusion

The industry 4.0 can make the manufacturing companies more efficient and profitable with fewer employees. In the forestry sector, automation and industrial optimization provide great advantages in terms of performance and production gain.

The level of implementation of the technologies depends on the characteristic of the sector and the national development level of country.

The biggest barrier during the implementation of industry 4.0 is the lack of knowledge and skills among staff and the high cost of technologies.

The sector has a general interest in industry 4.0 however there is a lack of digital business strategy among the forestry related sectors.

The vast majority of the people working in furniture and wood working industries clearly do not know how to integrate industry 4.0 technologies to their sector.

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End Grain Wooden Parquet Production

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Abstract

Aim of study: To produced end grain laminated parquets in different surface variations by using materials prepared by crosscut from branch woods of native wood species.

Material and methods: In the production of end grain laminated parquet, branch woods of yellow pine (Pinus sylvestris Lipsky), Eastern beech (Fagus orientalis Lipsky) and sessile oak (Quercus petraea Lieble) wood species that are widely growing in our country were used. End grain laminated parquet production was produced according to the laminated parquet production technology and infrastructure features.

Main results: End grain laminated parquets produced from branch woods of scotch pine, beech and oak native wood species have been warping (spring, bow etc.) after pressing. Despite the different press conditions, surface and infrastructure variations, warping could not be prevented.

Highlights: Determined that the end grain laminated parquet cannot be produced from the branch wood of the native pine, beech and oak wood species. It is recommended to carry out new studies for the production of end grain parquet with different wood species and methods.

Keywords: End Grain Parguet, Laminated Parguet, Parguet

Introduction

Together with the increasing demand for forest products, the decrease in forest resources both in our country and in the world and consequently, the excessive increase on the prices of limited raw material have led the producers to use the raw material in the best way (Çabukoğlu, 2007). Wooden material is preferred with its positive features in flooring. Originally created from planks placed side by side, wooden floors have been combined in different systems over time with the development of woodworking techniques, thinned, diversified with the use of different types, used in composite form by being taken to pieces and reassembled in order to reduce the resource consumption but It has never lost its importance (Özdöl Koca et al., 2013). In recent years, the processing of wood material in different ways has broght out the variety of parquet, with the aim of meeting the desired properties of the wood floor by optimizing for various usage areas (Güngör, 2008). As time passed, wooden flooring has also undergone slow but important developments and this took place especially during the Renaissance period. Developments such as the invention of tongue and groove machines and drying of wooden materials in ovens have led to innovations in this area, causing an increase in production and usage rate and a decrease in costs. Today, parquet is produced and used in various types such as solid, mosaic, laminated, panel and laminate. After the production of concrete floors and bonding materials in the 1930s, even thinner mosaic wooden floors were created and so it became easier to obtain and use wood. Mosaic wooden parquets then have spread all over the world and used widely. In the first years, despite being used in massive form, taking some problems such as consumption of costs and resources and etc. into consideration, they were also started to be used as layered material (laminated or plywood), fiber or chipboard, (laminate flooring) (Özdöl, 2010; Özdöl Koca et al., 2013). For the production of traditional wood flooring material (parquet), it is desirable to have a combination of aesthetics, heat insulation, sound absorption, deformation against moisture, abrasion, hardness, elasticity, economy and processing. Moreover, woods with smooth, solid and large diameter log (generally oak

25-35 cm, beech 30 cm) and wood with the least wood defects (such as fiber curl, knot) are preferred (Akyıldız and et.al., 2015). When compared with conventional and widely used wooden flooring materials; the strength, durability, longevity, sound and noise-reducing properties and easy maintenance of end grain materials, dates back to centuries, make them mostly preferred since they can be produced in lower quality and smaller sizes and even from used timbers (debris) and can be designed in different ways (Akyıldız et al., 2015). In this study, laminated parquet (multi-layered) production of different types and surface variations from the end grain of lower quality wood (branch wood) when compared to traditional wood and wood-based parquets have been tried.

Material and Methods

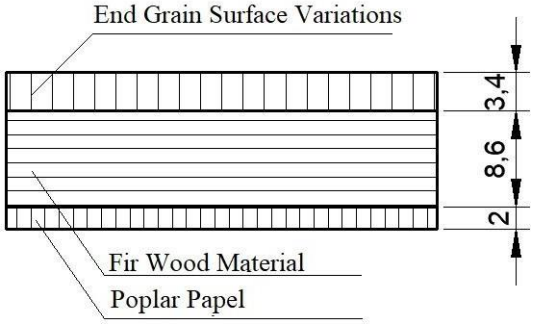
Material

Due to their widespread use in the woodworking and furniture industry in our country, scotch pine (*Pinus sylvestris* Lipsky), Eastern beech (*Fagus orientalis* Lipsky) and sessile oak (*Quercus petraea* Lieble) tree species woods are preferred as an upper layer material in end grain laminated parquet production types. In Type 1 production, fir wood material for the middle layer and poplar papel for the sublayer have been preferred. In Type 2 production Beech plywood for sub layer material (marine / water contra) has been preferred.

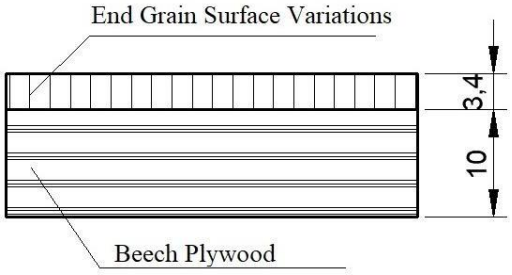
Branch wood used in the study has been provided from Ereğli district Zonguldak province, and Cide district Kastamonu province. Fir lumber, beech plywood and poplar papel have been provided from TKS (Tosya Wood Veneer and Particleboard Industry Trade and Inc.) operating in Tosya district.

Method

Production method: End grain parquet production has been carried out according to the laminated parquet (multi-layered parquet) production technology (TS EN 13489, 2017). In the research, 2 types were determined for the production of end grain laminated parquet. 1st Type 3-layer (700x200 mm in size) and 2nd Type 2-layer (400x400mm in size) (Figure 1) and three different surface variations were made of a) ~ Ø10 cm diameter branches b) 10x10 cm square branches and c) 10x5 cm rectangular branches (Figure 2).



Type 1 Production



Type 2 Production

Figure 1. End grain laminated parquet production types (dimensions are in millimeters).

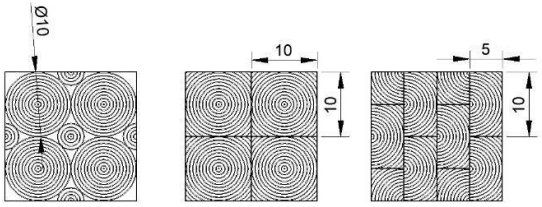


Figure 2. End grain laminated parquet surface variations (dimensions are in centimeters).

Preparation of the upper layer material: Branch wood, supplied in different diameters and lengths, was left to dry naturally for 2 months by cross-stacking and technical drying was carried out by cutting in coarse dimensions of 40-60 cm according to surface variations. The drying process was carried out gradually (starting 50 ºC-5 days, second stage 90 ºC-5 days, third stage until 103 ºC weight becomes stable) Figure 3.

Figure 3. Drying the samples

Following the drying procedure, samples were kept in the air conditioning room of Kastamonu University, Faculty of Forestry, Department of Forest Industry Engineering at 20 ± 2 ºC temperature and relative humidity of 65 ± 5% until it reached a constant weight (TS 642 ISO 554, 1997). Later, the samples were cut in net dimensions according to surface variations. Both surfaces of the samples were sanded with 100 and 220 numbered sanders in special pattern in a pallet sander before pressing (Figure 4).

Figure 4. Sanding of upper layer samples

Preparation of middle and sub layer materials: The Fir used in the middle layer for Type 1 production was obtained from the market as 1st class dried timber. After cutting in coarse dimensions, it was kept in the air conditioning room of Kastamonu University Faculty of Forestry, Department of Forest Industry Engineering, whose temperature was 20 ± 2 ºC and relative humidity was 65 ± 5% until it reached a constant weight (TS 642 ISO 554, 1997). Then it was cut as a long length lath of 200x20 mm. Subsequently, both surfaces were sanded in a calibrating machine and cut into 200x20x8.6 mm net dimensions.

The beech plywood, supplied in panel form for Type 2 production, was cut in 400x400 mm dimensions. Before pressing, both surfaces were sanded in a calibrating machine.

Press process: Both cold press and hot press applications have been made for the production of Type 1 and Type 2 end grain parquet. D3 norm polyvinyl acetate (PVAc) glue has been used in the cold press process. Urea formaldehyde glue has been used in the hot pressing process, and different temperatures and times have been tested in the pressing process.

Results and Discussion

With the branch woods of pine, beech and oak tree species grown in our country and used in this study, no successful results have been obtained in the production of end grain laminated parquet with both production types, all surface variations and different pressing shapes.

Warping (spring, bow etc.) has occurred on the types of parquet that have been under the process of production. Though the warping amount varies according to the production type, surface variation and pressing style, the obtained result has been the same and the warping has occurred from the substrates (sublayers) to the surface.

The warping in Type 1 has led the parquets to break from different points, especially after hot press conditions (Figure 5).

In Type 2, as a result of the warping stres, decomposition in the layers of beech plywood (marine / water contra) has been observed. At the same time, it has been determined that the upper layer materials especially the beech type does not adhere to the sub layer in Type 2. Some images of the results obtained in the study are given below (Figure 6).

Figure 5. Type 1 End grain laminated parquet production result

Figure 6. Type 2 End grain laminated parquet production result

Conclusion

In this study, the production of end grain laminated parquet from branch woods of native woods of scotch pine, beech and oak has been tried. As a result of the study, it has been determined that laminated parquet cannot be produced from the end grain surface of the branch wood as a result of warping, which is thought to be composed of the anatomical structure of the branch wood and the section used. New studies have been recommended to be carried out for the production of end grain parquet with different wood species and methods.

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Investigation of the Performance of Natural Dyes Obtained from Turkish Red Pine Bark Adjusting to Wood Pulp Using Starch and Alum

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Abstract

Aim of study: Turkish red pine forests have a distribution area of approximately 6 million hectares in our country. Approximately one million m3 of Turkish red pine bark is left in the forests after cuttings every year. The aim of this study is; To produce natural dyes from Turkish red pine bark left as waste in forests and to ensure that this dye hold to wood pulp.

Area of study: For this aim, the bark of Turkish red pine trees within the boundaries of Aladağ / ADANA Pos Forest Management Directorate was used. Turkish red pine bark was collected immediately after cutting.

Material and methods: Pure water extraction method has been preferred to obtain natural dyes from red pine bark. Wood pulp was supplied from abroad in ready form. Eucalyptus grandis wood pulp is used. Spectroscopic analyzes were applied to dyed papers produced in the laboratory.

Main results: Initially, With the method applied in the Sokslet device, natural dyestuff was obtained. Good adhesion was achieved by the addition of both starch and alum mordant. The combination of starch and alum mordants has provided even better adhesion. When the color angles are examined; It was observed that the colors obtained were in the I. region.

Highlights: We believe that if Turkish red pine bark left in the forest as waste can be utilized in obtaining natural dyestuffs, it will contribute greatly to rural development and hence the country's economy. At the same time, we think that the use of Turkish red pine bark, which is a high-calorie forest flammable substance, will have positive results in the management of forest fires.

Keywords: Turkish Red Pine Bark, Starch, Alum, Wood Pulp, Natural Dye.

Introduction

Coniferous and leafy bark produced for wood in our country are considered waste and generally used as fuel. However, the bark contains different chemical substance groups than wood. In this respect, the bark becomes the center of attention in terms of chemicals compared to wood, and the studies on the shell are increasing day by day (Dönmez and Dönmez, 2013). In this study, which examines the different ways of using the bark, it is aimed to bring the outer bark of the waste Turkish red pine tree to the industry and to contribute to the literature.

Making various products from tree bark is a very old indigenous tradition. From barks; Bottle cork, peel, tannins, dyestuffs, chewing gum, resin, latex, foodstuffs, aromatic substances, fishing line and arrow poisons, antibiotic substances and some substances used in medicine were obtained (Harkin and Rowe, 2005).

Cellulose, which is the basic component of plants, forms the structure of the paper. Paper is formed as a result of cellulose-based vegetable fibers becoming "pulp" by going through various stages and then gaining a certain durability of this pulp and having a smooth surface (Dölen, 2013). It continued for a thousand years.

The plant kingdom is a treasure trove of natural products. The use of natural herbs has increased in recent years. One of these areas of use is the production of natural dyes. Natural dyestuffs; It can be defined as high-grade colored substances with an infinite number of uses such as textiles, paper, wood, varnish, leather, ink, food, cosmetics,

pharmaceuticals and toothpaste (Krishnamurty et al., 2002).

Although natural dyes have been used in dyeing for centuries, there is a lack of scientific research in many respects. However, the environmentally friendly appearance of natural dyes has recently gained momentum. Despite the cheap production of synthetic dyes, the abundance of resources of natural dyes enables them to compete in the world market (Öğütgen, 2008; Dixit and Jahan, 2005).

Turkish Red Pine Bark

Pinus ponderosa species of which the most important types in Turkey (**Pinus brutia** Ten.) Is diploxylon sylvestris pine species belonging to the lower section. This pine species is a species of the Eastern Mediterranean region operate, including the most widely distributed world beached on the Mediterranean coast in Turkey (Selik, 1963).

In addition, there is a substance called OPC in the bark of Turkish red pine. OPC, which is 18-20 times stronger than vitamin C and 40-50 times stronger than vitamin E, is mostly found in red pine bark. The most important feature of OPC is that it tries to prevent the oxidation of blood fat and cholesterol. OPC, obtained from a mixture of grape seed and pine tree bark in France, is an approved herbal medicine for the treatment of weak blood vessels. In order for a substance to be considered as a dye, it must be colored and must be closely combined with the fiber, which OPC also has. It also seems possible to separate dye from red pine bark (Demir and Demir 2012).

*Colorimetric Measurement (CIE L * a * b * System)*

In the commonly used CIE L * a * b * color universe, the L * symbol is between 0 and 100 and denotes lightness. L * = 100 indicates white, L * = 0 indicates black. The a * and b * expressions are chromatic characteristics. a * goes from red to green from plus to minus, while b * goes from yellow to blue from plus to minus. In addition, C * denotes the color saturation and h indicates the hue angle (Appolonia et al., 2006). Figure 1 shows the CIE L * a * b * color universe.

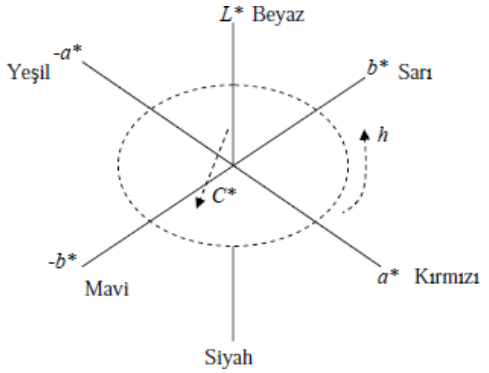

Figure 1. CIE L * a * b * color space (Acar, 2009)

Here Δ; show the difference and the letter E; It comes from the German word Empfindung, which means feeling. Color differences in units of CIE L * a * b * are calculated with the help of Equation 1-5.

$$\Delta E = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2} \quad (1)$$

$$\Delta L^* = L2^* - L1^* \quad (2)$$

$$\Delta a^* = a2^* - a1^* \quad (3)$$

$$\Delta b^* = b2^* - b1^* \quad (4)$$

The color angle (h) is used to determine the region where the color is in degrees and is calculated with the help of Equation 5.

$$h^\circ = \tan^{-1}(b^*/a^*) \quad (5)$$

Material and Methods

Turkish Red Pine Bark

Turkish red pine bark was obtained from within the borders of POS Forest Management Directorate in Aladağ district of Adana province. Turkish red pine barks were collected from the sections where they were cut from the south side after the bark was peeled. The collected Turkish red pine bark images are shown in Figure 2. While collecting Turkish red pine bark, the following points were taken into account.

Figure 2. Red pine bark images (C. KEŞMER).

Wood Pulp

Cellulose samples imported from abroad were used as wood pulp. Wood pulp obtained from Eucalyptus grandis was used in this experiment. After the moisture tests were done, the cellulose sample was taken, broken down into water and kept in water for one day. Later, cellulose samples softened in water were taken to the fiber mixer and fiberized. The chemical and morphological properties of the wood pulp used in Table 1 are given.

Table 1. Chemical and morphological properties of the wood pulp (Eucalyptus grandis) used.

Chemical and Morphological Properties	Standard	Average
Acetone Extraction,%		0.17
Ash, %	ISO - 1762	0.35
OX, g/admt	ISO - 11480	83.75
Fibers, million / g	Morphi	22.90
Average Fiber Length, mm	Morphi	0.67
Roughness, mg/100m	Morphi	6.45
Good Elements,% in Length	Morphi	21.00
Fines(Britt Jar), %	Fiber Tester	10.60
Fiber width,µm	Morphi	15.70

Preparation of Alum (KAl (SO4)2 • 12H2O)

1gr alum was taken and dissolved in 500mL of pure water. The same process is repeated every time you use it.

Starch Addition

1.5% cationic starch was added in proportion to the weight of dry wood fiber.

Natural Dye Made from Turkish Red Pine Bark

The paint was produced in socklet device. The water/dye raw material ratio is set as 100/5 (1000mL pure water + 50gr Turkish red pine bark) units. The water and dye raw material mixture was heated to 80 ° C in the jug in the extractor. After heating, the water and dye raw material mixture was extracted for 4 hours at 80 ° C; The measurement was made to keep the temperature constant. During the extraction, the mixture was mixed intermittently. After 4 hours, the mixture was cooled and filtered.

Painting Wood Pulp

Wood pulp moisture was measured and weighed and kept in water for 24 hours. At the end of this period, the pulp suspension was put into the fiber opener and the fibers became individual. Subsequently, a certain amount of pulp suspension was taken into beakers and the dye and mordant were added to the wood pulp suspension at the same time and mixed intermittently for 10 minutes. At the end of 10 minutes, the mixture was converted into naturally dyed paper in a paper machine. In paper making; Rapid-

Köthen brand laboratory type paper making machine was used in the Fiber and Paper Laboratory of Bartın University, Faculty of Forestry, Forest Industry Engineering Department.

