Assoc. Prof. Dr. Gülden SANDAL ERZURUMLU
Niğde Omer Halisdemir University, Department of Landscape Architecture, Niğde / TURKEY

Res. Asist. Nuriye Ebru YILDIZ
Ankara University, Department of Landscape Architecture, Ankara / TURKEY

DETERMINING THE ROUTE FOR NATURE AND CULTURE TOURISM WITH THE LEAST COST PATH ANALYSIS IN NATURAL PROTECTED AREA (CAPPADOCIA REGION)

ABSTRACT

The Cappadocia Region is an important memory place that has memorial and symbolic values as well as its natural and cultural riches. These values should be transferred to the next generations and their national and international recognition should be ensured through sustainable tourism approaches. In this paper, it is aimed to determine the most appropriate route to ensure sustainable tourism planning in the Cappadocia Region and the recognition of the natural and cultural areas of the region in national and international platforms. Within the scope of the research, the Least Cost Path (LCP) analysis was performed in ArcGIS 10.5, which is a GIS software, and the region's slope groups, land cover and settlement centers with high tourism potential were used as inventory. The fact that LCP analysis can be used in different tourism activities such as mountaineering, birdwatching, horse riding and camping as well as nature walks and the fact that it can be used to reach the determined regions, emphasize the widespread value of the study.

Keywords: Nature Tourism, Cultural Tourism, Route Planning, Least Cost Path Analysis

DOĞA VE KÜLTÜR TURİZMİ İÇİN EN DÜŞÜK MALİYETLİ YOL ANALİZİ İLE GÜZERGÂH BELİRLEME (KAPADOKYA BÖLGESİ)

ÖZET

Kapadokya Bölgesi, doğal ve kültürel zenginliklerinin yanı sıra anısal ve sembolik değerlere de sahip önemli bir hafıza mekânıdır. Bu değerler gelecek kuşaklara aktarılmalı ve sürdürülebilir turizm yaklaşımları ile ulusal ve uluslararası düzeyde tanınabilirliği sağlanmalıdır. Bu çalışmada, Kapadokya Bölgesi'nde gerçekleştirilecek sürdürülebilir turizm planlamasının sağlanması ve bölgenin doğal ve kültürel alanlarının ulusal ve uluslararası platformlarda tanınabilirliğinin sağlanması amacı ile en uygun güzergâhın belirlenmesi hedeflenmiş ve teknolojik gelişmeler ile birlikte önemli bir araç haline gelen Coğrafi Bilgi Sistemlerinin kullanımı irdelenmektedir. Araştırma kapsamında, Kapadokya Bölgesi'nin tanıtımının sağlanması amacı ile gerçekleştirilecek turizm faaliyetlerinde, gezi güzergahının belirlenmesi amacı ile CBS yazılımı olan ArcGIS 10.5'de Least Cost Path (LCP) analizi gerçekleştirilmiş ve bölgenin eğim grupları, arazi örtüsü ile bölgede turizm potansiyeli yüksek olan yerleşim merkezleri envanter olarak kullanılmıştır. LCP analizinin, doğal ve kültürel amaçlı gerçekleştirilecek turizm yürüyüşlerinin yanı sıra kuş gözlemciliği, at binme, kamp gibi farklı turizm aktivitelerinde de rota belirleme ve belirlenen bölgelere ulaşmada kullanılabilecek olması, çalışmanın yaygın değerini ön plana çıkarmaktadır.

Anahtar Kelimeler: Doğa Turizmi, Kültürel Turizm, Güzergâh Planlama, Least Cost Path Analizi

1. INTRODUCTION

Cappadocia Region that has shaped with the identity of the natural and cultural values, is located within the central Kızılırmak section of the Central Anatolia in Turkey, between 38°41'55.48" north latitudes and 34°53'58.03" east longitudes, within the boundaries of Nevşehir, Aksaray, Niğde, Kayseri and Kırşehir provinces (Sivil Havacılık Genel Müdürlüğü [SHGM], 2019). The most important feature of the area is that it contains the traditional settlement texture and natural heritage areas formed by the climatic, geological, geomorphological character of Erciyes and Hasan Mountain tuffs. In the region with settlements date BC Based on 3000 years and different civilizations, there are many neighbourhoods of original traditional dwellings built by a masonry stone system and declared as an urban and archaeological site (Tanıtma Genel Müdürlüğü [TGM], 2019). In this region, which is protected by being declared as an urban and archaeological site, there are churches, monasteries, dwellings, educational buildings built with rock carving and masonry building system, as well as registered building types such as fountains. Therefore, it is one of the important responsibilities to ensure the national and international recognition of sustainable and natural tourism approaches by preserving the inherent and cultural values of the region as well as the transfer of their symbolic values to future generations. The rapid increase of nature-based tourism during the last decades (Balmford et al., 2009) coupled with the diversification of protected area objectives (Stolton & Dudley, 2010), implies that a broader range of values needs to be handled and weighted by protected area managers (Chape, Spalding, & Jenkins, 2008, Munoz, Hausner, Brown, Runge and Fauchald, 2019).