Obtaining Spectroscopic Analysis

Çukurova University Faculty of Engineering and Architecture Textile Engineering Department Observation and Imaging Laboratory was used for

spectrophotometer analysis. As spectrophotometer; MINOLTA Spectrophotometer CM– 3600d) (D65) device was used. On the computer; RealColor Spectal Color Measurement v1.3 (2006) program was used. Colorimetric measurement (CIEL * a * b * System) was used to determine the values. Spectrophotometer where measurements are made is shown in Figure 3.

Figure 3. Spectrophotometry device (C. KEŞMER).

Results

Results obtained from spectroscopic analyzes are given in Table 2 and Table 3. The color tones obtained are given in Figure 4.

Table 2. Color difference values of papers with Turkish red pine bark dye

Paper	Dyestuff(mL)	Alum(mL)	L*	a*	b*	ΔL*	Δa*	Δb*	ΔE
1	–	–	92.61	-0.32	4.83	–	–	–	–
2	100	–	76.53	8.41	15.72	-16.08	8.72	10.89	21.29
3	150	–	75.22	9.08	15.80	-17.39	9.40	10.97	22.61
4	200	–	73.77	8.76	16.15	-18.84	9.08	11.32	23.78
5	100	100	64.25	9.62	25.77	-28.36	9.94	20.94	36.63
6	100	200	64.17	9.73	26.01	-28.44	10.05	21.18	36.86

Table 3. Color angles of papers with Turkish red pine bark dye

Paper	Dyestuff(mL)	Alum(mL)	a*	b*	h
1	–	–	-0,32	4,83	86,21
2	100	–	5,90	22,14	75,08
3	150	–	6,68	22,98	73,79
4	200	–	8,05	23,49	71,08
5	100	100	9,42	40,41	76,88
6	100	200	11,21	40,97	74,70

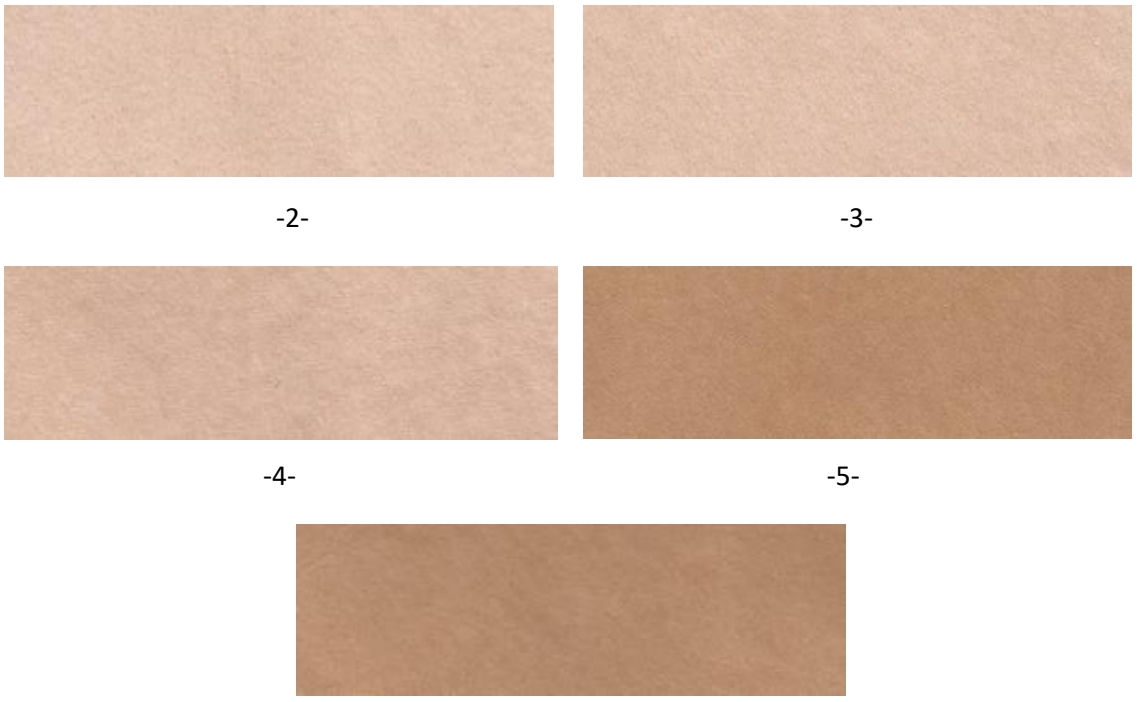

Figure 4. Color tones obtained from Turkish red pine bark dye

Discussion

L *; means gloss, high L * value means low paint yield. The low L * value is; means a dark color according to the reference sample, low L * also means high dye efficiency (Eser & Önal, 2015). Based on this information, when Table 2 is examined, it is seen that the L * value decreases as the amount of paint increases (papers No 2, 3 and 4). When the amount of paint remains constant (5 and 6 papers); It was observed that the L * value decreased with the increase of the screed amount. Consequently, the highest dye yield was detected in 200mL dyed paper numbered 4 with a value of 73.77, and the lowest dye adhesion was determined on paper no.2 and 100mL dyed paper with 76.53 L *. In natural dyed and alum-added papers, the highest dye yield was detected in paper No.6 with 64.17.

A decrease in the value of ifadeE means that the compared colors approach each other, and an increase in the value indicates that the colors are moving away from each other. As seen in Equation 1.1, 'E; It is calculated with the help of L *, a * and b * values. Therefore, the ΔE value refers to the degree of adhesion of the paint. High ΔE value means good adhesion. Dye adhesion as the L * value decreases; While ΔE means good, as its value increases, paint adhesion increases. L * and ΔE values are inversely proportional. Based on this information, when the values in Table 2 are examined, the highest ΔE value is 36.86 and this value was determined in 100mL dyed and 200mL alum added paper no.6.The highest paint adhesion in terms of both L* and ΔE values 36.86 was obtained from the sample no. 6 with 100mL painted and 200mL alum added.

The highest paint adhesion in terms of both L * and ΔE values was obtained from the sample no. 6 with 100mL painted and 200mL alum added.

Table 4. Classification of color differences (from Deveoğlu, 2008; Dölen, 1994).

ΔE	Color difference
0	No
1	Very small
2	Small
3	Middle
4	Big
5	Very big

When the values in Table 3 are examined, it has been determined that the color angle (h) values remain between 74.70 and 86.21. This information showed that the colors we obtained were in the first region in the color

space. The separation of regions in color space is given in Figure 5**.**

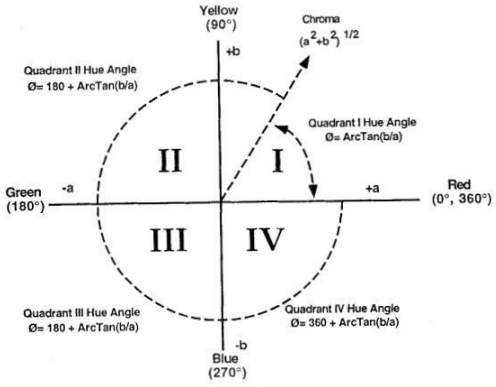

Figure 5: CIE L * a * b * color space (Mclellan et al., 1995).

Conclusions

It has been observed that the dye adhesion is very good in all the papers with natural dyes. Starch increased the fixation of the dye depending on the amount of dye. With the addition of alum mordant, the paint has increased even more. When ΔE values are examined, the rate of retention; With the increase in the amount of paint, an improvement of approximately 11.78% was observed. When compared to all papers, it was determined that a better paint adhesion was achieved by about 73% with the addition of alum. It was observed that all the color tones obtained on dyed papers were in the I. region. Turkish red pine forests spread over an area of approximately 6 million hectares in our country. After cutting, red pine bark remains in the forest as waste. Turkish red pine bark is a flammable substance with high calories. If evaluated, it will enable to reduce both the number and the severity of forest fires.

It is also very important that the barks left over from the use of natural dyes can be used as natural fertilizers without any pre-treatment.

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Examination of the Ratios Of Holding Onion Skin Natural Dye Into Wood Pulp Of Alum And Starch Mordants

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Abstract

Aim of study: Until the second half of the 19th century, natural dyes were used for dyeing all kinds of products. In recent years, a worldwide trend towards natural and environmental products has begun. The purpose of this study; It is to obtain natural coloring matter from edible onion skin which is waste in nature. Another purpose is; To determine the effectiveness of starch and alum mordants in dyeing wood pulp with natural dyestuff.

Area of study: The onion skin to be used in the production of natural dyestuffs were collected from the public market of Adana province Sarıçam district as waste. Wood pulp was supplied from a private company that produces tissue paper domestically.

Material and methods: Pure water extraction method is preferred for obtaining natural dyes. Pure water / onion skin ratio of 100br./5br. (1000gr distilled water / 50gr onion peel) was used in the extraction method. Mordanting method is preferred together. Colorimetric measurement (CIE L *a *b *System) method was used in the spectroscopic analysis of papers.

Main results: Onion skin contains high amounts of quercetin. The amount of quercetin increases the dyeing and adhesion efficiency of the natural dyestuff. Quercetin was especially good with alum mordant and a high paint adhesion was achieved. Color saturation and Kubelka-Munk values have also proven good paint adhesion.

Highlights: Natural dye from onion skin will provide the formation of a new line of business. This will also benefit the country's current account deficit. It is possible to use the remnants of natural dyestuff production as a natural fertilizer without any processing.

Keywords: Onion Skin, Dyestuff, Alum, Starch

Introduction

The history of paper and the history of humanity are almost the same. History means writing. The importance of the paper provides the transfer of information. The easy handling of the paper has accelerated the flow of information. The need for information flow has increased paper production. The transfer of knowledge from generation to generation has enabled the information to reach a wide segment. Paper provided memory to societies. It gave the emperors the opportunity to easily rule the empires. Therefore, the production information of the paper was kept as confidential information and made it a strategic product. Today, paper has a wide range of uses. Despite all technological developments, its use is increasing. (Karıncaoğlu, 2010).

Onion is generally not a plant that grows spontaneously in nature. The skins of dried onions contain dye. It is made with the method of dyeing with mordant with the dried and ground skins of the onion (Kılıç Karatay & Oyman, 2017).

The decline of natural dyeing in Turkey began in 1882 with the introduction of synthetic dyes countries in spite of everything Anatolian people give up until today from vegetable dyes and traditional dyeing it has existed. Nowadays, entrepreneurs who want to produce on this subject are supported by the state. So much so that in some factories, integrated units that do dyeing with vegetable dyes are established. The most important problem in herbal dyeing is the inability to use the natural dyestuff resources thrown away. In this context, onion skins contain very important quercetin dye, but it can not be evaluated. If evaluated, we could provide $ 100 million in foreign currency input from onion skins alone (Önal, A., 2000). With this

gain, it is possible to build factories in under developed regions every year and provide jobs for many unemployed people (Önal & Kulle, 2012).

Studies to develop alternative harmless products to all products that harm human and environmental health continue in every field. As human and environmental health awareness comes to the fore, states introduce new protective standards, so natural dyes are demanded by the society as important alternative materials to synthetic-based and harmful dyes (Luciana et al., 1997; Kamel et al., 2005; Calogero & Marco, 2008; Atılgan et al., 2013).

Natural dyes are better at biodegradable and generally highly environmentally compatible. Natural dyes are not toxic, they do not have an allergenic effect on the human body, they are not carcinogenic, they can be easily obtained and renewed (Saha & Dutta, 2007; Adeel et al., 2009).

Quercetin

Quercetin, which is used as natural yellow dye extract, is abundant in onion peel (Erdoğan, et al., 2004; Mcnab et al., 2009). Mordant metals (iron, aluminum, calcium and magnesium) are generally used in the natural dyeing process (Erdoğan et al., 2004). Figure 1 shows the structure of the Al (quercetin) complex. Flavone-based compounds are known to form more stable complexes with metal cations. Alum ($KAl(SO_4)_2.12H_2O$) is widely used with polyphenolic dyes to obtain bright colors (Septhum et al., 2007). Quercetin is also used as a natural yellow dye extract, which has high fastnesses (light, washing, sweat, friction, abrasion) (Karadağ & Böhmer, 2001).

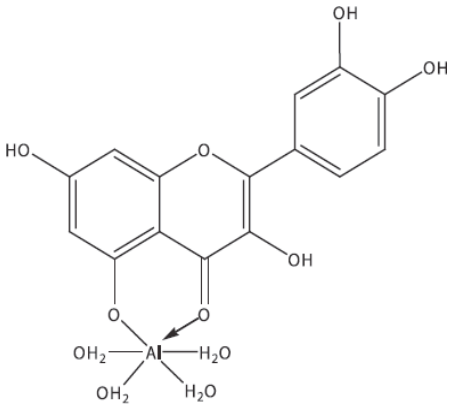

Figure 1. Al (quercetin) complex (Septhum et al., 2007).

*Colorimetric Measurement (CIE L * a * b * System)*

In the commonly used CIE L * a * b * color universe, the L * symbol is between 0 and 100 and denotes lightness. L * = 100 indicates white, L * = 0 indicates black. The a * and b * expressions are chromatic characteristics. a * goes from red to green from plus to minus, while b * goes from yellow to blue from plus to minus. In addition, C * denotes the color saturation and h indicates the hue angle (Appolonia et al., 2006). CIE L * a * b * color universe is shown in Figure 2.

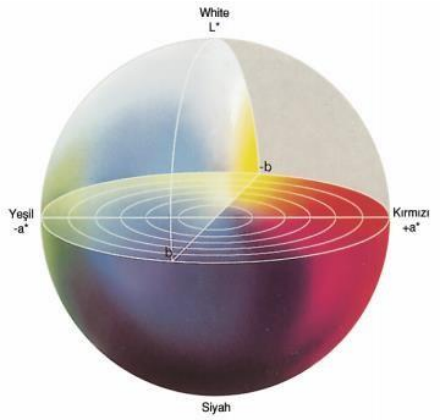

Figure 2. CIE L * a * b * color universe (Stefan et al., 1999).

Here Δ; show the difference and the letter E; It comes from the German word Empfindung, which means feeling. Color differences in units of CIE L * a * b * are calculated with the help of equation 1-4.

$$\Delta E = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2} \quad (1)$$

$$\Delta L^* = L2^* - L1^* \quad (2)$$

$$\Delta a^* = a2^* - a1^* \quad (3)$$

$$\Delta b^* = b2^* - b1^* \quad (4)$$

Chroma (C *) is a measure of density or saturation and is calculated with the help of Equation 5.

$$C^* = (a^{*2} + b^{*2})^{1/2} \quad (5)$$

Kubelka-Munk Theory

The three parameters that affect color formation and appearance in materials are absorption, scattering and reflection. In opaque samples such as textile materials, the relationship between the light absorption and

scattering property of the surface and the reflection of the light falling on this surface is expressed by the Kubelka-Munk equation and these values are measured at the maximum absorption (minimum reflectance) wavelength of the dyed fabric (Akgün, et al., 2012; Kubelka, 1948; Mc Donald, 1987; Mc Laren, 1986). The relationship between these parameters is defined by the Kubelka - Munk equation given in Equation 6.

$$K/S = (1-R)^2 / 2R \quad (6)$$

Material and Methods

Material

Onion Skin

Onion skins were obtained from greengrocers in Adana province and Aladag district. Later, it was cleaned of dirt and left to dry in a laboratory environment. After drying, it is chopped by passing through a hand-held blender (Figure 3).

Wood Pulp

Cellulose samples imported from abroad were used as wood pulp. Wood pulp obtained from *Eucalyptus grandis* was used in this study. After the moisture tests were carried out, a sample of 239g cellulose was taken, crushed into 8 liters of water, and kept in water for one day. Later, cellulose samples that softened in water were taken to the mixer and fiberized. The chemical and morphological properties of the wood pulp used in Table 1 are summarized.

Figure 3. Ground onion peel (C. KEŞMER).

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Chemical and Morphological Properties	Standard	Average
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Method

Preparation of Alum ($KAl(SO_4)_2 \cdot 12H_2O$)

1gr alum was taken and dissolved in 500mL of pure water. The same process is repeated every time you use it.

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1.5% cationic starch was added in proportion to the weight of dry wood fiber.

Natural Dye of Onion Skin

The paint was produced in socklet device. The water / dye raw material ratio is set as 100/5 (1000mL pure water + 50gr red pine bark) units. The water and dye raw material mixture was heated to 80 ° C in the jug in the extractor. After heating, the water and dye raw material mixture was extracted for 4 hours at 80 ° C; The measurement was made to keep the temperature constant. During the extraction, the mixture was mixed intermittently. After 4 hours, the mixture was cooled and filtered.

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into the fiber opener and the fibers became individual. Afterwards, a certain amount of pulp suspension is taken into beakers and at the same time, dye and mordant, wood pulp.

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Figure 4. Spectrophotometry device (C. KEŞMER).

Results and Discussion

Results obtained from spectroscopic analyzes are given in Table 2, Table 3 and Table 4. The color tones obtained are given in Figure 5.