In this statement, Göreme Historical National Park in the Cappadocia Region was chosen as a study area. Göreme Historical National Park was added to the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage List in 1985 and it was declared a National Park by the Ministry of Culture and Tourism in 1986. Cappadocia Region where geomorphological processes resulting from "Fairy Chimneys" located, owned by natural and cultural beauty is one of Turkey's most important and most visited tourist spot (Milli Parklar Genel Müdürlüğü [MGM], 2019). However, in recent years, it has been aimed to determine the most suitable route in order to ensure the sustainable tourism planning in the region that exceeds the carrying capacity and the recognition of the natural and cultural areas of the region on national and international platforms. Within the scope of the research, in order to determine the travel route in the tourism activities to be carried out in Avanos, Çavuşin, Uçhisar, Ortahisar, Göreme, Ürgüp and Mustafapa settlements within the borders of Göreme Historical National Park, Least Cost Path (LCP) analysis was performed in ArcGIS 10.5, which is a GIS software, and the region's slope groups, land cover and settlement centers with high tourism potential were used as inventory.

The least-cost analysis is one of the most common approaches in archaeological research for modelling past movement across a landscape and, not surprisingly, it is also one of the most heavily critiqued (Seifried and Gardner, 2019). LCP analysis which can be used for natural and cultural purposes, as well as tourism walks, bird watching, horse riding and camping, can be used to determine the route and reach to the determined regions. LCP analysis is a tool that can be used for natural and cultural purposes such as tourism walks, bird watching, horse riding, camping, route determination in different tourism activities and reaching the determined regions. This brings the common value of the study to the fore.

2. MATERIAL AND METHOD

Göreme Historical National Park, which was the main material of the study and was declared as lar National Park Kurulu by the Council of Ministers with the National Parks Law in 1986, is located within the boundaries of the Nevşehir Province in the Volcanic Region where the Mount Hasan and Erciyes Mountain are located in the Central Anatolia Region (Figure 1).

Cappadocia Region; plateaus, plains, small mountain plants, high hills, alluvial filled creek and river valleys, drainage basins and steep slopes in the valleys are composed of high plains separated from each other. Erciyes and Hasan Mountain's large volcanic cones, some of the Kızılırmak valley in the north and some of the basalt-covered eroded tuff beds dominate the land. At the same time, there are culturally valuable settlements with agricultural and rural settlements such as Ürgüp and Mustafapaşa (TGM, 2019).

In the research conducted for Göreme Tarihi Milli Park; For the purpose of literature review and collecting of inventories, national and international written studies / literature data, visual data such as maps, photographs and geographical information systems were used. Within the scope of the research, spatial and written data were correlated with the use of ArcGIS 10.5 and Google Earth 2018 satellite image, and spatial maps were created and Least Cost Path Analysis was performed in order to realize CBS based route planning in nature tourism. During the integration of the data, the coordinates of Avanos, Cavusin, Goreme, Uchisar, Ortahisar, Urgup and Mustafapasa settlements were determined with the help of the satellite imagery of Google Earth 2018 and a database was created. In order to provide a base for the study, numerical elevation model (DEM) and relief (hillshade) map were created in CBS environment.
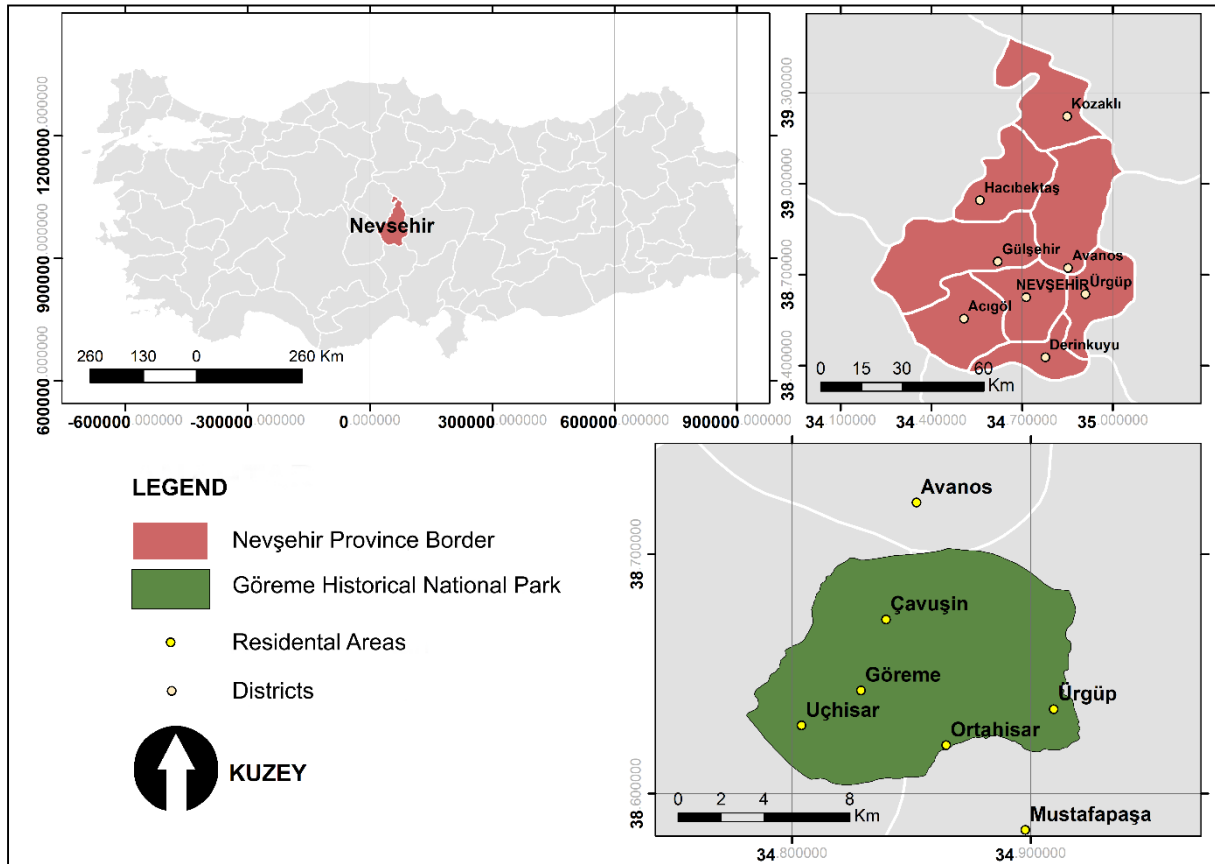

Figure 1. Göreme Historical National Park, Geographic Location (Original, 2020)

The aim of the study is to map the most cost-effective route (Least Cost Path: LCP) in terms of physical, social and cultural to use forests, water surfaces and settlements (Avanos, Çavuşin, Göreme, Uçhisar, Ortahisar, Ürgüp, Mustafapaşa) representing the socio-cultural structure and the places where the slope is the lowest (0-15%) in topography (Table 1)

Table 1. Layer and Benchmark Table for Weighted Overlay

Layer	Benchmark	Point
Slope (%)	% 0-15	1 (Suitable)
% 50	% > 15	2 (Non-suitable)
Land Cover % 50	Settlements	1 (Suitable)
	Water surface (Wooden / Suspension bridge will be provided)	1 (Suitable)
	Forest and other natural areas	1 (Suitable)
	Cultivated area	2 (Non-suitable)

3. RESEARCH FINDINGS

Least Cost Path (LCP) Analysis, which was carried out to determine the lowest cost route, was completed in 4 steps (Figure 2). The land cover (CORINE 2012), which covers the border and near