Table 2. Color difference values of papers with onion skin dye

Paper	Dyestuff(mL)	Alum(mL)	L*	a*	b*	ΔL	Δa	Δb	ΔE
1	–	–	92.61	-0.32	4.83	–	–	–	–
2	100	–	73.20	5.90	22.14	-19.41	6.22	17.31	26.74
3	150	–	71.65	6.68	22.98	-20.96	7.00	18.15	28.60
4	200	–	68.26	8.05	23.49	-24.35	8.37	18.66	31.80
5	100	100	64.33	9.42	40.41	-28.28	9.74	35.58	46.48
6	100	200	58.24	11.21	40.97	-34.37	11.53	36.14	51.19

Table 3. Color saturation (C) values of the papers with onion skin dye

Paper	Dyestuff (mL)	Alum (mL)	a*	b*	C
1	–	–	-0.32	4.83	4.84
2	100	–	5.90	22.14	22.91
3	150	–	6.68	22.98	24.13
4	200	–	8.05	23.49	24.83
5	100	100	9.42	40.41	41.49
6	100	200	11.21	40.97	42.48

Table 4. Kubelka-Munk (K / S) values of papers with onion skin dye

Paper	Dyestuff(mL)	Alum(mL)	K/S
1	–	–	0.08
2	100	–	1.50
3	150	–	1.90
4	200	–	2.63
5	100	100	4.18
6	100	200	6.64

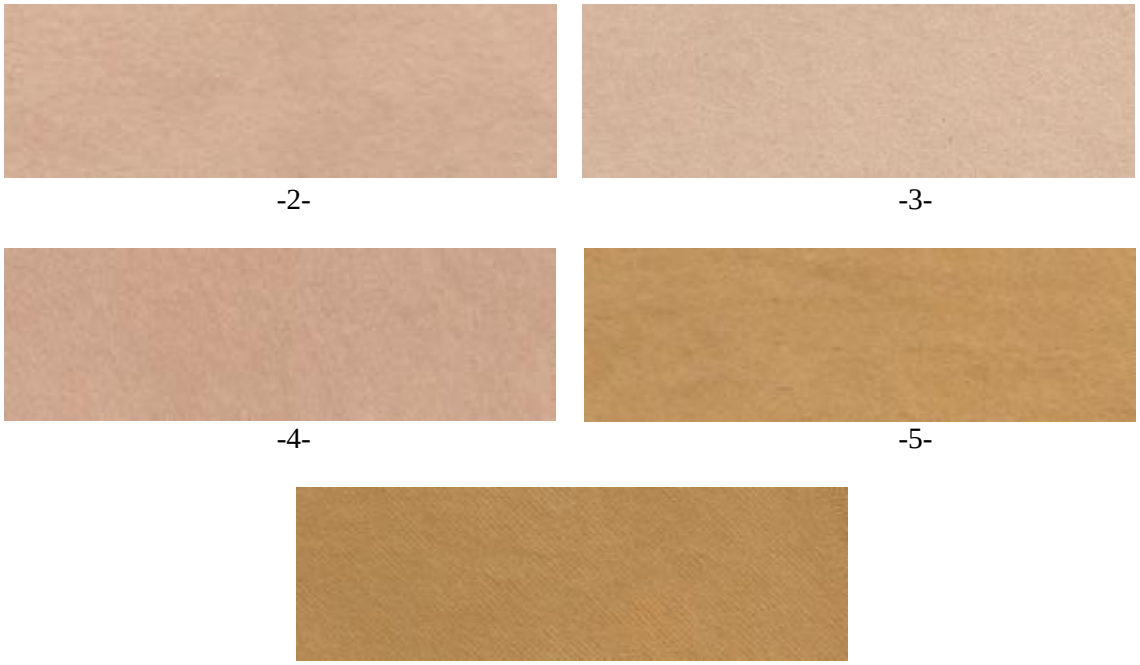

Figure 5. Color tones obtained from onion skin dye

Discussion

L *; refers to gloss, high L * value means low paint yield. The low L * value is; means a dark color according to the reference sample, low L * also means high dye efficiency (Eser & Önal, 2015). Based on this information, when Table 2 is examined, it is seen that the L * value decreases as the amount of paint increases (papers No 2, 3 and 4). When the amount of paint remains constant (5 and 6 papers); It was observed that the L* value decreased with the increase of the screed amount. Therefore, in onion peel dyed papers without alum addition, the highest dye yield was detected in 200mL dyed paper numbered 4 with 68.26 value, and the lowest dye adhesion was determined on no.2 and 100mL dyed paper with 73.20 L*. In natural dyed and alum-added papers, the highest dye yield was found in paper No.6 with 58.24.

A decrease in the value of ΔE means that the compared colors approach each other, and an increase in the value indicates that the colors are moving away from each other. As seen in Equation 1.1, 'E; It is calculated with the help of L *, a * and b * values. Therefore, ΔE value refers to the degree of adhesion of the paint. High ΔE value means good adhesion. Dye adhesion as the L * value decreases; While ΔE means good, as its value increases, paint adhesion increases. L * and ΔE values are inversely proportional. Based on this information, when the values in Table 2 are examined, the highest ΔE value is 51.19 and this value was determined in the 6 numbered 100mL painted and 200mL alum added paper.

The highest paint adhesion in terms of both L* and ΔE values was obtained from the sample no. 6 with 100mL painted and 200mL alum added.

Looking at Table 5, it is seen that all IE values are greater than 5. This is in the class of very large dye adhesion in naturally dyed papers.

Table 5. Classification of color differences (Deveoğlu, 2008; Dölen, 1994).

ΔE	Color difference
0	No
1	Very small
2	Small
3	Middle
4	Big
5	Very big

A point away from the neutral point denotes the chroma (C *), which is a measure of the saturation (saturation) of a color with a

given brightness (L * value) (Hunterlab, 1995). In the light of this information, when the values in Table 3 are examined, it has been determined that the highest C * value is in the No. 6 paper with 42.48 values. The C * value increased with the increase in the amount of paint. With the addition of alum mordant, the C* value was further increased and dyed papers with even higher color saturation were obtained.

Abdu Zubairu and Yusuf Madu Mshelia (2012): In their work titled "Effects of Selected Mordants on the Application of Natural Dye from Onion Skin (Allium cepa)" from K/S value; It was stated that the higher the K/S value, which is mentioned as the strength of the color, the higher the adherence of the color. When the values in Table 4 are examined, it is determined that the K/S value increases with the increase in the amount of paint. The addition of alum mordant further increased the K/S value. The highest K/S value was determined with 6.64 in paper No.6. Therefore, the best paint adhesion has been determined on paper No.6.

Conclusion

It has been observed that starch and alum are effective in natural dye adhesion. The natural dyestuff obtained in onion skin is fixed to the wood pulp when both starch and starch are used together with alum. When the color difference (ΔE) values, L * values and K / S values were examined, it was concluded that the paint retention was achieved by adding both starch and alum. It has been observed that when the alum mordant and starch are used together, the paint adhesion is better.

When the ΔE values were examined, an improvement of approximately 19% was observed with the increase in the amount of paint. When all papers were compared, it was determined that 91.4% better dye adhesion was achieved with the addition of alum.

In recent years, the importance of natural dyes has increased due to ecological balance, biological degradation and better adaptation of natural dyes to the environment. Turkey's history is quite old in terms of having a rich potential in terms of plants used in natural dyeing, and has a tradition of natural coloring. This richness can not be reflected in the number of plant species used in painting today. However, the production of these natural dye plants at certain standards will again enrich the agricultural areas and begin to be used in handicrafts, and this will add a significant export income to our country. This situation will both improve tourism and provide an income for the producer.

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New Trends in Ecotourism: Forest Bathing/Forest Therapy in the World and Turkey

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Abstract

Aim of study: The study aims to reveal the content of forest bathing, which is also recognized as an ecotourism activity, to evaluate the application areas in the world and to make suggestions for the locations where forest bathing sessions can be performed in Turkey.

Area of study: Certified and non-certified routes and bases where forest bathing is applied worldwide will be examined.

Material and methods: The first stage of the study consists of determining the areas where forest bathing and forest therapy are applied. Then, literature and internet research was done, and studies conducted within Turkey and abroad were examined. After obtaining sufficient information, the analysis phase started. It has been investigated and tried to present forest bathing activities to determine the current uses worldwide. Also, meetings were held with Turkey's first certified forest therapist.

Main results: The forest areas where the health effects of forest therapy are determined and the general characteristics of these forests were revealed. Recommendations were made for the forest areas in Turkey to gain and maintain trail designation for forest bathing.

Highlights: Forest therapy, which is considered as preventive medicine, is expected to be approved by the World Health Organization (WHO). Turkey will have a significant role in this context with the forest resources that it has. In this regard, planning studies to be carried out in cooperation with the major countries will increase the value of Turkey's forest resources.

Keywords: Forest Bathing, Forest Therapy, Ecotourism, Forests of Turkey

Introduction

From the beginning of 2020, all of the countries encountered with COVID-19 pandemic. As Jones (2020) stated, by having disturbing effects on human populations and seriously disrupt their activities, contagious diseases such as COVID-19 can be accepted as a social shock (Pinheiro & Luis, 2020). This kind of shocks causes physical and psychological harm to people in the short, medium and long term. Studies in which psychological damages are determined as well as the known physical effects of Covid-19 have started to take place in the literature. Wang et al. (2020) mentioned that more than half of the respondents (>652 participants) rated the psychological impacts (anxiety, depression, and stress) as moderate-to-severe, during the initial phase of the COVID-19 outbreak in China. Huang & Zao (2020) conducted a study with a total of 7236 participants and stated that the 1/3 participants showed anxiety disorders anxiety and nearly 1/5 participants had depressive symptoms and sleep problems. Most of these impacts are observed mostly according to quarantine and home isolation.

Quarantines have caused a break on the human-nature relationship, and being away from nature affects human psychology. Many scientific studies have shown the significant positive effects of natural environments on human physiology and psychology (Kaplan, 1992; Kaplan & Kaplan, 1995; Kellert et al., 2008; Souter-Brown, 2015; Frumkin et al., 2017; Hunter, 2019; Wyles et al., 2019; Olafsdottir et al., 2020).

An increasing number of diverse research disciplines are now immersed in understanding the nature-health connection. As a result, the growing body of scientific evidence is gradually nudging nature into the realm of public health and traditional

medicine as a tool healthcare providers can use to promote healthy living (PHS, 2020).

Nature-Based Tourism (NBT) and Ecotourism

'Nature-based' tourism is frequently described as one of the fastest-growing sectors of the world's largest industry and a significant justification for conservation (Balmford et al. 2012). It can also be defined as a segment in the tourism market in which people travel with the primary purpose of visiting a natural destination such as national parks, wilderness areas and developing countries where a large portion of the world's biodiversity is concentrated (Kuenzi & McNeely, 2008). Fennell (2015) defined NBT as a form of tourism that encompasses forms of tourism such as mass tourism, adventure tourism, low- impact tourism, ecotourism, which use natural resources in a wild or undeveloped form. "Nature-based" is one of the core criteria used to define ecotourism because the philosophy of ecotourism is deeply connected to nature. NBT and ecotourism can occur in the same environments, but they differ from each other at some points. Philosophically, ecotourism is a tourism field distinguished by its environmental concern and appreciation for nature (Fennell, 2015; Ramirez & Santana, 2019).

Ecotourism is sustainable tourism, which is based on the ecological principle and sustainable development theory. It aims to conserve resources, especially biological diversity, and maintain sustainable use of resources, which can bring ecological experience to travellers, conserve the ecological environment, and gain economic benefit. (Wang & Tong, 2012). Ecotourism, as a concept of sustainable tourism, is also used in the development of rural tourism (Indika & Vonika, 2016).

New demand of nature-based tourism increases worldwide (not only in protected but also in rural areas), and specific trends and megatrends in nature-based tourism can be identified in terms of experiential "themes" and resources for forest-based and nature-based experiences (Bori-Sanz & Niskanen, 2002; cited in Conti, 2019).

A forest is a multi-sense environment. It can be experienced with all senses, and it fits perfectly as an operational environment for a wellness service product for ecotourism because of its invigorating effects (Johanna & Sami, 2011).

Numerous interventions and programmes have been already created and developed in different countries to encourage populations to use forests for health and wellbeing. Some of these interventions focus on promoting health, while others target those who have some existing problem; either mental, physical, emotional or behavioural. Health benefits of forests can be divided into four categories such as;

- Forests for human health promotion and disease prevention,
- Forests for therapy and rehabilitation,
- Forests for education providing indirect health benefits and
- Forests for recreation and tourism (FOREST EUROPE, 2019).

New trends such as "forest therapy" and "forest bathing" have arisen through the health benefits of forests.

Forest Bathing and Forest Therapy

A forest bathing trip, called "Shinrin-yoku" in Japanese, involves a visit to a forest area for relaxation and recreation by breathing in volatile substances, called phytoncides, released from the trees (Li et al. 2008).

The Ministry of Agriculture coined the term 'shinrin-yoku, Forestry and Fisheries of Japan (MAFF) in 1982, which was introduced as a public health concept, primarily to reduce the staggeringly high suicide rates in the early 1980s. Then began to be introduced into Japanese clinical fields and has since become a worldwide trend (Kotte et al. 2019, Hansen, Jones & Tocchini, 2017; Garcia & Miralles, 2020). "Shinrin-yoku" is a process in which activities in forest environments are used to improve the mental and physical health of people. Given the Japanese origin and school of thoughts there, forest bathing is one foundation of Forest Therapy. In 2004, MAFF came out with the "Therapeutic Effects of Forests plan." This may be thought of like an advanced version of the "Shinrin-yoku plan," the significant difference being that it emphasizes the importance of evidence-based scientific investigation on the effects of forest

environments on human health (Park et al. 2007; Tsunetsugu et al., 2010).

At Europe, for exploring the relationships between health, natural environments in general, and forests in particular, COST (The European Cooperation in the field of Scientific and Technical Research) Action E39 "Forests, Trees, and Human Health and Well-Being" was started in 2004 and last in 2008. The Action aims specifically to set out the key health priorities identified within European countries and the possibility for forestry to contribute to meeting them, to engage health policy interests in the identification of information gaps in this field, and to develop a network of researchers and research institutions in forestry, health, environment and the social sciences (Nilsson et al., 2011).

International Union of Forest Research Organizations (IUFRO) launched a new task force on forests and human health in Finland in 2007 to foster cross-disciplinary dialogue between the different researchers in this field, especially forestry and health professionals. As part of this effort, the Japanese Society of Forest Medicine was established in 2007 under the Japanese Society for Hygiene, to promote research in the field of forest medicine, including the effects of forest bathing trips and the therapeutic effects of forests on human health (Park et al. 2010)

Forest therapy and forest bathing have various benefits not only based on health (physiological and psychological), but also on the host environment such as providing mandates for forest protection and economic diversification of existing nature-based tourism and recreation sectors (Gürbey et al., 2020).

Positive physiological effects of forest therapy have been reported by many researchers as;

- Reducing heart rate and blood pressure,
- Increase in natural killer cells/anti-cancer protein,
- Production and reducing blood-sugar levels,
- Stomach ulcer recovery and easing digestion,
- Allergies and respiratory diseases,
- Decreasing the level of cortisol and other stress hormones,

Positive psychological effects can be seen on mental health and emotional wellbeing by reducing;

- Stress,
- Depression,
- Anger,
- Fatigue,
- Confusion,
- Improving mood,
- Concentration and memory,

and increasing sense of relaxation and helping in the treatment of eating disorders (Gürbey et al., 2020).

Forest Therapy Bases and Roads in the World and Turkey

A "Forest Therapy Base" and a "Therapy Road" are scientifically approved locations with forests and urban environments where experiments were conducted analyzing the healing and preventive medical benefits due to the environment (FTS, 2020). When the therapeutic effects of an entire candidate area are designated, it is certified as a "base". In contrast, when those of only a roadside is established, it is certified as a "road". "Road" can be promoted to "base" when the therapeutic effects become area-wise rather than merely along a line (Ohe et al., 2017).

Discussion of the "Plan of the Forest Therapy Base" was begun in 2003 by the initiative of the Forest Agency, the national policymaker for forestry, and the Forest and Forest Products Research Institute, a national research institute for forestry. A research project to accumulate evidence on the benefits of forest therapy was also launched in 2004. Then, the "Forest Therapy Society (FTS)", which is specialized in dealing with forest therapy programs, was established in 2007. The first certification was established in 2006 (6 Therapy Bases and 4 Therapy Roads were designated). Today, 56 Forest Therapy Bases and nine therapy roads have been certified nationwide in Japan (Table 1). Forest therapy is considered preventive medicine rather than medical treatment as mentioned earlier, and the head of this FTS is a medical doctor (Ohe et al., 2017; FTS, 2020).

A certified forest-therapy base in Japan needs to have more than two trails, or 'forest-therapy roads' (Li, 2019). The base needs to be gratify five senses (sight, smell, touch,

hearing and taste), rich in biodiversity and have different types of water resources. There is also a need for systems and regulations that protect the natural environment and landscape, and control noise and air pollution, etc. The areas must be free of soil pollution and natural and artificial toxic pollutants. Trail slope, width, trail surface, walking distance and difficulty level must be well-planned. Also, safety (rockfall, cliff, drainage) is taken into consideration. The trails may differ in difficulty and length, and also at least one trail must be designed according to the universal design criterias. Rest facilities and toilets must be provided at appropriate and accessible places. Forests with plant species such as conifers which are capable of high emitting monoterpenes are preferable. Forest areas with high canopy cover should not be preferred in terms of feeling safe. Accessibility for visitors with private car or public transportation and parking lots are also factors to be considered (Adapted from FTS, 2020b).

In China, the concept and model of Japanese forest therapy was introduced in 2012 and the promotion and practice of forest therapy began in 2013 (Zhang et al., 2020). Since 2015, China has carried out various activities related to Forest Therapy. The respective provinces largely coordinated these activities. For example Sichuan Forestry Society for the first time announced two forest therapy routes, which are through Emei forests and Dujiangyan-Siguliang Mountain forests. According to the strategic plan, another 10 to 15 forest therapy corridors will be developed till 2022 in the province (URL-1). In Beijing, five forest therapy centers (Songshan, Badaling, Shichangyu, Baiwangshan & Xishan) are being built (Jinglan & Lanlan, 2017). By the end of 2020, it is expected that 500 Forest Recuperation Bases to be established in China (Liu et al., 2019). The number of designated Forest Therapy bases and roads in Asian countries such as Taiwan and Korea is also growing.

In Europe and continent of America, forest therapy roads have begun to certificated by some institutions and associations of forest therapy.

Despite having rich forest resources, there isn't any Forest Therapy bases or Roads designated with proven health effects in Turkey.

All forests of Turkey and many national parks in the country are suitable for forest bathing and therapy in terms of proximity to cities (Doğaner, 2019). Especially Samanlı, Mountain, Mount Uludağ, Bozdağlar, Mount Ida, Istranca, Bolu, Kaçkar, Taurus and Küre Mountains are the best examples in this regard.

Table 1. Forest Therapy Bases (FTBs) and Forest Therapy Roads (FTRs) in Japan (FTS,2020c; URL-2; URL-3)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Length (km)	Attitude/Elevation (m)
	Saku-Shi	FTB/ October 2006	***Betula dahurica***, *Larix sp.*, *Pinus densiflora*, *Quercus serrata*, *Castanea sp.*	Fabre's small diameter	2.6	830-851 (21 m)
				Waterside's small diameter	0.7	890-945 (55 m)
				Small diameter of the piece	1.6	1154-1250 (96 m)
				Small diameter of larch valley	1.6	1053-1151 (98 m)
				Small diameter of deer	1.3	1150-1171 (97 m)
	Minamiminowa-Mura	FTR/ April 2006	(Broad-leaved forest) *Chamaecyparis obtusa*, *Pinus densiflora*	Mizunashi Pond	4.3	1379-1487 (108 m)
				Nature exploration	3.7	1482-1648 (166 m)
				Pond tour course	9.2	1560-1920 (360 m)
			Quercus crispula, *Fagus sp.*	Okushiga Shirakabaen Road	3.3	1461-1506 (45 m)
	Matsukawa-Machi	FTB/ March 2013	(Mixed Forest) *Chamaecyparis obtusa*, *Cryptomeria japonica*	Oyote no Mori	2.2	800
				Rindo	2	1400
	Heavens Sonohara (Achi Village)	FTR/ April 2010	*Larix sp.* *Chamaecyparis obtusa* *Malus sieboldii*, *Pterocarya rhoifolia* *Acer sp.*	Iwana no Mori Promenade	2.2	800
	Agematsu Town	FTB/ April 2006	*Chamaecyparis obtusa* *Chamaecyparis pisifera* *Thujopsis dolabrata*	Fureai no Michi	2.8	1080-1130 (50 m)
				Robin	2.7	1080-1160 (80 m)
				Mukaiyama	2.1	1080-1170 (90 m)
				Cold swamp	3.3	1080-1150 (70 m)
				Neutral course	2.1	1080-1170 (90 m)
			(50% natural broad-leaved forest and 50% *Chamaecyparis obtusa* plantations)	Kamiakazawa	2.2	1080-1200 (120 m)

(Table 1 Continued) (FTS 2020c; URL-4)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Trail Length (km)	Attitude/Elevation (m)
NAGANO	Otari-Mura	FTB/ March 2007	*Fagus sp.* *Abies mariesii* *Betula sp.* *Larix sp.*	Mountain stream Mountain stream Himemiya Kamaike Pond Tsugaike Nature Park Tsugaike / Cortina Woodchip Road Shionomichi	1.5 3.5 2 1-2 0.7 5.7	1080-1100 (20 m) 1080-1100 (20 m) 1190 1600-1900(300 m) - -
	Shinano-Machi (2 star base)	FTB/ April 2006	*Quercus crispula, Cryptomeria japonica* *Larix sp.* Betula sp. *Fraxinus mandshurica*	Seismic waterfall (Nainotaki) Goshikachi Zounokomichi	7 1.2 2.5	- - -
	Iiyama-Shi	FTB/ April 2006	(Deciduous broad-leaved forest) *Fagus sp.* *Cryptomeria japonica* *Quercus crispula*	Beech Satoyama Komichi Chayaike Forest Bath Shinetsu Madarao Kogen	1.2 2.3 80 7.3	529- 537 (8 m) 1074-1106 (32 m) 563-1382 (819 m) 862-969 (107 m)
	Yamanouchi-Machi Shiga Kogen	FTB/ April 2008	*Cryptomeria japonica* (300 years old) *Tsuga diversifolia, Abies mariesii* *Thuja standishi Quercus crispula*	Kami no Mori Kosuge no Sato, Hokuryu Lake Mizunashi Pond Okushiga Shirakabaen Road Pond tour Seseragi Nature exploration	3.8 4.3 3.7 10.3 3.2 4	514- 910 (396 m) 1370-1470 (100 m) 1410-1460 (50 m) 1550-1910 (360 m) 1580-1670 (90 m) 1480-1640 (160 m)
	Kijimadaira-Mura	FTR/ March 2007	*Fagus sp.* *Betula sp.* + *Larix sp* + *Quercus sp.*	North Dove South Dove Osawa Takappyoyama Hakkenzan	4.9 0.6 1 3.6 3.8	1460-1600 (140 m) 1450-1600 (150 m) 1460-1470 (10 m) 1460-1740 (280 m) 1390-1560 (170 m)

(Table 1 Continued) (FTS 2020c)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Trail Length (km)	Attitude/Elevation (m)
NAGANO	Kijimadaira-Mura continues		*Larix sp., Betula sp., Cryptomeria japonica*	Large beech	1.5	1380-1440 (60 m)
				Dogo flat	1.3	1380-1440 (60 m)
				Dob flat	1	1300-1400 (100 m)
IWATE	Iwate-Machi	FTB/ March 2015	(Mixed forest) *Quercus crispula, Cryptomeria japonica, Fagus sp., Larix sp.,*	Ishigami-no-Oka	2	270-326 (56 m)
				Kodaki Course	1.06	291-335 (44 m.)
				Arashiyama	2.84	291-332m (41 m.)
				Ishigami Hill	1.5	270-326 (56 m.)
				Ishigami no Oka	1	270-315 (45 m.)
	Iwaizumi-Cho	FTR/ April 2006	*Fagus sp. Pinus densiflora, Betula ermanii, Quercus crispula, Picea abies*	Beech forest	2	916 (Flat)
				Yamano grass	2	916-960 (44 m.)
AKITA	Kazuno-Shi	FTB/ April 2008	*Cryptomeria japonica, Fagus sp., Larix sp., Betula sp.*	Yuze Ravine	4.7	174-213 (39 m.)
				Onuma	2	945-960 (15m.)
				Steamed hot water	6	802-1110 (308 m.)
				Goshogake	2.3	990-1150(160 m.)
				Higashiyama	8.8	235-317 (82 m.)
				Kuromoriyama	5.7	219-412 (193 m.)
				Nakataki	1.2	330-360 (30 m.)
GUNMA	Ueno-Mura	FTB/ March 2006	(Deciduous broad-leaved forest centered on *Fagus sp.) Aesculus hippocastanum, Quercus crispula, Tsuga diversifolia, Abies veitchii, Abies mariesii, Rhododendron chinensis, Carpinus laxiflora, Fraxinus lanuginosa, Hydrangea hirta, Abies mariesii, Cotinus coggygria*	"Nakanozawa Headwaters Nature Walk" has 4 courses	12.6	-

(Table 1 Continued) (FTS 2020c; URL-5)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Trail Length (km)	Attitude/Elevation (m)
GUNMA	Kusatsu-Machi	FTB/ April 2010	(Mixed forest) *Larix sp., Quercus crispula, Castanea crenata, Acer sp., Chamaecyparis obtusa*	Royal	1.3	-
				Cycling road	3.4	-
				Peaceful Forest	1.3	-
	Kanra-Machi	FTB/ April 2014	-	-	-	-
	Shibukawa –Shi Akagi Nature Park	FTB/ March 2014	(Mixed forest) *Quercus serrata Acer sp*.	Saison garden area	2	100
				Four seasons forest area	3.5	100
				Natural ecological garden area	4	100
TOKYO	Okutama-Machi	FTB/ April 2008	(Coniferous forest, natural forest) *Quercus serrata, Prunus avium, Cryptomeria japonica, Chamaecyparis obtusa, Pinus densiflora*	Lake Okutama Ikoi	12	530-561 (31 m)
				Aroma Road "Tokei Trail"	1.3	400-450 (50 m)
				Okutama old road	9	341-605 (264 m)
				Hatonosu Canyon Promenade	2.5	270-338 (68 m)
				River Moss Valley, Hyakuhiro no Taki Exploration Road	1.8	663-833 (170 m)
	Hinohara-Mura	FTR/ March 2007	(Mixed forest) *Cryptomeria japonica, Chamaecyparis obtusa*	Otaki Road	1	1040-1100 (60 m)
GIFU	Motosu-Shi	FTB/ March 2015	(Coniferous forest) *Cryptomeria japonica Chamaecyparis obtusa, Quercus sp., Prunus serrulata*	NEO Sakura Exchange Land Shikisai no Oka"	1.5	250 (50m) 10% slope
				Usuzumi Zakura Roman no Michi"	3	200 (30 m) 1,6 % slope
			(Broad-leaved species)	Bunshu no Mori Sasayuri no Michi"	3.1	180m, 13% slope

(Table 1 Continued) (FTS 2020c; URL-6)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Trail Length (km)	Attitude/Elevation (m)
TOKAI	Tsu-Shi, Mie	FTB/ April 2008	*Cryptomeria japonica* *Chamaecyparis obtusa*	Kimigano Dam Lakeside	10.7	180-200 (20m)
				Takatsukayama	8.6	180-480 8300m)
				Kiriyama	3.4	340-540 (200m)
				Mitake Zao	5.4	320-720 (500m)
				Mitake Mt. Obora	7.9	320-990 (670m)
				Nisshin Nishiura	10.5	310-820 (510m)
				Obora cobblestone	5.6	660-1020 (360m)
				Hirakura course	9.2	320-440 (120m)
				Tsukahara History	4.4	210-300 (90m)
				Ise Honkaido	11.6	220-560 (340m)
				Kitahata History Exploration	10	315-350 (35m)
				Hinotani Onsen	11.6	140-270 (130m)
HYOGO	Shiso-Shi	FTB/ March 2015	(Mixed forest) *Cryptomeria japonica* *Zelkova serrata* *Acer sp.*	Akanishi	0.8	635-665 (30m)
				Kunimi no Mori	2.3	425-467 (42m)
TOTTORI	Chizu-Cyo	FTB/ April 2010	*Cryptomeria japonica* *Acer sp., Castanea crenata, Carpinus sp., Prunus serrulata, Fraxinus sp. Magnolia obovata, Quercus mongolica, Juglans sp. Cercidiphyllum japonicum, Betula sp.* Komorebi forest	China Nature Trail – Ashizu Valley	2.3	Flat
				Mitaki Dam- Ashizu Valley	1.3	-
				Headwaters- Ashizu Valley	2	-
				Komorebi no Mori	1.5	-
				Amagi Forest Park	2	-
				Yokoze Valley	1.7	-

(Table 1 Continued) (FTS, 2020c; URL-7)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Trail Length (km)	Attitude/Elevation (m)
KOCHI	Tsuno-Cho	FTB/ April 2008	Broad-leaved forest *Acer sp., Fagus sp., Zelkova serrata, Aesculus hippocastanum, Quercus crispula, Larix sp. Stewartia monadelpha*	Tengu Himeshara	4,5	1087-1355 (268m)
				Tengu no Mori	3.7	1270-1484 (214m)
				Karst Plateau Observation Road	1-3	1355-1437 (82m)
				Shimanto headwaters non-entry valley road	1.2	525-535 (10m)
	Yusuhara-Cho	FTB/ March 2007		Kubotani Therapy Road Walk	3	(10 m) 0.6%
KAGOSHIMA	Kirishima-shi	FTB/ March 2007	*Abies sp., Tabebuia sp., Quercus sp.*	Yanagidaira Walking Path	2.5	490-530 (40m)
				Hand wash walking path	0.9	600-690 (90m)
				Maruo Nature Exploration Road	2.3	560-700 (140m)
				Kirishima Shinsuikyo	1.8	348-395 (47m)
MIYAZAKI	Nichinan-Shi Kitago	FTB/2008	*Quercus sp. Castanopsis sp. Laurus sp.* (300 species of moss)	Inohae valley	6	200-250 (50 m)
				Hachinosu Valley	1.6	51,5-70 (18,5 m)
	Aya-cho	FTB/ March 2007	*Persea thunbergii Quercus gilva, Laurus sp.*	Relaxing course	1.5	121-215 (94 m)
				Many courses	3.5	-
				Machinaka Course	1.5	-
	Hinokage-cho	FTB/ April 2006	*Cryptomeria japonica Chamaecyparis obtusa Quercus sp. Castanopsis sp.*	Ishigaki	2.5	175-194 (19 m)
				TR railway ruins	4	68-88 (20 m)
				Yakedake dolly r.	7	200-300 (100 m)
				Mitate promenade	3.2	570-580 (10 m)
				Kyushu Nature Trail	4	-
				Tansuke / Yahazudake Healing Forest Sports Park	3	450-550 (100 m)

(Table 1 Continued) (FTS, 2020c)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Trail Length (km)	Attitude/Elevation (m)
HOKKAIDO	Tsubetsu-cho, Nonno no Mori	FTB/ April 2011	-	Clear stream road	1.8	-
				Miharashi Road	2.4	-
				Komorebi Road	1.4	-
	Yamasaki Forest	FTB CLOSED	-	-	-	-
YAMAGATA	Oguni-Machi	FTB/ April 2006	(Deciduous broad-leaved forest centered on *Fagus sp*.) *Quercus crispula, Fraxinus mandsch, Aesculus hippocastanum Pterocarya rhoifolia*	Main road	2.2	410-500 (90m)
				Kemono sidewalk	1.4	430-450 (20m)
				Hanareyama promenade	0.4	450-460 (10m)
MIYAGI	Tome-Shi	FTB/ April 2008	*Cryptomeria japonica, Pinus sp. Quercus serrata, Castanea crenata Styrax japonicus, Weigela hortensis,*	Ponpo Kotanuki no Michi	0.28	346-348 (22m)
				Kotori no Michi	0.55	242-362 (120m)
				Azalea Road	0.86	217-362 (145m)
				Ochiba no Michi	0.88	337-378 (41m)
				Road of peace	0.44	302-369 (67m)
				Pinecone road	0.15	342-369 (27m)
				Conifer Road	0.37	342-372 (30m)
				Toyoashihara no Michi	0.44	348- 410 (62m)
AOMORI	Fukaura-Machi	FTB/ March 2013	(Deciduous broad-leaved forest centered on *Fagus sp.*/mixed forest) *Quercus crispula, Acer sp., Aesculus turbinata, Cotinus coggygria, Cupressaceae*	Aoike / Boiling Pond Course	2.8	200-259 (59m)
				Kanayama Pond Short Course	2.1	220-230(10m)
				Kanayama Pond Long Course	3.6	220-230(10m)
				Oike course	1.8	180-200 (20m)

(Table 1 Continued) (FTS, 2020c; URL-8)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Trail Length (km)	Attitude/Elevation (m)
IBARAKI	Daigo-Machi	FTB/ March 2016	*Cryptomeria japonica* *Chamaecyparis obtusa* *Quercus sp.* *Prunus avium,* *Carpinus sp.*	Forest bath model course	1.6	385,7- 430 (44,3)
				1km circuit course	1	385,7-400 (14,3)
				Showa Emperor's Trajectory Tour Course	1.7	385,7-430 (44,3)
CHIBA	Minamiboso-Shi	FTB/ March 2014		Toyama Fushihime / Hakkenden no Michi	-	-
				Cape Daibusa	-	-
				Many Fudo waterfall roads	-	-
				Shiroyama road	-	-
				Ondara mountain road	-	-
				Anbaya Satoyama road	-	-
				Bride Road / Kurotaki Road	-	-
KANAGAWA	Atsugi-Shi	FTB/ March 2007	*Cryptomeria japonica* *Chamaecyparis obtusa*	D foot forest road	3.5	123-427 (304m)
				Hakusan Junrei Pass	3.5	80-284 (204m)
				Kanegatake	3.7	94-561(467m)
	Yamakita-Machi	FTB/2011	*Cryptomeria japonica* *Chamaecyparis obtusa* *Quercus serrata,* *Quercus acutissima*	Kawamura Castle Ruins / Shasui Falls	6	110-225 (115m)
				Nishitanzawa Prefectural Forest	4.2	540-740 (200m)
				Yozuku Forest	3.8	333- 436 103m)
				Onoyama	2.5	360-723 363m)
	Hakone-Machi	FTB/ March 2016	*Cryptomeria japonica,* *Chamaecyparis obtusa, Zelkova serrata, Quercus rubra, Fagus sp, Acer sp., Magnolia obovata, Stewartia monadelpha*	Hakone Yasuragi no Mori	1	730-770 (40m)
				Kuzuryu no Mori	3	720-730(10m)

(Table 1 Continued) (FTS, 2020c; URL-9)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Trail Length (km)	Attitude/Elevation (m)
KANAGAWA	Me-Byo Valley Biotopia	FTR/ April 2018	*Ginkgo Biloba*	Healing Forest	20 minutes	-
				Satoyama / Power Spot	30 minutes	-
				Ginkgo tree lined course	72 minutes	-
	Hadano-Shi	FTB/ 2020		Hadano Tokawa Park / Wind Suspension Bridge	2.7	(65 m)
				Omote Tanzawa Outdoor Activity Center / Kuzunoha Izumi Course	1.3	(153 m)
				Minoge / Harutake spring water course	2.3	(240 m)
				Kuzuha Gorge	1.9	(41m)
				Koboyama Park	3.2	(169 m)
SAIMATA	Kitamoto-Shi	FTB/2020		Saitama Prefecture Nature Learning Center	-	-
				Sun Amenity Kitamoto Campfield	-	-
NIIGATA	Tsunan-Machi	FTB/ April 2008	*Fagus sp.* *Quercus sp., Larix sp.* *Betula sp., Cryptomeria japonica*	River terrace superb view road	1.1-6.4	550-730 (180m)
				Yamabushiyama Healing Road	1-7	700-900 (200m)
	Myoko-Shi	FTB/ April 2008	*Fagus sp., Betula sp.* *Quercus crispula* *Picea abies*	Myoko Kogen Nature Trail	15.7	731-1247 (516m)
				Sasagamine	10	1224-1410 (186m)
				Sasagamine Yumemidaira Promenade	9.6	1227-1348 (121m)
				Akaike	6.9	906-1138 (232m)
				Sota History Village	4.3	40-180 (140m)
				Hiramaru Fureai no Mori	2	812-897 (85m)