surroundings of the Göreme Historical National Park and the settlements of Avanos, Çavuşin, Göreme, Uçhisar, Ortahisar, Ürgüp and Mustafapaşa, are classified and land cover; It is divided into 4 categories: residential areas, agricultural areas, forest and other natural areas and water surfaces. The land cover data is reclassified, in the determination of the most suitable route, it was given 1 (high) point to use natural landscaping areas in addition to its geomorphological values, to use of settlements with rural character along the route to be followed by individuals, to pass through the water surfaces with the condition of building vine or wooden bridges due to natural landscape character and landscape value; it was given 2 (low) point to use cultivated areas (Figure 3). It is a must that the slope of the land should be suitable for nature walks. The slope groups of the study area were reclassified. The areas with a slope of 0-15% were 1 point (high) because they were suitable for walking. The areas with a slope of 15-25%, 25-35% or <51% were 2 points (low) because of the inconvenience of walking (Figure 3). Land cover and slope data were analyzed by the weighted overlay.
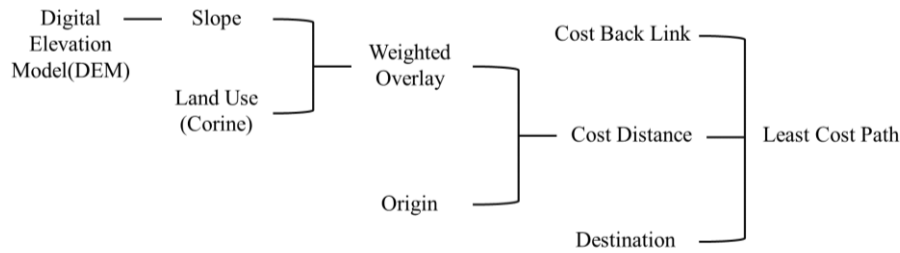

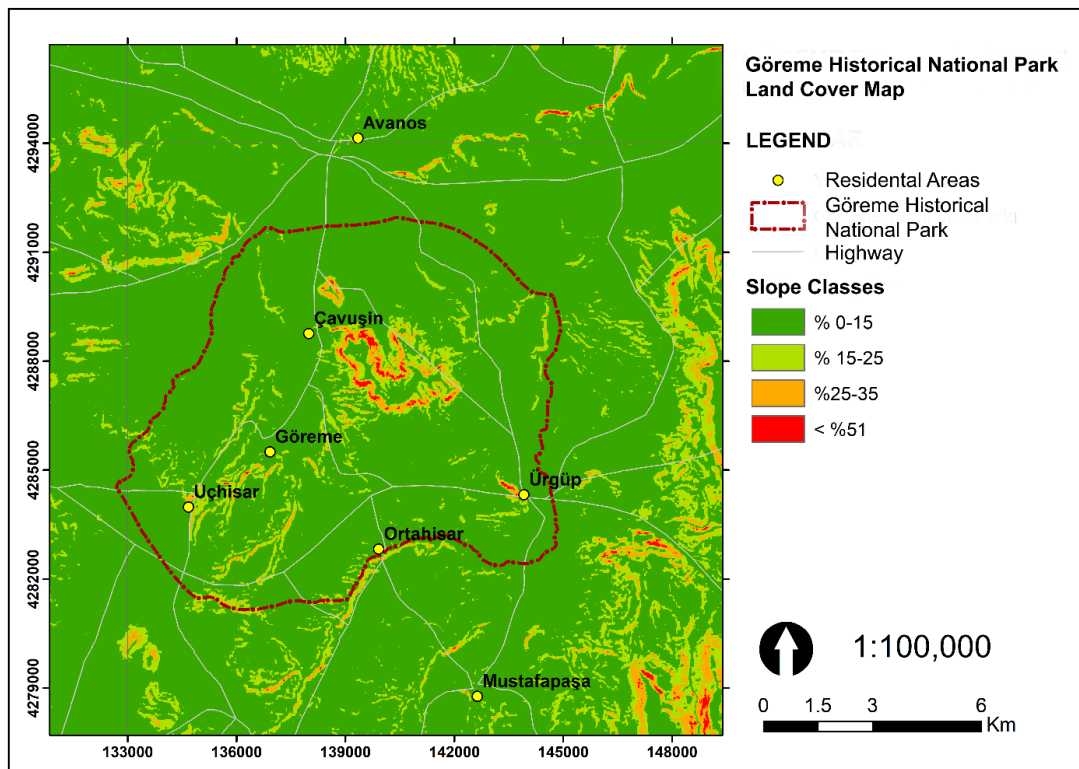**Figure 2.** Least Cost Path Analysis Flowchart (Yıldız & Zeğerek, 2018)

Figure 3. Slope Groups (Original, 2020)

As part of the LCP analysis, the departure point for walking in the study area, which includes the National Park of Göreme, Avanos was determined as the origin of the analysis, and Mustafapaşa settlement as the destination of the analysis. However, the pauses that individuals had to visit along the route were determined as Çavuşin, Göreme, Uçhisar, Ortahisar, Ürgüp and route planning was completed in 6 stages considering these stops. With the use of ArcGIS 10.5 from Geographical.

Information Systems software, the distance between the departure point and the destination and the stopping points are determined by the appropriate distance tool (Cost Distance), which measures using

the digital elevation model. In the expression of Selim and Sönmez (2017); use the node / connection model used in graph theory. In the node / link representation, each pixel is treated as a central node, and each node is connected to adjacent nodes with multiple connections (Yıldız & Zeğerek, 2018). In the scope of the research; the most appropriate land structure classifying the appropriate back link (Cost Back Link) has been applied for between the departure point and stops or stops and destination for walking route. In the expression of Selim and Sönmez (2017); The Cost Back Link defines the neighboring pixel that can go to the nearest resource in the most appropriate way (Yıldız & Zeğerek, 2018). Least Cost Path analysis was performed in the last stage of the analysis. This analysis calculates the lowest cost route from settlements to stoppages and from stops to Mustafapaşa (Figure 4, Figure 5, Figure 6, Figure 7, Figure 8 and Figure 9). The method used optimizes the cost in multiple iterations based on the inputs, identifying the lowest cost paths from a departure point to a destination point (Rees, 2004; Yıldız & Zeğerek, 2018).
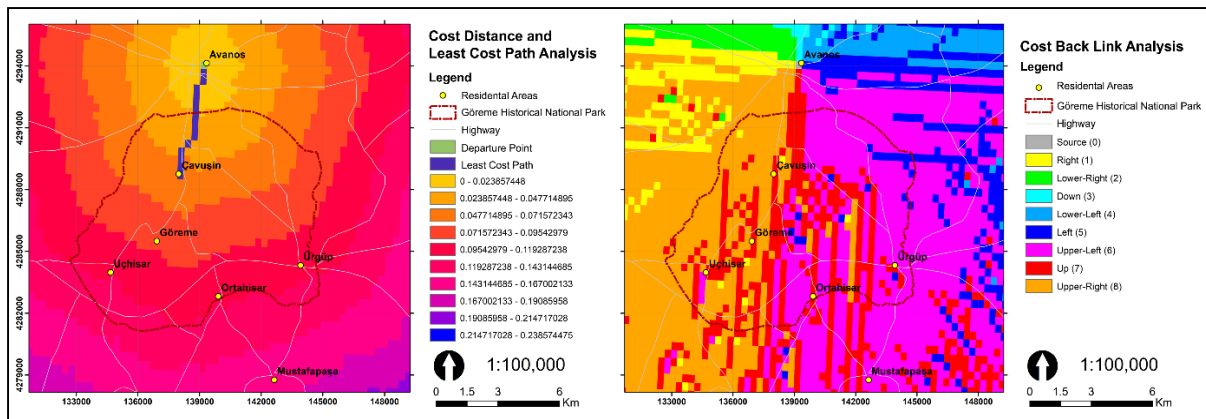

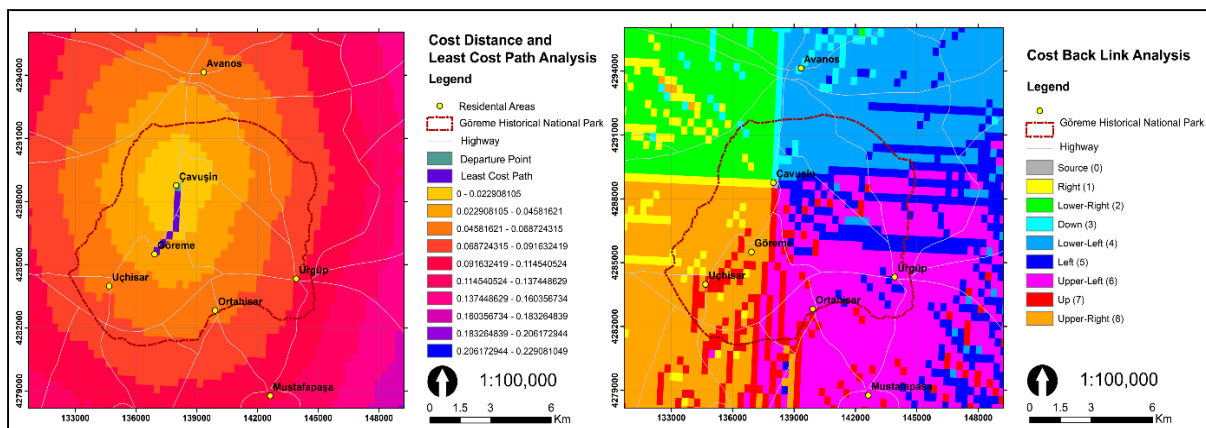**Figure 4.** Cost Distance, Least Cost Path and Cost Back Link Analysis – 1 (Orijinal, 2020)