(Table 1 Continued) (FTS, 2020c; URL-10)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Trail Length (km)	Attitude/Elevation (m)
YAMANASHI	Yamanashi-Shi	FTB/ March 2007	*Acer sp.*, *Aesculus turbinata*, *Quercus crispula*	Nishizawa Valley	10	
				Mie waterfall	5	
				Hirose Lake Opposite Bank	5	
				Kyoho Hill Road	1	
				Manyo Road	1	
	Takeda-No-Mori	FTB/ March 2013	*Pinus densiflora*, *Quercus sp.*	Flat course in a small diameter of healing	1.4	Around 610m
				Healing small diameter Nishinodaira course	2.2	Around 610m
				Five senses forest	2.3	520-610 (90m)
				Outer course	5	460-610 (150m)
TOYAMA	Toyama-Shi	FTB/March 2009	*Quercus crispula* *Quercus serrata* *Prunus grayana* *Magnolia obovata* *Betula platyphylla* *Acer sieboldianum*	6 courses		780 (230m)
	Kamiıchi-Machi	FTR/2012		Sakka Toga Tree-lined	1.1	90- 120 (30m)
				Sakka Kushigatayama	1.8	90-210 (120m)
				Oiwa Flower House	5.2	130-420 (290m)
				Babajima trekking course	5	710-1255 (545m)
				Babajima Family Forest	0.8	720-730m (10m)

(Table 1 Continued) (FTS, 2020c)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Trail Length (km)	Attitude/Elevation (m)
ISHIKAWA	Tsubata-Machi	FTR/2013	*Quercus serrata* *Pinus densiflora* *Acer sp.* *Cryptomeria japonica* *Chamaecyparis obtusa*	Gentiana view course	2.3	69-85 (16m)
				MISIA Forest Course	3.8	31- 87 (56m)
				Lakeside cycling course	5.4	31-80 (49 m)
				Mikado Pond Lakeside	1.7	30- 85 (55m)
				Mikuniyama Observation	1	224-324 (100m)
SHIZUOKA	Kawazu-Machi	FTR/ March 2007	*Cryptomeria japonica* *Chamaecyparis obtusa*	Izu Genki Waku Forest	6	375-619 (244m)
SHIGA	Takashima-Shi	FTB/ April 2008	*Quercus serrata, Magnolia obovata,* *Magnolia salicifolia,* *Prunus avium* *Cryptomeria japonica* *Castanea crenata*	Higashiyama circuit course	3.8	190-255 (65m)
				Hiraike course	2.8	About 550m
				Tone Waterfall	1.3	About 350m
WAKAYAMA	Koya-Cho	FTB/ March 2007	*Cryptomeria japonica* *Chamaecyparis obtusa* *Pinus densiflora* *Tsuga sp.* *Sciadopitys verticillata*	Koyasan-cho Ishimichi Fetal World Route	5.8	500-850 (300m)
				Koyasancho Ishimichi Kongokai	3.2	825-850 (25m)
				Kohechi	7.5	738-1000 (262m)
				Nyoninmichi	16	566-1000 (434m)
				Fudozaka	3.8	566-850 (284m)
				Koyasan Koyamaki Plant Community Conservation Forest	2.5	837-880 (43m)
				Rolling axis mountain tour	5.5	668- 830 (162m)
				Masayo Tenji	6.1	800- 900 (100m)
NARA	Yoshino-Cho	FTB/2012	*Cryptomeria japonica* *Chamaecyparis obtusa*	Shinsenkyo Ryumon no Sato Course	6	250- 372 (122m)
				Yoshino / Miyataki Manyo Course	7	200- 491 (291m)

(Table 1 Continued) (FTS, 2020c; URL-11)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Trail Length (km)	Attitude/Elevation (m)
OKAYAMA	Shinjyo-Son	FTB/ April 2008	*Fagus sp.* *Cedrus sp.*	Small diameter of cradle	2	700-750 (50m)
				Lakeside small diameter	4.5	760-780 (20m)
				Healing path	1.3	500-540 (40m)
SHIMANE	Iınan-Cho (2 star base)	FTB/ March 2007	*Cryptomeria japonica* *Chamaecyparis obtusa*	Odagawa course	1.3	500-550 (50m)
				Yamano grass garden course	1.5	500-550 (50m)
HIROSHIMA	Akiota-Cho	FTB/ April 2012	*Fagus sp.* *Quercus sp.*	Mt. Shinnyu	3.2	800-965 (165m)
				Sandankyo	5.8	332-424 (92m)
				Osorakan	3.7	965-1164 (199m)
				Ryutokyo	3.7	335-490 (155m)
	Jinsekikogen-Cho	FTB/ April 2008	*Pinus densiflora* *Acer palmatum* *Quercus acutissima* *Cotınus coggygria*	Teishakukyo Scola Plateau	2.2	475- 500 (25m)
				Jinseki Plateau Tiergarden	3.9	684-716 (32m)
YAMAGUCHI	Yamaguchi-Shi	FTB/ March 2006	*Chamaecyparis obtusa* *Pinus densiflora* *Zelkova serrata* *Quercus acutissima* *Prunus serrulata* *Acer sp.* *Prunus avium*	Bird forest area	1.6	flat
				Lake Ohara area	5.1	Flat
				Chojagahara area	3.9	Up to 60m
FUKUOKA	Ukiha City	FTB/ April 2008	*Cryptomeria japonica* *Chamaecyparis obtusa*	The headwaters of Kose	2.2	-
				Tsuzura Rice Terrace Promenade	1.8-3-4	-
	Yame City	FTB/ April 2008	*Cryptomeria japonica* *Chamaecyparis obtusa* *Quercus sp*.	Acorn-picking path	1.77	417-481 (64m)
				Promenade to the fountain and islets	1.83	420-464 (44m)
				Kuma bamboo grass and lake path	2.26	433-441 (8 m)

(Table 1 Continued) (FTS, 2020c; URL-12)

PREFECTURE	Base/Road Name	Type & Certification Date	Highlighted Plant Species	Trails	Trail Length (km)	Attitude/Elevation (m)
FUKUOKA	Sasaguri-Machi	FTB/ March 2009	*Cryptomeria japonica* *Chamaecyparis obtusa*	Sunset Arata Tour Couple cedar Hydrangea (Suginami) Sasaguri Kyudai no Mori Jugeinomori	1.75 10 6.36 7.34 2 10.3	600 530 679 670 35 380
	Buzen-Shi	FTB/2013	*Laurus sp.*, *Cryptomeria japonica* *Chamaecyparis obtusa* *Quercus acuta* *Abies sp.*	Kuboteyama circuit Jirobo Tengu Bridge Course Toriihata Satoyama Osanpo Course Edakawauchi Hydrangea	3.4 3 3 4	550-800 (250m) 550-650 (100m) 270-340 (70m) 150- 280(130m)
OITA	Oita City	FTB/ March 2012	*Cryptomeria japonica* *Chamaecyparis obtusa* *Quercus serrata, Pinus sp.*	Takasakiyama Sacred Mountain Mandarin Duck Valley Usoyama Heisei Forest Park Yoroigadake Tenmenzan Honguyama Kakinokiyama	2 3 6 2.5 3.1 2.7 2 3.5 4.5	428-628 (200m) 50-610 (560m) 79- 372 (293m) 164- 644 (480m) 602- 682 (80m) 647- 847m (200m) 303-403m (200m) 393- 608 (215m) 54-484 (430m)
KUMAMOTO	Mizukami Village,	FTB/April 2010,	Cedrus sp.	3 courses	500m, 1.7, 4.1	
OKINAWA	Kunigami-Son	FTB/ March 2007	(Subtropical forest) *Schima Wallichii ssp. Liukiuensis, Alnus formosana*	Kunigami Village Forest Park Yanbaru Learning Forest Hiji Otaki Promenade Yonahadake mountain trail	3 700m -1.4 3 3	25-310m (285m) 150 (25m) 25 (30m) 310 (70m)

Conclusions

Forest therapy, which is considered as preventive medicine, is expected to be approved by the World Health Organization (WHO). The Society of Forest Medicine within the Japanese Society for Hygiene and The International Society of Nature and Forest Medicine (INFOM) point to the importance given to forest bathing and forest therapy both in Japan and internationally. Enforcement of forest therapies under insurance in Japan and as part of the medical system is a different indicator of this importance (Ergüven, 2019). After the COVID-19, the world focus on to find healing opportunities for people to restore mental and physical wellbeing through nature (Gürbey et al., 2020). Forest Therapy ranks first in this regard by its proven health effects.

Forest therapy tourism is classified under nature-based tourism, nature tourism, ecotourism, rural tourism, forest tourism, forest-based wellbeing tourism (Komppula & Konu, 2017).

Being at the centre of the junction joining Asia, Europe and Africa, Turkey has several unique ecosystems, with its unique geographic position, topographic features and climatic differences among regions. Nearly 30% of its total land area covered with forests (Terzioğlu et al., 2012). By having forest areas in regions with different climatic conditions offering forest therapy practises under the ecotourism activities throughout the year, is an advantage for Turkey.

Turkey is also rich in thermal sources. The total number of thermal waters is estimated to be 1300 in Turkey, where there are more than 600 thermal waters with a temperature of higher than 20 °C. In terms of these figures, Turkey ranks first in Europe and is one of the top five countries in the world (Özşahin & Kaymaz, 2013). In many certified Forest Therapy Bases come to the fore with hot springs or thermal waters. It will be more effective to start Forest Therapy studies in forest areas close to thermal waters such as the provinces of Yalova, Bursa, Bolu and İzmir.

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Ecotourism in the Mountains of the Issyk-Kul Region

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Abstract

Aim of study: Kyrgyzstan is a country with a favourable climate and natural conditions, which create preconditions for the development of ecological tourism, since there are places untouched by man in the country. The aim of the work is to describe the potential possibilities of ecological tourism in the State Natural Park "Karakol".

Area of study: Ecological tourism, sustainable development.

Material and methods: Analysis and processing of literature data.

Main results: The description of unique natural complexes, flora and fauna, recreation areas and tourist routes of the State Natural Park "Karakol".

Highlights: The main mission of the natural park is to preserve unique natural complexes, forests, objects of flora and fauna, which have a special ecological value for a favourable combination of natural and cultural landscapes, their use in recreational, educational, scientific and cultural purposes.

Keywords: Ecotourism, Karakol, Issyk-Kul, Natural Park, Recreation

Introduction

At present, there is an intensification of tourists interest in active types of tourism, which allow preserving natural heritage (Aryanto, 2018; Evstratova, 2019; Nasibulina, 2017; Abaydeldinov, 2016; Adongo, 2018). Since in most European countries the resources of "wild nature" are largely exhausted, and in Kyrgyzstan about 65% of the territory is occupied by still intact or slightly disturbed ecosystems, then, obviously, in the near future, Kyrgyzstan will be in demand on the world tourist market. Kyrgyzstan is a country with a favourable climate and natural conditions that create preconditions for the development of various types of tourism, such as resort and recreational, sports, water, cycling, equestrian, educational, mountain, hiking, etc. Recently, an important place is given to the development of ecological tourism, since the country has untouched places in specially protected natural areas (URL-1, 2020). Visiting tourists prefer the active type of tourism, adventure, mountain and water. Since most of the territory of Kyrgyzstan is occupied by mountains, they are the most attractive resource for tourists from far abroad. There are favourable climatic, medical and recreational, aesthetic, cultural, historical and other opportunities that can attract international tourists and climbers for recreation and treatment. Tourists take into account the peculiarities of the mountain landscape, mountain climate, the duration of sunshine, the richness and diversity of flora and fauna, natural opportunities for mountain sports, hunting, fishing, mountaineering (Nazgul Jenish, 2017). The city of Karakol has potential for the development of ecological tourism. This type of tourism does not violate the integrity of natural ecosystems and is focused on getting an idea of the natural, cultural and ethnographic features of a particular territory. At the same time, ecotourism creates such economic conditions when nature conservation becomes beneficial to local residents (Atyshov, 2005). In 2019, for 8 months, the total number of tourists who visited Karakol was 16,920 people, of which 12,324 were foreign citizens. Starting from the city of Karakol, you can visit the unique, peculiar natural attractions of the region.

An important role in the development of ecological tourism in the region belongs to the State natural park "Karakol", the main mission of which is to preserve unique natural complexes, forests, objects of flora and fauna, which have a special ecological value for a favorable combination of natural and cultural

landscapes, their use in recreational, educational, scientific and cultural purposes. The natural park with a total area of 38095.3 hectares occupies the southwestern part of the Ak-Suy district, in the Issyk-Kul region (Figure 1).

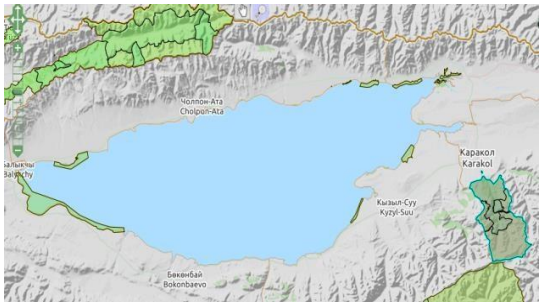

Figure 1. Territory of the state natural park "Karakol" (framed)

The territory of the State nature park "Karakol" is divided into four functional zones:

1. The protected reserve - 22938.0 hectares
2. The restoration zone is 1249.0 ha.
3. Recreation area - 13774.0 ha.
4. Management zone - 13774.0 ha.

Climate

The climate of the area where the natural park is located is generally sharply continental. However, due to the pronounced zonal verticality, an extraordinary variety of microclimatic conditions is noted, depending on the height above sea level, exposure and steepness of slopes. As a rule, as the height above sea level increases, the air temperature decreases, the amount of precipitation, the absolute and relative humidity of the air increases to a certain limit, the growing season is significantly reduced in comparison with the valley part. In terms of exposure, the northern slopes are colder and wetter, the southern ones are warmer and drier (Podrezov at al., 1992).

Relief and Soil

According to the physical and geographical zoning of the Kyrgyz Republic, the territory of the natural park is located in the northern Tien-Shan physical and geographical mountainous region, the Ak-Suu physical and geographical region, which is part of the Tien-Shan mountain system. The main part of the forest fund of the natural park is located on the slopes of the Terskey Ala-Too mountain range, which is part of the Northern Tien-Shan mountains. The ridge is stretched out in a giant arc in a wide direction, encircling the Issyk-Kul basin in the south. In general, Terskey Ala-Too is characterized by a variety of forms and types of relief. There are flat depressions with hilly foothills bordering them, and narrow rugged valleys with fast rivers, and sharp jagged ridges of watersheds, over which the ridges of the highest mountain ranges with their firn fields and glaciers rise. Mountain slopes descending to the lake. Issyk-Kul, end with gentle hills. The space between the Terskey Ala-Too mountain ranges in the north and Kok-Shaal-Too in the south is filled with numerous mountain ranges, high plateaus and intermountain hollows. All forests of the natural park are mountainous in terms of relief and altitude (Rantsman, 1959). A significant variety of soil and vegetation cover on the territory of the forest fund is due to the presence of high-altitude bioclimatic zones associated with the vertical zoning of climate and vegetation. The development of the soil cover is subject to vertical zoning. Mountain-valley light chestnut soils develop at an altitude of 1300-1600 m. At an altitude of 1700-2000 m. above sea level, mountain dark chestnut is formed, creeping on the northern slopes at an altitude of 1900-2500 m. mountain chernozems of medium humus. In the same belt, 1800 (1900) - 2300 (2700) m, mountain forest brown soils of spruce forests are widespread. Above are the soils of the subalpine belt (mountain meadow-steppe). Within the above-described soil types, 19 soil varieties were identified, differing in the thickness of the soil profile in the degree of erosion and stonyness, skeletal structure in the mechanical composition of the upper horizons and parent rocks, as well as the number of bedrock outcrops in combination with the soil (Mamytov, 1996).

Hydrography

The Karakol River originates from the Karakol glacier from the northern slope of Terskey Ata-Too at an absolute altitude of 5200 meters and flows into Lake Issyk-Kul (Figure 2). The length of the river is

approximately 50 km, the catchment area is 394 km2. In the mountainous region, the river receives a number of tributaries Kultyr, Kashka-Suu (right-bank) and Telety, Aytyur, Zendyn-Bulak, Karcha-Kuyan (left bank). The Karakol River, like all tributaries, belongs to the rivers of snow and glacier feeding, its flow rate is closely related to the air temperature regime, atmospheric precipitation and groundwater play a secondary role in the river feeding; the latter refers to its upper and middle reaches. In the mountains, the river is a turbulent mountain stream, and on the fan it becomes more calm. During the year, the water discharge in the Karakol River is subject to significant changes, its highest value is in July (18 m3 / s), the lowest - in March (1.66 m3 / s). In terms of chemical composition, the water of the Karakol River is weakly mineralized, hydrocarbonate-sulfate type, with a predominance of calcium (Kadyrov, 1986).

Figure 2. Schematic map of the Karakol river

Plants World

The flora is represented by more than 300 species of plants, of which more than 30 species of trees and shrubs. Within the territory of the region there are 7 higher flowering plants listed in the Red Book of the Kyrgyz Republic. In the hollow, these are calamus root, hairy garniella, Kolpakovsky's tulip, Tien-Shan Siberian woman, tall elecampane, Kashgar barberry, Kyrgyz kopeck. Above the valleys, in the mountains, there are thickets of juniper, wild rose, honeysuckle of barberry, wild currant, mountain ash. The Karakol mountain gorge is covered with dense forests of slender Tien-Shan spruces (Figure 3). At a considerable height, between the jagged mountain ridges, huge flat plateaus of subalpine and alpine meadows appear with a bright, variegated carpet of flowers that catch the eye with the beauty of their forms, colors, and shades.

Figure 3. Forests of slender, Tien-Shan spruces

The forest fund of the Karakol natural park occupies the northern slope of the Terskey-Alatau ridge in the Karakol river basin in the Issyk-Kul forest area, the northern forest area of dark coniferous forests. The Issyk-Kul forest-growing region is located in the northern part of the Tien-Shan mountain system at an altitude of 1609 m to 5000 meters above sea level. The peculiarity of the region is the alternation of spruce forests with meadow-steppe and meadows on the northern slopes of the mountains, with steppe and meadow-steppe on the southern slopes. Spruce forests are confined mainly to the northern slopes, where they form a strip 1000-1200 m wide, the lower border, which runs at an absolute height of 1700-1800 m, the upper one at 3100-3200 m above sea level. Spruce forests do not form a continuous belt, growing in separate massifs, islets, mixing with pegs, pastures, steep slopes and outcrops of rocks (Kasiev, 2005).