Figure 5. Cost Distance, Least Cost Path and Cost Back Link Analysis – 2 (Orijinal, 2020)
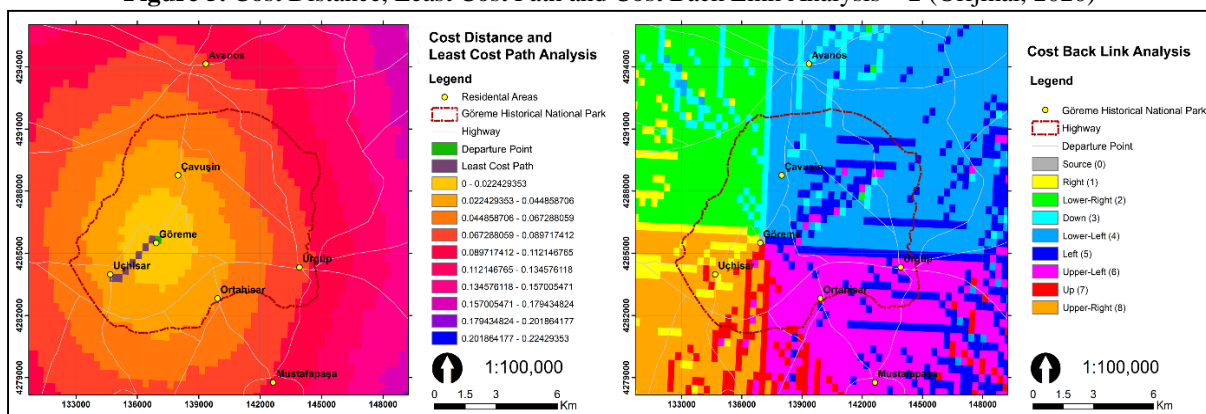

Figure 6. Cost Distance, Least Cost Path and Cost Back Link Analysis – 3 (Orijinal, 2020)
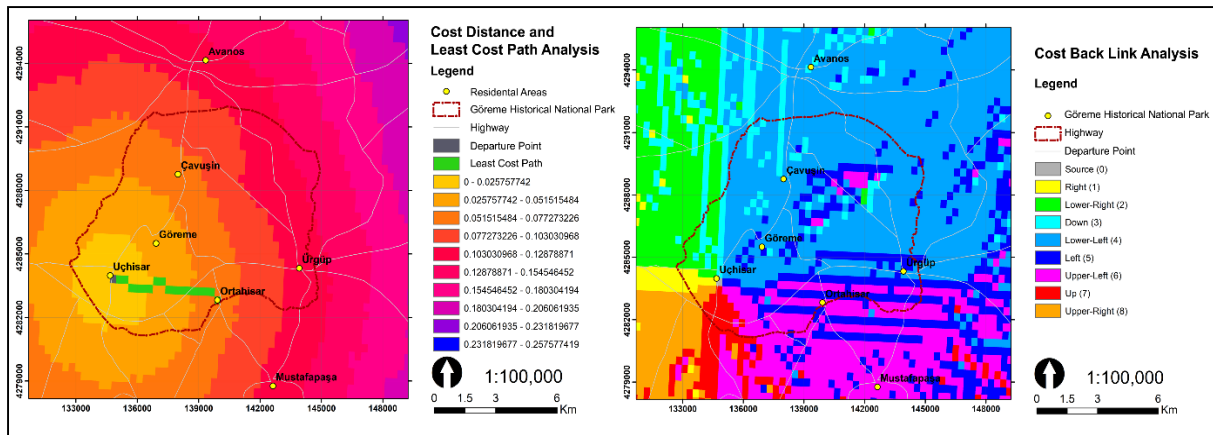
Figure 7. Cost Distance, Least Cost Path and Cost Back Link Analysis – 4 (Orijinal, 2020)
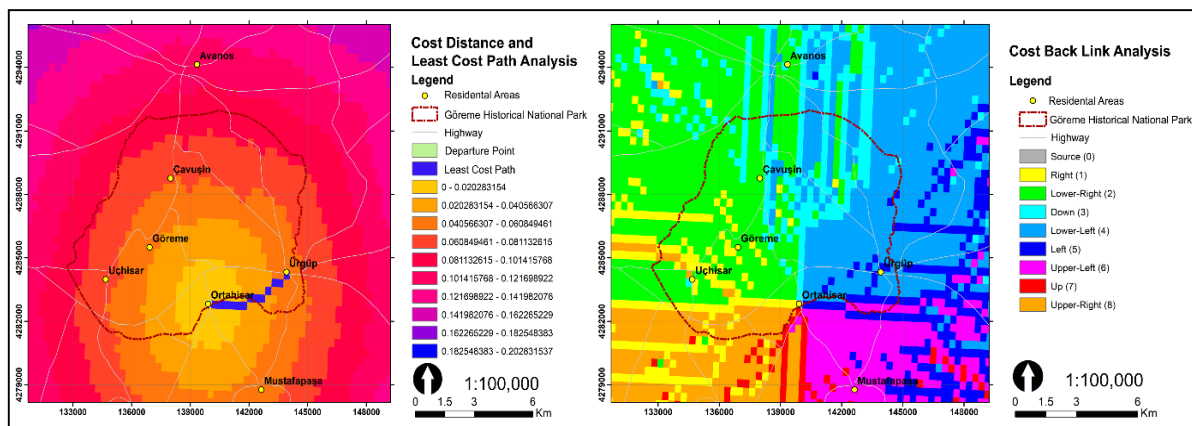

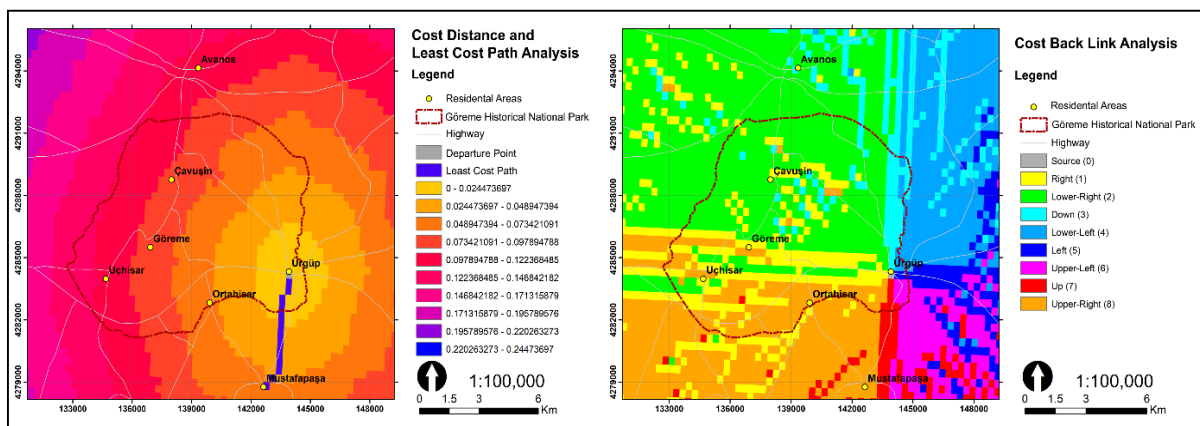**Figure 8.** Cost Distance, Least Cost Path and Cost Back Link Analysis – 5 (Orijinal, 2020)

Figure 9. Cost Distance, Least Cost Path and Cost Back Link Analysis – 6 (Orijinal, 2020)

After the analysis phase in the geographical information systems was completed, the routes were examined and compared with the walking routes preferred by the individuals visiting the area for the purpose of nature and cultural tourism; coordinate values taken from various points such as rest areas on the route and navigation effects on the map was controlled from Google Earth via satellite image and its suitability was evaluated.

4.   CONCLUSION AND SUGGESTIONS

The Least Cost Path analysis (LCP), which is the most cost-effective route in ArcGIS 10.5, which is a practical and widely used tool in current landscape architecture studies, helps design and planners find the least costly way to connect two locations within a cost surface (Bagli, Geneletti and Orsi, 2011;

Yıldız & Zeğerek, 2018). This analysis can be accomplished by the integration of multiple layers such as land cover and slope.