Animal World

The fauna of the area is relatively diverse due to the complexity of the geographic environment. From the order of predators,

there are: snow leopard, brown bear, wolf, fox, lynx, ermine and steppe ferret, etc. From birds: steppe eagle, golden eagle, crow, starling, lark, nightingale, chukotka, cuckoo, pigeons, etc. (Yanushevich, 1968). You can also meet a hare, squirrel, mountain goat, snowcock, etc. Rare and endangered species included in the Red Book of Kyrgyzstan include bear, lynx, leopard, snowcock (Figure 4). Insects found in the park include bumblebees, a carpenter bee, butterflies - Apollo (sailboat, delphius).

Figure 4. Mountain goat

Socio-Economic Conditions of the Region where the Park is Located

The main branch of the national economy is agriculture. The leading branch of the national economy in the area of the natural park is animal husbandry, agriculture, tourism. In agriculture, along with grain crops and vegetables and melons. The main base for animal husbandry is high-mountain and mountain-steppe pastures. With the development of tourism and skiing, the tourism industry is developing in the region. During the ski season (winter) the area is visited by tourists from other regions, far and near abroad. Due to the intensity of visits by tourists in the region and in the city of Karakol, the provision of hotel services is developing (Socio-economic development of the Issyk-Kul region, 2017).

Tourism

Rich natural resources and picturesque relief create potential for tourism development, since tourism is one of the types of nature management. And as world practice shows, the development of ecotourism in areas of natural parks is a good and cost-effective way to develop tourism. The most promising areas of ecotourism in the park are climbing, rafting, skiing, horseback riding and hiking (Esina, 2017; Job, 2017; Vina, 2017; Yorov, 2019).

Karakol gorge is distinguished by its picturesque nature. On the slopes of this gorge and along the banks of the Karakol river, barberry, sea buckthorn, and wild rose grow abundantly. Further dominated by the Tien-Shan spruce. Archa are found above the spruce forests, then subalpine and alpine meadows extend. In May, the flowering of a huge variety of tulips, asters, snowdrops, yellow trollies and other plants is transformed into an abundantly flowering park. In just a few hours, you can go and see the steppes, subalpine, alpine meadows, mountain forests and get into the realm of eternal snow and ice. The gorge is also characterized by a wide variety of animals: roe deer, wild boars, lynxes, wolves, mountain goat, snow leopards, bears, eagles, golden eagles and others. There is an alp base in the upper reaches of the gorge, where many mountains of Telman (4460 m), Dzhigit (5130 m), Przhevalsky (4283 m), Karakol (5281 m), Zhukov (4450 m), Dimitrova (4450 m), Fuchika (4210 m), and Gasstelo (4350 m). On the slopes of the right tributary of Kashka-Suu, there is a ski base, where winter types of tourism are actively developing (Figure 5).

Figure 5. Ski resort "Karakol"

On the left bank of the Karakol river, there are passes through which you can make tracks in the Irdyk gorge and see the peaks of

Vostok, moraine-glacial lakes. On the right bank of the gorge are Przhevalsky peak (4283 m) and 40 years of Kyrgyzstan (4300 m). Further, through the Ala-Kol pass, you can get into the Arashan gorge from where you can enjoy the panorama of lake Issyk-Kul (Figure 6). Exciting sites are: a complex of waterfalls and lake Ala-Kol (Figure 7).

Figure 6. The best track around the city of Karakol (Altyn Arashan – Ala-Kol)

Figure 7. Mountain lake Ala-Kol

Conclusion

The Karakol River Gorge is one of the most picturesque Teskey-Ala-Too gorges. Its side tributaries are very picturesque: Sary-Kungei, Chon-Tash, Karchy-Kyya, Kashka-Suu, Terme-Top. Above the forest zone, the Karakol gorge bifurcates. The northern branch goes to the Karakol peak, and the southeastern branch to the beautiful Ala-Kul lake, located at an altitude of 3550 m above sea level. Along the entire route, in picturesque places, there are recreational areas where there are parking lots for cars, cooking centers on the cauldron, tables and benches made of forest bars, and also canopies intended for shelter from the rain. Yurt towns are organized, living in yurts, foreign tourists get to know local life more closely. Thus, the city of Karakol has great natural potential for the development of ecotourism, which will therefore contribute to the sustainable development of the entire region. Tourism revenues must be used to maintain a fragile ecosystem and develop tourism infrastructure.

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Value Orientations and Attitudes of Hunters and Non-Hunters toward Wildlife Conservation in Bartın

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Abstract

Aim of study: Human dimension of wildlife studies have tended to segment the public to understand determinants of human behavior related to wildlife. This study aims to compare attitudes of hunters and non-hunters toward wildlife conservation through measuring its value orientation components and to elicit affecting variables on the attitudes.

Area of study: The study covers hunters and non-hunters in Bartın province.

Material and methods: The study was based on the data from a questionnaire survey with 500 hunters and 1,048 non-hunters conducted in a wildlife valuation project that included a wildlife conservation attitude scale. A reliability analysis of the scale and an independent samples t test with mean scores of the scale were performed. Also, a multiple regression analysis was used to examine the effects of some variables on the attitudes toward wildlife conservation.

Main results: Hunters had more positive attitudes toward wildlife conservation than non-hunters did. This difference that is statistically significant, was due to not only hunters' expectations for plenty of hunting resources with strong egocentric value-orientations, but also stronger motives related to social altruistic and pure biocentric value orientations.

Highlights: Information meetings about wildlife ecosystems and conservation should target younger, less-educated and rural resident non-hunters, as well as relatively older and less educated hunters with lower incomes. All public segments' attitudes toward wildlife conservation in Turkey should be examined with worldwide well-known wildlife attitude scales.

Keywords: Wildlife, Attitudes, Value Orientations, Bartın

Introduction

Human dimensions of wildlife (HDW) as a growing study field was born in 1960s (Miller, 2009) has been to understand determinants of human behavior related to wildlife, such as values, beliefs and attitudes (Decker et al., 1987). The determinants hierarchically form behavioral intentions according to Theory of Reasoned Action (Ajzen & Fishbein, 1980) and Theory of Planned Behavior (Ajzen, 1991) which are well-known behavioral theories. In the context of the HDW studies, some classifications and scales, such as King's (1947) classification of wildlife values, Kellert's typology of basic wildlife values (Kellert, 1976) and Wildlife Attitudes and Values Scale (Purdy & Decker, 1989) were designed to evaluate and measure public's values, beliefs or attitudes related to wildlife or wildlife management issues. Many attempts (Manfredo, 2008) have been made to integrate the findings of the HDW survey with these scales into the resource management.

Another focal behavioral determinant in the HDW studies is value orientations (VOs) which are defined as a pattern of direction and intensity of basic beliefs for a more restricted part of the environment, such as wildlife (Fulton et al., 1996). Wıthin the cognitive hierarchy structure from values to behavior, VOs may be used to predict higher-order cognitions such as individual beliefs, attitudes and behavioral intentions (Fulton et al., 1996; Vaske & Donnelly, 1999). The VOs are typically measured along bipolar dimensions such as anthropocentric and biocentric or biospheric VOs (Steel et al., 1994; Vaske & Donnely, 1999; Stern et al., 1993) or anthropocentric and ecocentric VOs (Thompson & Barton, 1994) for natural ecosystems. Some bipolar scales for wildlife VOs are also classified such as wildlife utilization-wildlife protection (Fulton et al.,

1996) or mutualism-domination (Manfredo, 2008; Manfredo et al., 2009) or conservation-oriented and welfare-oriented (Dubois & Fraser, 2013).

Anthropocentric VO is defined as the view that human is in the center of the universe and of a prioritization of human well-being over nature (Watson, 1983), while ecocentric VO conversely includes concern for all living things such as wildlife, regardless of their usefulness to humans (Thompson & Barton, 1994). This disparity is similar to a tripartite classification of environmental VOs (egoistic, social altruistic and biospheric) proposed by Stern and Dietz (1994). The egoistic and altruistic VOs focus on human needs like anthropocentric VO. Egoistic VO is related to the importance of nature for oneself, while social altruistic VO is based on welfare of other people. Otherwise, the biospheric or biocentric VO is similar to ecocentric concerns. It focuses on conserving nature for its intrinsic rights (Stern & Dietz, 1994). Some researchers stated that utilitarian people have anthropocentric or use orientations and protectionist people have biocentric orientations (Needham, 2010; Vaske et al., 2011). However, all of these VOs can be activated in support of the same environmental conservation policy, but with very different underlying motives (Bjerke & Kaltenborn, 1999; Thompson & Barton, 1994).

The HDW researchers also have tended to segment the public and to recognize their values, which may help to understand possible responses of different stakeholder groups to wildlife management strategies (Vaske & Needham, 2007; Bright et al., 2000; Decker, et al., 2001). The distinction of between hunters and non-hunters is one of the classical segmentations. A review of the VO literature (Fulton et al., 1996; Vaske & Donnely, 1999) presents that these two groups are typical samples of two ends of a use-protection VO or anthropocentric-ecocentric orientation continuums (Carothers et al., 2001).

Successful and effective wildlife management has three dimensions that is wildlife population, wildlife habitat and humans (Bath, 1998). Most of the related studies in Turkey have focused on the first and second dimensions, while the behavioral determinants of hunters and non-hunters have usually been omitted. There are a few studies about socioeconomic characteristics and hunting experiences of hunters (Ay et al., 2005; Iğırcık et al., 2004; Şafak, 2006; Bekiroğlu & Okan, 2009), thoughts of some local stakeholders about wildlife management (Iğırcık et al., 2008) and human-wildlife conflicts (Şafak, 2012; Yavuz, 2017). However, value and attitude scales have been recently employed in some environmental valuation exercises, especially with contingent valuation surveys, for explaining respondents' stated willingness to pay (Pouta, 2003; Pouta, 2004). Such a wildlife valuation project (Kaya et al., 2009) using a wildlife conservation attitude scale has been realized in Bartın to estimate economic value of wildlife conservation. This study aims to derive knowledge about and to compare attitudes of hunters and non-hunters toward wildlife conservation through its VO components (egoistic, altruistic and biocentric orientations) from the scale data obtained in the project and to elicit affecting variables on the conservation attitudes.

Material and Methods

Study Area

Bartın, which covers an area of 2.330 square kilometers, is a small Black Sea province in the northwestern part of Turkey with a population of approximately 200.000. Provincial forest covers 58% of the land area, while agricultural lands comprise 35% and grasslands 5‰ (URL-1, 2019). The province's fauna consists of 56 species of mammals, 200 species of birds, 18 species of reptiles and 7 species of amphibians. This number corresponds to about one-third of 750 vertebrata species in Turkey, excluding fish species (Özkazanç, 2010). A recent camera trap study shows that there were determined 12 large mammals in this area. Roe deer is the most common species in the study area, the second wild boar, then respectively red fox, bear (Özkazanç et al., 2017).

The Bartın Provincial Division Office of 10th Regional Directorate of the Ministry of Agriculture and Forestry (BPDO) manages the province's wildlife ecosystems as well as the protected area. This government office also executes annual decisions concerning the

Central Hunting Commission established by Law No. 4915 on Terrestrial Hunting. Among the wildlife conservation areas in Bartın Province, 17.000 hectares of the Küre Mountains National Park in the western Black Sea Region of Turkey comprise a major part. Other protected areas are the 6.374-hectare Sökü Wildlife Reserve and the 4.229- hectare Kumluca Model Hunting Area (BPDO, 2008). Hunting is generally free throughout the province, except for residential areas, the protected areas and the model hunting ground as is the case all over Turkey, provided hunters obey the rules relating to hunting periods, bag limits, and which species may be hunted or not. These rules are stipulated by the Central Hunting Commission. Hunting of migrant birds is popular, although Bartın Province is not on the main migration pathways of any bird species (Kaya et al., 2009).

There is no reliable data on the number of hunters in the province but it is estimated that there were 5.000 in 2008, based on the number of sporting gun licenses and hunting licenses in official records. Numbers of non-resident hunters and foreign hunters who hunt in the province's wildlife ecosystems are unknown (Kaya et al., 2009).

Survey Design

A questionnaire survey conducted in the main wildlife valuation study (Kaya et al., 2009) included a wildlife conservation attitude (WCA) scale that was simply designed to derive variables affecting economic values of wildlife conservation, beside value elicitation questions, questions on beliefs about environmental and wildlife-related problems and beliefs about sufficiency of wildlife ecosystems for providing various benefits and respondents' demographic and socioeconomic characteristics. The WCA scale consisted of ten VO statements of which five positive and five negative statements for conservation (Table 1). Each statement was accompanied by a five-point scale (definitely agree, agree, neutral, disagree and definitely disagree). Agreement with five positive statements indicated a supportive VO for wildlife conservation, and agreement with the other five indicated no support. Then the negative statements were directed to positive manner for conservation.

These statements were especially adapted from scales used in some studies on the economic valuation of improving environmental quality (Day & Mourato, 2002; Mourato, 2002) to elicit motives behind respondents' stated economic values. Some well-known VO scales such as awareness of consequences (Stern & Dietz, 1994) and environmental concern (Schultz, 2001) scales on environmental concern, Thompson & Barton's (1994) scale on assessing anthropocentric and ecocentric motives, wildlife value orientation scale (Fulton et al., 1996) on wildlife were also used in designing the scale.

Many of the statements reflect biocentric (ecocentric) VOs. The items 6 and 7 are positive statements and include biocentric VOs for wildlife conservation. Reverse manner of the items 1, 8, 9 and 10 designates biocentric concern for wildlife ecosystems, even if the conservation involves human sacrifice as Stern and Dietz (1994) stated. Items 1 and 6 reflect pure biocentric VOs while other items related to biocentric VOs require comparisons between economic concerns and wildlife protection. The rest of the items serve as examples of the anthropocentric VOs. The items 3 and 4 illustrates egocentric VO, which implies a support for wildlife conservation if it satisfies respondent's own needs. The item 5 and reverse manner of the item 2 illustrate social altruistic VO for wildlife conservation as the statements involve in protecting wildlife for others, children or future generations.

Sampling and Implementation

The main survey was conducted with two random sample groups of 520 hunters and 1.070 non-hunters using a face-to-face interview technique in the central city, counties and villages of Bartın Province between January and August, 2008. 1.548 surveys (500 from hunters and 1.048 from non-hunters) were available for statistical analysis due to invalid answers.

A demographic and socioeconomic profile of the respondents is given in Table 2. Hunters were older than non-hunters, although both sampling groups were middle-aged. The

hunters had less income, a lower education level and larger families than non-hunters.

Data Analysis

Responses to the statements in the VO scale were coded on a five-point scale, ranged from 1 for "definitely disagree" to 5 for "definitely agree". The negative statements in the scale were scored in a reverse manner to achieve additivity for all analyses. Then a reliability analysis of the WCA scale was performed by using an alpha model to calculate Cronbach's alpha values for the scale to assess the VO statements as a whole and to calculate a valid total and mean of item scores. The reliability test with the scale yielded Cronbach's alphas of 0.644 for hunter respondents and 0.681 for non-hunter respondents. These values mean that the scale was reliable at acceptable level and consisted of items that were internally consistent and measured the same construct.

Table 1. The WCA scale for wildlife conservation

Item	Statements	Direction	VO
1	If no one uses a wildlife ecosystem, the fact that it is damaged is not important.	Negative	Biocentric
2	If a wildlife ecosystem becomes damaged, the fact that other people will not be able to use it does not bother me if I, myself, don't use it.	Negative	Social altruistic
3	It is worth spending more money on wildlife conservation because it contributes to developing hunting and tourism.	Positive	Egoistic
4	Even if I don't use a wildlife ecosystem at the moment, I would still like to conserve them in case I want to use one in the future, even if that costs me money now.	Positive	Egoistic
5	We have a responsibility to protect wildlife for future generations, even if that costs us money.	Positive	Social altruistic
6	The threat of extinction of wild species is a serious problem.	Positive	Biocentric
7	If a wild animal species is threatened with extinction, then it should be protected at all costs.	Positive	Biocentric
8	If costs for wildlife conservation are very high, we will just have to learn to live without wildlife.	Negative	Biocentric
9	If many jobs are provided by damaging wildlife ecosystems, damage is preferable.	Negative	Biocentric
10	We have more important things in Bartın to worry about than the death of a wild animal threatened with extinction.	Negative	Biocentric

Table 2. Demographic and socioeconomic attributes of the sampling

Attributes		Non-hunters	Hunters
Number of respondents		1,048	500
Age (mean, years)		36.20	40.70
Gender (%)	Male	82.00	100.00
	Female	18.00	0.00
Res. area (%)	Urban	60.00	58.40
	Rural	40.00	41.60
Education (mean, years)		10.71	9.21
Household dimension (mean)		3.62	4.06
Monthly individual income (mean, TL)		942.67	836.37
Monthly household income (mean, TL)		1.390,71	1.073,04
Membership of any nature-friendly association (%)		3.24	-
Membership of any hunters' club (%)		-	41.00
Hunting experience (mean, years)		-	15.82

The VOs for wildlife conservation of hunters and non-hunters were investigated using means calculated with datasets obtained from the survey of two respondent groups. While evaluating the mean values, an attitude score scale with 0.80 intervals between 1-5 was used (from the lowest to the highest level 1.00-1.80, 1.81-2.60, 2.61-3.40, 3.41-4.20;

4.21-5.00). An independent samples t test was also performed to test for differences in means of the variables between hunters and non-hunters. A significance level of 0.05 was used for the t tests. By using the total scores of the WCA scale as a dependent variable, a multiple regression analysis with least squares for each of the two respondent groups was performed to examine the effects of demographic and socioeconomic characteristics of hunters and non-hunters, and their beliefs about general, environmental and wildlife-related issues on their WCA for wildlife conservation.

SPSS 15.0 was used for all statistical analyses, and p values less than 0.05 were considered significant.

Results and Discussion

Wildlife Activities of Hunter and Non-hunters

Figure 1 illustrates the proportions of hunters and non-hunters interested in wildlife related-activities in Bartın. Respondents in the non-hunter group generally indicated that they have never been interested in hunting. The low commercial use (6.2%) hunters currently make of Bartın's wildlife ecosystems, so almost all hunters see hunting as a recreational activity. Both groups ranked other activities similarly. However, the most popular activity for non-hunters is watching wildlife-related documentary films (71.9%); they perceive more of a benefit from this activity than hunters do (55.0%). Photographing wildlife was mentioned by less than ten percent of each respondent group, while collecting wildlife-related material as a consumptive use was preferred more by hunters than by non-hunters (6.2% and 1.2%, respectively). The difference is statistically significant.