LCP, in the landscape planning and design studies, is an important and practical tool that can be used to determine routes for different purposes such as minimizing disaster risks and damaging and saving human life. It can be help people to find route during fire, earthquake, flood such as settlements, nature conservation areas and national parks and the transportation of fire brigades and the escape route of individuals. In the expression of Bagli, Geneletti and Orsi, (2011); The method based on the LCP has been applied in considering environmental and economical aspects with the integration of the GIS and the multi-criteria decision analysis approach. Though, the LCPA is a successfully implemented starting (Source) from a predefined and endpoint (Destination). Application of the LCPA is a cost effective GIS-based intelligent approach in route planning which leads to a sustainable, faster and cheaper planning method. It is compulsory for environmental and economical development in developing countries to use this LCPA in linear features route planning. From the departure point to the stop points within the boundaries of Göreme Historical National Park; from the stop points to the destination (Mustafapaşa), an ecological foundation-based tourism route has been identified by determining the most appropriate distance, route and return link in the appropriate land structure and slope (Figure 11). With the results of this study; previous studies (Bagli, Geneletti and Orsi, 2011; Michelle and Clayton, 2008; Selim & Sönmez 2017; Yıldız & Zeğerek, 2018) of the ecology-based route designation with LCP have shown that it is a fast and low-cost tool for determining alternative hiking routes for recreational activities in sloping / flat areas.
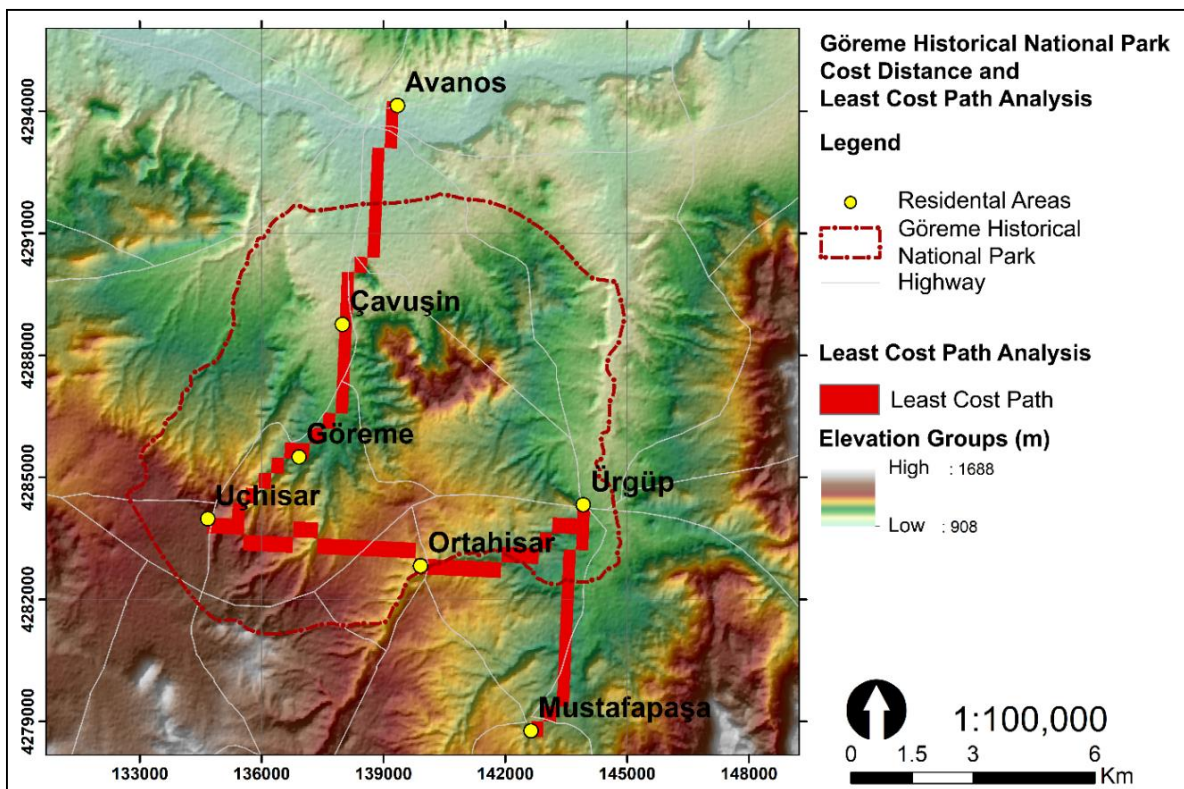

Figure 10. Analysis of the Least Cost Path in the Cappadocia Region (Original, 2020)

Further research could explore the associations between mapped place-based values and biophysical features in order to identify the places that are most valuable to park visitors and that have high ecological value, and thus contribute to policies that include ecosystem service valuation (Alessa, Kliskey and Brown, 2008). In addition to being a practical tool in terms of tourism activities, the method used in the research also contributes significantly to the country and regional economy. At the same time, the study is a valuable, and it can be used for sustainable landscape planning and design studies for determining the optimal distance and the least cost route for the shortest route to the risk point in order to minimize the risks of disaster and to minimize the risks in case of disaster. This study, which will contribute to the promotion of the tourism potential of Göreme Historic National Park, which

includes natural and cultural landscaping areas, is expected to contribute to the development of tourism economy in the region, in parallel to the Master Plan of Nature and Culture Tourism in Cappadocia Region.

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