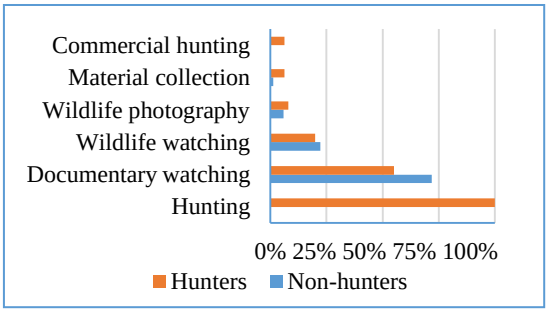

Figure 1. Wildlife related-activities in Bartın

Beliefs About Wildlife-Related Problems

Hunters believe that the degradation of wildlife is the most important environmental problem in the province but it ranks fifth following river pollution, drinking water pollution, waste management and air pollution for non-hunters.

Figure 2 summarizes beliefs about the insufficiency of Bartın wildlife ecosystems in terms of their active or passive benefit. The figure generally indicates that hunters considered the Bartın wildlife ecosystems to be insufficient for all uses more than non-hunters. The results reveal that the majority of hunter respondents believe that wildlife ecosystems are insufficient, especially for future generations. They reported high levels of concern about hunting and potential benefits, while their concerns were at the lowest level for other active uses such as wildlife viewing, photographing, wildlife documentation and wildlife related material collection. However, most hunters disagreed that wildlife ecosystems are very rich and sufficient to be self-sustaining. These results have implications for their high motivations toward wildlife conservation.

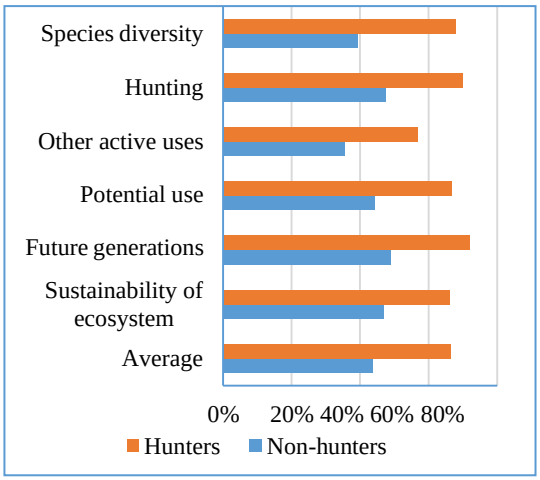

Figure 2. Beliefs about insufficiency of wildlife ecosystems

It is important to know beliefs about threats to wildlife in Bartın Province. Figure 3 shows that illegal hunting, lack of education and excessive hunting are, from both groups' points of view, the main threats to wildlife. Non-hunter respondents find society's indifference (44%) important, while hunters draw attention to illegal (73%) and excessive

hunting (56%), and faulty agricultural practices (51%). However, the fact that insufficient financial support and the free good issue are seen a less important by hunters than non-hunters may have anthropocentric motivations. Both respondent groups regard public managers' indifference as an important threat to wildlife, while other threats, such as natural factors, general economic problems, insufficient wildlife management plans and faulty land allocations, are less important.

Attitudes Toward Conservation

Table 3 illustrates that the strength of biocentric VOs of both groups toward wildlife conservation varies. Items 6 and 1, reflect the pure biocentric VOs, had the highest mean values, with the mean values of 4.41 and 4.21 for hunters and 4.37 and 4.19 for non-hunters, respectively. It means that the pure biocentric VOs of both groups to conserve wildlife are very strong. Although most support came for the statement related to the extinction of wild species, this support decreased when the costs of protection were included in item 7. It is conspicuous that there was a significant difference in this viewpoint between the groups ($p<0.001$). Hunters accepted making more sacrifices at all costs to protect threatened wild species than non-hunters did.

In the scale, three negative statements (items 8, 9 and 10) toward wildlife conservation were constructed to reflect trade-offs between biocentric orientations and economic concerns such as high conservation costs, job opportunities, and wildlife ecosystems. In the case of high conservation costs and job opportunities, the results show that the conservative attitudes of hunters decreased somewhat. The mean values of hunters' biocentric VOs (3.65 for high costs and 3.50 for job opportunities) in these statements were lower than the means for non-hunters (3.76 and 3.62, respectively) even though there is no statistically significant difference between these respondent groups according to the result of the independent samples t test. These mean values indicate that, although hunters have more positive attitudes toward wildlife conservation than non-hunters for many VOs, economic concerns were important to them because they have lower incomes.

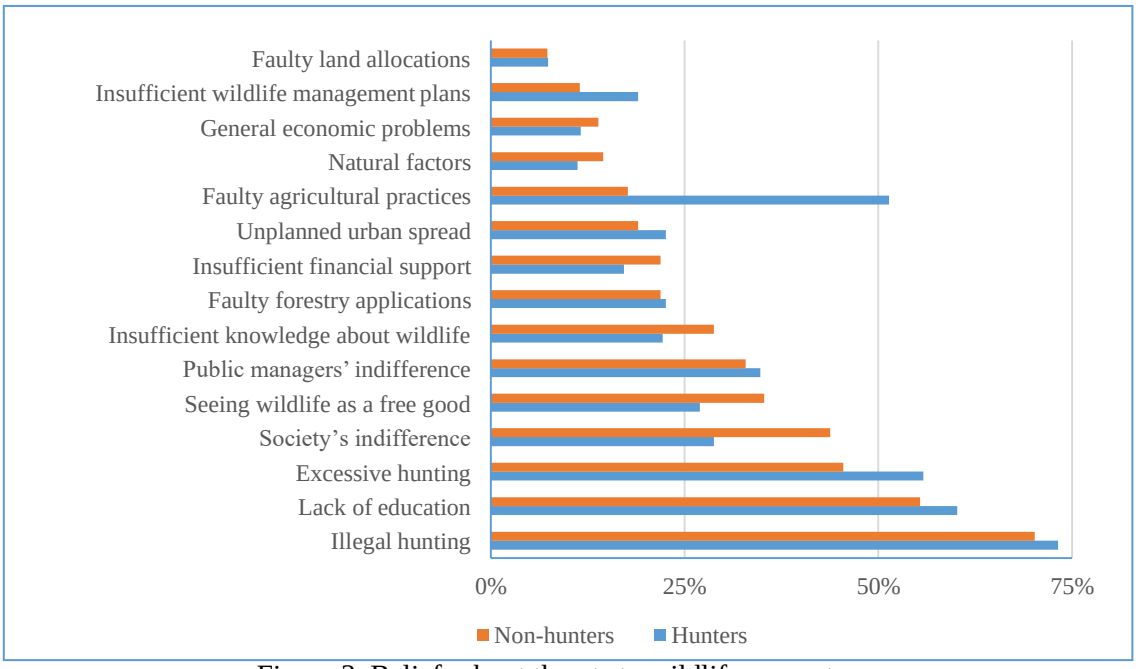

Figure 3. Beliefs about threats to wildlife ecosystems

The biocentric concerns of both respondent groups - especially those of non-hunters (with a mean of 2.55) - about wildlife conservation decreased when compared to addressing all problems in the province. A significant difference was found between the

two respondent groups, with non-hunters clearly having more negative attitudes toward the conservation of threatened species from this perspective. Hunters' attitudes in this extreme case were neutral, while non-hunters' attitudes were low.

Table 3. Attitudes toward conservation of wildlife ecosystems

Item	VO	Hunters	Non-hunters	t-test
1	Biocentric	4.21	4.19	0.362
6	Biocentric	4.41	4.37	0.696
7	Biocentric	3.71	3.45	4.580***
8	Biocentric	3.65	3.76	-1.819
9	Biocentric	3.50	3.62	-1.932
10	Biocentric	2.95	2.55	6.222***
	Biocentric mean	3.74	3.66	
2	Social altruistic	4.26	4.22	0.753
5	Social altruistic	4.21	4.08	2.455*
	Soc. alt. mean	4.23	4.15	
3	Egoistic	4.00	3.75	4.061***
4	Egoistic	3.71	3.19	9.132***
	Egoistic mean	3.86	3.47	
	Mean	3.86	3.71	4.950***
	Mean for subscales	3.94	3.76	

*Significant at p< 0.05; ** significant at p< 0.01; *** significant at p< 0.001.

High values of social altruistic VOs for hunters and non-hunters in items 2 and 5 show that concern for other people and future generations is an important part of conservative attitudes. Hunters agree more with social altruistic motives than non-hunters do, but only the differences for the motive related with future generations are significant at the 0.05 level.

Egoistic VOs for securing active use and potential benefits of wildlife conservation (items 3 and 4) were generally strong with one exception. Hunters, who had strong egoistic VOs about wildlife, attached less importance to conserving wildlife for potential benefits than for active benefits, possibly because of the uncertainty of capturing direct or indirect benefits from wildlife in the near future. There were statistically significant disparities at the 0.001 level between hunters and non-hunters for these VOs. The majority of non-hunters tended to support wildlife conservation for the maintenance of benefits for active use, which is less than that for hunters. The reason may be related to the expectations of non-hunters for improvements in the local economy and public welfare as a result of increased hunting tourism. One of the lowest motivations of non-hunters toward wildlife conservation was that of potential benefits, with a mean value of 3.19. This point of view may be the result of their belief that they would never derive direct or indirect benefits from wildlife.

Table 3 shows that hunters have more positive attitudes toward wildlife conservation except as they relate to high conservation costs and job opportunities. However, the mean scores show that hunters were more positive toward wildlife conservation than non-hunters were, and this difference was significant at 0.001. Similar results have been found in some studies (Reading, 1993; Long, 1998). In addition, both groups have strong positive attitudes toward wildlife conservation for weighted mean scores of the subscales.

Variables that Affect Conservative Attitudes

It was assumed in the lineer regression models that individual attitudes toward wildlife conservation were a function of individual demographic and socioeconomic attributes, beliefs about the province's general and environmental problems and sufficiency of wildlife ecosystems, and wildlife-related activities. Definitions and descriptive statistics of the variables used in the models are given in Table 4.

Table 4. Definitions and sample statistics of variables

Variable	Description	Non-hunters		Hunters	
		Mean	SD.	Mean	SD.
Demographic and socioeconomic attributes					
AGE	Age (1 for 18-29; 2 for 30-39; 3 for 40-49; 4 for 50-59; 5 for older than 59)	2.20	1.17	2.67	1.30
INC	Monthly household income (1 for less than 500 TL; 2 for 500-999 TL; 3 for 1.000-1.499 TL; 4 for 1.500-2.499 TL; 5 for 2.500-4.999 TL; 6 for 5.000-9.999 TL; 7 for more than 9.999 TL)	3.16	1.12	2.69	0.98
EDU	Educational level (0 for none; 1 for elementary; 2 for high school; 3 for university)	1.72	1.04	1.36	0.75
RESID	Residential Area (1 for villages; 2 for towns; 3 for cities)	2.19	0.78	2.05	0.83
MEMB	Membership of a nature-friendly association for non-hunters or a hunters' club for hunters (1 for yes; 0 for no)	0.03	0.17	0.41	0.49
HEXP	Hunting experience (years)	-	-	15.82	11.55
Beliefs about general problems (1 for yes; 0 for no)					
ENV	Environmental problems	0.54	0.50	0.38	0.49
INF	Inflation	0.36	0.48	0.29	0.45
URBAN	Unplanned urban spread	0.50	0.50	0.41	0.49
POV	Poverty	0.35	0.48	0.43	0.50
SPORT	Insufficiency of sporting activities	0.22	0.42	0.21	0.41
Beliefs about environmental problems (1 for yes; 0 for no)					
WILD	Degradation of wildlife ecosystems	0.49	0.50	0.64	0.48
BIO	Degradation of biological diversity	0.32	0.47	0.48	0.50
Wildlife-related activities (1 for yes; 0 for no)					
WATCH	Wildlife watching	0.22	0.42	0.20	0.40
PHOTO	Wildlife photographing	0.06	0.24	0.08	0.27
DOCUM	Documentary film watching	0.72	0.45	0.55	0.50
Beliefs about insufficiency of wildlife ecosystems					
SHUNT	For hunting (1 for yes; 0 for no)	0.47	0.50	0.70	0.46
SFUTR	For future generations (1 for yes; 0 for no)	0.49	0.50	0.72	0.45
SECOS	For sustaining wildlife (1 for yes; 0 for no)	0.47	0.50	0.66	0.47
Dependent variable					
ATT	Respondents' average scores from the WAC scale	3.72	0.54	3.86	0.51

The results of multiple regression analyses for both respondent groups are presented in Table 5. Both models were significant at the 0.01 level, but low R^2 values (19.5% for hunters and 13.1% for non-hunters) indicated that the models explained a small part of the variance in the attitudes of the respondent groups with all explanatory variables.

The results for non-hunters show that the effect of household income and membership in a nature-friendly association on the attitudes was positive, but these independent variables were not statistically significant at the 0.1 level. Age, educational level, and belief about degradation of wildlife ecosystems and insufficiency of wildlife ecosystems for future generations were the most significant variables ($p<0.01$) in explaining variations in non-hunters' attitudes toward wildlife conservation. However, residential area, documentary film-watching and beliefs about environmental problems, unplanned urban spread and poverty had significant effects on the attitudes of non-hunters at the 0.05 level; wildlife-watching and beliefs about insufficiency of wildlife ecosystems for sustaining ecosystems were important variables at the 0.1 level. Almost all of these significant variables had positive effects on the conservative attitudes of non-hunters, but the sign of the poverty variable coefficient was negative. Based on the regression model, non-hunters, who tend to be older, more educated and resident in larger cities, have higher positive attitudes toward wildlife conservation. However, the model indicates that, as expected, more concerns about environmental problems, unplanned urban spread and degradation of wildlife ecosystems and insufficiency of wildlife

ecosystems resulted in higher conservative attitudes, while greater priority given to poverty caused a tendency toward negative attitudes toward wildlife conservation. Non-hunters who perceived active benefits from wildlife through wildlife watching and watching documentaries held higher conservative attitudes.

Table 5. Results of regression analysis

	Hunters		Non-hunters	
Variable	Coefficient	t-value	Coefficient	t-value
AGE	-0.059**	-2.516	0.050***	3.424
INC	0.052**	2.347	0.025	1.570
EDU	0.074**	2.310	0.092***	4.766
RESID			0.051**	2.084
HEXP	0.006**	2.499		
MEMB	0.033	0.754	0.133	1.486
ENV			0.071**	2.202
INF	-0.083*	-1.775		
URBAN	0.071*	1.651	0.066**	2.024
POV			-0.075**	-2.190
SPORT	0.227***	4.403		
WILD			0.114***	3.549
BIO	0.101**	2.399		
WATCH			0.065*	1.692
PHOTO	0.245***	3.177		
DOCUM			0.075**	2.083
SHUNT	0.163***	3.247		
SFUTR	0.130**	2.518	0.126***	2.626
SECOS			0.092*	1.893
Constant	3.335***	32.341	2.981***	36.426
n	500		1048	
F-test	11.047***		13.166***	
R^2	21.4%		14.2%	
R^2 adj	19.5%		13.1%	

* Significant at p< 0.10; ** significant at p< 0.05, *** significant at p< 0.01.

As Table 5 shows, much of variables were found to be statistically significant in explaining variations in hunters' attitudes. Wildlife photography, beliefs about insufficiency of sporting activities and hunting resources were the most significant variables in the model set for hunters. In addition, the variables, age, income, education, hunter experience, beliefs about degradation of biological diversity and insufficiency of wildlife for future generations were significant at the 0.05 level, while beliefs about inflation and urban spread were significant at the 0.1 level. The signs of much of variables were positive and the age and inflation variables was negative; thus, older hunters had lower conservative attitudes toward wildlife than non-hunters. The negative impact of age is puzzling, but it may be because older hunters have been 'free riders' for a long time or because of economic concerns, although hunters' attitudes toward wildlife were positively affected by increases in their income and educational levels. The results also show that hunters who are interested in wildlife photography, who perceive the facilities for sporting activity as insufficient and who perceive wildlife as insufficient for hunting and future generations have more positive attitudes. The memberships variable in the hunters' model have the expected sign but were statistically insignificant.

Conclusion

The data obtained from the WAC scale, the focus of this study, showed that public attitudes toward wildlife conservation were moderately high, with mean values less than 4.0 for both respondent groups. According to

the detailed results, public attitudes motivated by pure biocentric and social altruistic VOs were almost very strong while the attitudes oriented by other biocentric concerns were changed from strong to low when the scope of economic concerns expanded. Similarly, the multiple regression analyses explained the negative relationship between conservative attitudes and economic concerns that public attitudes toward wildlife conservation decrease if economic concerns increase.

However, hunters had more positive and stronger attitudes toward wildlife conservation than non-hunters did, even though they had comparatively low income and education levels and these demographic variables significantly affected their conservative attitudes. Reasons for this result are not only hunters' expectations for plenty of hunting resources, but also stronger motives related to pure biocentric and social altruistic VOs. Furthermore, the greater knowledge level of hunters about wildlife may ensures their awareness of harmful conditions and threats to wildlife.

Study results which show that strong beliefs about lack of education and public knowledge related to wildlife and the remarkable domination of economic concerns over conservative attitudes in Bartın Province show that more public information about wildlife population, habitats and conservation efforts is needed. The BPDO has generally targeted hunters for education and information meetings and seminars. However, based on the results of this study, these information meetings should also be aimed at non-hunters. The results of the regression analyses provide wildlife managers with some useful clues about who should be targeted with education and information activities. The results suggest that among non-hunters, young people, less educated people and rural residents should be targeted, as well as hunters who are relatively older, less experienced, less educated and have low incomes. It is important to realise that the success of all information activities depends on the level of scientific knowledge of wildlife managers. Therefore, more inventory studies should be conducted about wildlife population and habitats in Bartın Province, and the BPDO should employ more officers with sufficient knowledge about wildlife.

The regression analyses showed that wildlife documentaries positively affect non-hunters' attitudes toward conserving wildlife, while wildlife photography, as a recreational activity for hunters, was more effective. Approximately two-thirds of non-hunters and half of the hunters prefer watching wildlife documentaries on television, so this wildlife-related activity is foremost among the various conservation strategies. Preparing documentary films about wildlife in Bartın Province and broadcasting them on local and national television channels can make a considerable contribution to public knowledge about wildlife, conservative attitudes toward wildlife, and support for wildlife management, especially among non-hunters. In addition, if the province builds sightseeing places with sensible designs for nature in terms of wildlife protection, improvement and replacement, Bartın Province may increase the facilities available for wildlife watching and photography, and thereby increase public perceptions about, and interest in, wildlife conservation.

Multiple regression analyses indicated that membership of any nature-friendly association or hunting club had no significant effect on individual attitudes toward wildlife conservation. However, positive signs of the membership variables for both models mean that establishing new non-governmental organizations related to wildlife conservation and increasing the number of members in these organizations and hunting clubs can positively affect public attitudes toward wildlife conservation.

More research on human dimension of wildlife, especially values, beliefs and attitudes, as determinants of human behavior toward wildlife, covering wider regions in Turkey should be made in the light of the lessons derived from this study. Lack of knowledge about wildlife, especially by non-hunters, is a striking issue, so further research should also be directed at specifically determining the effects of public knowledge about wildlife concerning conservative attitudes. Moreover, in recent years human-carnivore conflicts have arisen in some regions of Turkey. In this context, public

attitudes toward carnivores should be investigated to provide useful information for wildlife managers and to develop the most effective policies as they relate to limiting such encounters. The human dimension of wildlife conservation is not related only to hunters and non-hunters, but also to other interest groups, such as farmers, forest villagers, and officers responsible for wildlife resource management. As a final suggestion, all public segments' attitudes toward wildlife conservation should be surveyed periodically with worldwide well-known wildlife attitude scales.

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Assessment of Irrigation Water Quality of Side-Mansur Area in Benghazi Region

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Abstract

Aim of study: Sodium adsorption ratio (SAR), Sodium percentage (%), residual Sodium Carbonate (RSC), Permeability index (PI), Soluble Sodium Percentage (SSP), Magnesium hazard (MH) and the physical and chemical parameters of groundwater play a significant role in classifying and assessing irrigation water quality.

Area of study: This study focused on characterization of Groundwater of Side Mansur Area in Benghazi Region.

Material and methods: Groundwater samples were collected from wells to represent different uses such as domestic and farm wells during July to September 2020. The analyzed samples were used for classifying water quality for irrigation purpose.

Main results: The major ionic abundance in the area shows that trend $Cl^{-} > HCO3^{-} > Na^{+} > Ca^{++} > Mg^{+} > K^{+}$. Accordingly, the results suggest that the groundwater in the study area. There are higher concentrations of major ions and higher values of chemical parameters in the groundwater. The groundwater in the study area is fresh to moderately mineralized, with TDS values ranging from 608 to 1.804 mg/L. (PI) ranges from 51.82 to 66.87% with an average value of about 59.98%. The soil permeability is affected by long-term usage of water for irrigation and other purposes. Based on the (PI) in the study area, 55% of the samples were suitable for irrigation and 45% of the samples were unsuitable for irrigation purpose. However, according to RSC values shows that Suitable water for irrigation use. the calculated values of (SAR) in the study area the results suggest that All samples fall under (Use on sodium sensitive crops must be cautioned).

Highlights: Knowing the physical and chemical parameters of water plays an important role in determining the quality of irrigation water.

Keywords: Water Quality, Groundwater, Benghazi

Introduction

Many regions in the world use ground water as their main source of fresh water supply. Natural groundwater composition and quality is of concern because it is used worldwide as a freshwater supply (Batista, 2004). Groundwater is the main source of water used for human consumption and for both industrial and agricultural activities in regions where surface water is scarce. Salts found in irrigation water can affect both soil structure and crop yield (Fipps, 2003; Li, 2014). In general, ground water is the main source of the water resources in Libya since it constitutes 98% of the available water resources. The agriculture sector is the largest consumer of water, especially in the Mediterranean arid and semi-arid regions, where irrigation water represents from 50% up to almost 90% of total used water (Bortolini, Maucieri & Borin, 2018). Side-Mansur Area in Benghazi Region is mainly rural and has over the years depended largely on groundwater for domestic and agricultural use. The water quality management is essential for long-term irrigation system as it persuades the soil properties. The quality of suitable irrigation water is very much influenced by the constituents of the soil which is to be irrigated. A particular water may be harmful for irrigation on particular soil, but the same water may be acceptable or even useful for irrigation in some other soil. In irrigation water evaluation, emphasis is

given on chemical and physical characteristics of water. The suitability of water for irrigation is determined not only by the total amount of salt present but also by the kind of salt. Various soil and cropping problems develop as the total salt content increases, and special management practices may be required to maintain acceptable crop yields (Sutharsiny, 2012). The face of irrigated agriculture is changing with respect to water quantity and quality. Thus, the availability of good-quality water for irrigation is threatened in many places and irrigated agriculture faces the challenge of using less water, in many cases of poorer quality, to irrigate lands that provide food for an expanding population. (Alobaidy, Al-Sameraiy, Kadhem, & Majeed, 2010).

Irrigation Water Quality Criteria

Numerous parameters are used to define irrigation water quality, to assess salinity hazards, and to determine appropriate management strategies. A complete water quality analysis will include the determination of the total concentration of soluble salts, the relative proportion of sodium to the other cations, the bicarbonate concentration as related to the concentration of calcium and magnesium, and the concentrations of specific elements and compounds (Fipps, 2003).The suitability of irrigation water for long term use is determined by the quality of the water. All irrigation water contains salts, some which are harmful (sodium, bicarbonate) and some which improve soil structure (calcium). Water quality or suitability for use is judged on the potential severity of problems that can be expected to develop during long term use. In irrigation water evaluation, emphasis is placed on the chemical and physical characteristics of the water and only rarely are any other factors considered important. Here attempt has been made to assess the irrigation water quality of Side- Mansur Area in Benghazi Region.

Materials and Method

The Study Area

Side-Mansur Area is in the eastern part of Benghazi region. Figure 1 shows the location of the study area in Side-Mansur Area of Benghazi region.

Figure 1. shows the locations of the wells selected for monitoring in Side- Mansur aquifer in the Benghazi region.

Groundwater samples were collected from Seven points in study during September, 2020. All selected wells are under multiple usages such as public wells for drinking purpose (2 wells), and agriculture wells (5 wells). Coordinates of water samples and location names shows at (Table 1).

Table 1. Coordinates of water samples and location names

Point	Coordinate		Location
	E	N	
W1	32 09 24	20 14 19	Field (1) Sidi Mansour
W2	32 07 40	20 14 28	Field (2) Sidi Mansour
W3	32 09 37	20 11 45	Al-Jaliah
W4	32 10 15	20 10 50	Basher Imneisi Farm
W5	32 10 29	20 11 05	Tabiat Bo-Masoud
W6	32 10 59	20 11 18	Hawa-Almafara
W7	32 11 24	20 11 24	Barkat- Shaair

Sampling and Analysis

Water samples were taken at 7 sampling sites. Each sample was poured into 1-liter plastic bottles after rinsing several times with the same water. These bottles were tightly closed, labeled and transported to the laboratory for analysis within 24 hours after collection. Data were analyzed statistically. Classical descriptors such as mean, median, minimum, maximum, coefficient of variation (%CV), standard deviation (SD), skewness and kurtosis of data distribution were determined using (SPSS 22) the predictive analytics software and solutions. Water samples were analyzed by standard methods, while Magnesium content (MC), sodium percentage (SP), Sodium adsorption ratio (SAR), Residual sodium carbonate (RSC),

Permeability index (PI) and Soluble Sodium Percentage (SSP) were calculated as follows:

- Magnesium content (MC):

Magnesium content of water is considered as one of the most important qualitative criteria in determining the quality of water for irrigation. Generally, calcium and magnesium maintain a state of equilibrium in most waters. More magnesium in water will adversely affect crop yields as the soils become more alkaline. General classifications of irrigation water based upon Magnesium content (MC) are presented in Table 2.

$$\text{Mg content} = \left[\frac{Mg^{2+}}{Mg^{2+} + Ca^{2+}}\right] 100 \qquad (1)$$

Table 2. General classifications of irrigation water based upon Magnesium content (MC).

Parameter	Range	Groundwater class (Irrigation uses)
Magnesium hazard (MH).	<50	Suitable
	>50	Unsuitable

- Sodium percentage (SP):

Sodium concentration plays an important role in evaluating irrigational quality of groundwater. Sodium percent in water is a parameter computed to evaluate the suitability for irrigation(Dhirendra Mohan Joshi, 2009). A high concentration of sodium is undesirable as sodium is adsorbed on the exchange sites causing soil aggregates to disperse, reducing its permeability (Sutharsiny, 2012). The sodium in irrigation waters is also expressed as percent sodium or soluble-sodium percentage (Na %) and the sodium percentage was calculated by using formula proposed by (Wilcox 1954) and General classifications of irrigation water based upon sodium percentage (SP) are presented in Table 3.

$$\text{Na\%} = \left[\frac{(Na^{+} + K^{+})}{(Ca^{2+} + Mg^{2+} + Na^{+} + K^{+})}\right] * 100 \qquad (2)$$

Table 3. General classifications of irrigation water based upon sodium percentage (SP)

Parameter	Range	Groundwater class (Irrigation uses)
Sodium percentage (SP)	<20	Excellence
	20-40	Good
	40-60	Permissible
	60-80	Doubtful
	>80	Unsuitable

- Sodium adsorption ratio (SAR):

The sodium hazard is typically expressed as the sodium adsorption ratio (SAR). This index quantifies the proportion of sodium (Na^{+}) to calcium (Ca^{++}) and magnesium (Mg^{++}) ions in a sample. Calcium will flocculate (hold together), while sodium disperses (pushes apart) soil particles. This dispersed soil will readily crust and have water infiltration and permeability problems (Mohamed, 2008). The tendency for sodium to increase its proportion on the cation exchange sites at the expense of other types of cations (primarily calcium and magnesium) is estimated by the sodium adsorption ratio (SAR), which is the ratio of sodium concentration to the concentration of the square root of the average calcium plus magnesium concentration in either irrigation water or the soil solution (Miller & Gardiner, 2007) Numerous guidelines for assessment of the sodium adsorption ratio (SAR) of irrigation water have been published (Wilcox 1954) in table (4).

$$\text{SAR} = \frac{Na^{+}}{\sqrt{\left[\frac{Ca^{2+} + Mg^{2+}}{2}\right]}} \qquad (3)$$

Table 4. General classifications of irrigation water based upon SAR

SAR values	Sodium hazard	Comments
1-9	Low	Use on sodium sensitive crops must be cautioned
10-17	Medium	Amendments (such as gypsum) and leaching needed
18-25	High	Generally unsuitable for continuous use
>26	Very High	Generally unsuitable for use

- Residual sodium carbonate (RSC):

The concentration of bicarbonate and carbonate also influences the suitability of water for irrigation purpose. One of the empirical approaches is based on the assumption that all $Ca2^+$ and $Mg2^+$ precipitate as carbonate (Dhirendra Mohan Joshi, 2009). The residual sodium carbonate index of irrigation water or soil water was used to indicate the alkalinity hazard for soil. The (RSC) index is used to find the suitability of water for irrigation in clay soils which have a high cation exchange capacity. The relationship between carbonates and alkali earth's concentrations can be explained by (RSC) for irrigation quality of water. Residual sodium carbonate (RSC) was calculated by using formula proposed by (Eaton, 1950) and General classifications of irrigation water based upon Residual sodium carbonate (RSC) values are presented in Table 5.

$$RSC=(CO3^{2-}+HCO3^{-})-(Ca^{2+}+Mg^{2+}) \quad (4)$$

Table 5. General classifications of irrigation water based upon Residual sodium carbonate (RSC)

Parameter	Range	Groundwater class (Irrigation uses)
Residual sodium carbonate (RSC).	<1.25	Suitable
	1.25-2.5	Marginal
	>2.5	Unsuitable

- Soluble sodium percentage (SSP) (Dhirendra Mohan Joshi, 2009):

Soluble Sodium Percentage (SSP) is also used for assessment of irrigation water quality, as an important factor to study the sodium hazard. SSP is defined as the ration of sodium the total cation multiplied by 100.

High sodium (Na^+) percentage can decrease soil permeability and inhibit plant growth.

$$SSP\%=\left[\frac{(Na^+)}{(Ca^{2+}+Mg^{2+}+Na^+ +K^+)}\right]*100 \quad (5)$$

- Permeability index (PI):

The soil permeability is affected by long-term use of irrigation water and is influenced by sodium, calcium, magnesium and bicarbonate contents of the soil. (Doneen, 1964; Raju, 2006) has evolved a criterion for assessing the suitability of water for irrigation based on Permeability index (PI) at (Table 6), and PI has been calculated by using the formula (Szabolcs, 1964).

$$PI=\left[\frac{(Na^+ +\sqrt{HCO3^-})}{(Ca^{2+}+Mg^{2+}+Na^+)}\right]*100 \quad (6)$$

Table 6. General classifications of irrigation water based upon Permeability index (PI) values.

Parameter	Range	Groundwater class (Irrigation uses)
Permeability index (PI)	<60	Suitable
	>60	Unsuitable

Results and Discussion

It is important to understand the quality of groundwater for various uses (especially irrigation water). This is very unique because the rainfall pattern is constantly changing due to various factors. Since the quality and quantity of groundwater are very important, many methods are used to reveal the type of water, which will be discussed below. Tables 7, 8 and 9 show the average of the physical and chemical changes of groundwater in the Benghazi area and the calculated irrigation water quality parameters in the Side-Mansur area.

Table 7. Water quality parameters of Side-Mansur area in Benghazi region.

Cod	W1	W2	W3	W4	W5	W6	W7
EC	1.867	1.926	2.100	2.280	1.780	1.170	3.460
PH	7.01	6.75	6.95	7	7	7	6.8
T.D.S	1.083	1.073	1.180	1.322	965	608	1.804
Temp	22	21	22	23	22	22	22
T.Ha	460	470	475	508	404	300	822
Ca	97	101	100	107	88	70	170
Mg	54	55	54	59	45	30	135
Na	212	218	215	234	182	130	394
Cl	404	416	513	548	342	146	779
K	3.8	4.1	4.1	4.3	5.9	7.6	5.56
Hco3	240	241	215	238	256	280	240

Table 8. Descriptive statistics of the concentration of water quality parameters of Side-Mansur area in Benghazi region.

Parameter	Minimum	Maximum	Mean	SD
EC µS/cm	1.170.00	3.460.00	2.083.28	699.03
PH	6.75	7.01	6.93	0.10
T.D.S mg/l	608.00	1.804.00	1.147.8	364.3
Temp °C	21.00	23.00	22.0	0.57
T. Hardness	300.00	822.00	491.28	161.01
Ca mg/l	70.00	170.00	104.71	31.21
Mg mg/l	30.00	135.00	61.7	33.73
Na mg/l	130.00	394.00	226.4	81.4
Cl mg/l	146.00	779.00	449.7	195.43
K mg/l	3.80	7.60	5.05	1.37
Hco3 mg/l	215.00	280.00	244.2	19.8

Table 9. Shows the calculated irrigation water quality parameters of Side-Mansur area in Benghazi region.

Sampling points	Mg. content (MC) %	Sodium pct. (SP) %	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Soluble sodium pct. (SSP) %
W1	48.12	49.9	1.06	-5.41	49.38
W2	47.57	49.8	1.07	-5.68	49.32
W3	47.36	49.8	1.06	-5.97	49.32
W4	47.88	50.04	1.11	-6.36	49.50
W5	46.0	49.73	0.97	-3.9	48.8
W6	41.6	49.3	0.79	-1.40	47.70
W7	56.96	46.65	1.38	-15.81	46.26
Mean	47.94	49.34	1.06	-6.37	48.61

Conclusion

The groundwater quality with respect to agricultural and drinking purposes was assessed. Analysis of ground water samples collected from different locations of Side-Mansur Area in Benghazi Region revealed that, in some samples water quality parameters (Total dissolved sold, pH, Total hardness, Calcium, magnesium, chloride, sodium, potassium and bicarbonate) were beyond the permissible limit as per WHO standard. So, the proper environment management plan may be adopted to control drinking water pollution. The ground water of this area needs some degree of treatment before drinking and it needs to be protected from contamination so as to prevent adverse health effects on human beings. The excess amount of total dissolved solids in the groundwater is due to anthropogenic factors and geological characteristics of the aquifer.

In the present study, Irrigation water quality was determined based on Magnesium content (MC), sodium percentage (SP), Sodium adsorption ratio (SAR), Residual sodium carbonate (RSC), Permeability index (PI) and Soluble Sodium Percentage (SSP). Accordingly, some of the analyzed samples are unsuitable for irrigation under normal condition and requires special soil management and high leaching.

The conclusions can be summarized as follows.

- There are higher concentrations of major ions and higher values of chemical parameters in the groundwater. The groundwater in the study area is fresh to moderately mineralized, with TDS values ranging from 608 to 1.804 mg/L.
- The groundwater samples with different concentrations of TDS possess different hydro chemical characteristics. For groundwater samples Na^{+}, is the predominant cation, followed by $Ca2^{+}$ and $Mg2^{+}$, whereas for anions, Cl^{-} is predominant in the groundwater samples, followed by $HCO3^{-}$.
- Total hardness reveals that the water is generally hard in nature.
- The calculated values of SAR, PI, Na %, and RSC indicate permissible use of groundwater for irrigation purposes. Comparison of geochemical data shows that majority of the groundwater samples are suitable for drinking and irrigation purposes.
- The calculated values of sodium percentage of the groundwater samples indicate that 100% of the samples fall in permissible limit according to the Wilcox (1954) water suitability classification for irrigation purpose
- The RSC values reveal that the groundwater samples in study area are considered suitable for irrigation purpose.
- The permeability Index ranges from 51.82 to 66.87% with an average value of about 59.98%. The soil permeability is affected by long-term usage of water for irrigation and other purposes. Based on the permeability index in the study area, 55% of the samples were suitable for irrigation and 45 % of the samples were unsuitable according to the Doneen (1964) water suitability classification for irrigation purpose.

- The calculated values of sodium adsorption ratio (SAR) in the study area. All samples fall under (Use on sodium sensitive crops must be cautioned). category according to the recommended water classification for SAR (Wilcox, 1954).

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