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Accessing the Ecocity Potential of Bartın (Turkey)

Nurhan KOCAN[1*], Fatma Betül ALP[2]

[1] Bartın University Faculty of Engineering, Architecture and Design Department of Landscape Architecture 74100 Bartın/Türkiye
[2] Bartın University Faculty of Engineering, Architecture and Design Department of Landscape Architecture 74100 Bartın/Türkiye

[1]https://orcid.org/0000-0001-9433-7007,
[2]https://orcid.org/0000-0001-8325-1806
*Sorumlu yazar: e-mail: nkocan@bartin.edu.tr

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ABSTRACT

The environmental, economic, social and cultural values have affected the formation and development of cities throughout the history. The industrial revolution in the 19th century brought about a rapid transformation in the cities and it caused the change of the values that make up the city. The physical changes experienced by the cities caused rapid destruction of the environment and natural resources, thus they damaged the ecological structures of the cities. The reasons have led people to search for sustainable environment and nature. New urban forms have emerged to prevent harmful effects on the environment, to use resources sustainably, to protect the existence of nature in order to ensure the comfort of living spaces. Eco-cities, as a self-sufficient city model that encourages the rational and sustainable use of resources, are one of these urban forms. Ecocity concept considered this in mind. This study was carried out in Bartın City, which has urban, rural and coastal areas and important resources. In the study, the analyzes of the natural and cultural potential of the city were analyzed using geographic information system techniques. The potentials affect the ecocity possibility of the city. The data were stored in the ArcGIS 10.8 and thematic maps were created. Then, by overlapping the maps, the eligibility criteria were questioned. The potentials of Bartın city, which are suitable for being an ecocity, have been revealed. Within the scope of sustainability, the city's economic, social, cultural achievements and an ecocity model proposal has been presented.

Ekokent Potansiyeline Erişim-Bartın/Türkiye Örneği

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ÖZ

Tarih boyunca çevresel, ekonomik, sosyal ve kültürel değerler kentlerin oluşum ve gelişimini etkilemiştir. 19. yüzyılda yaşanan sanayi devrimi, kentlerde hızlı bir dönüşüm meydana getirmiş ve kenti oluşturan bu değerlerin de değişimine neden olmuştur. Kentlerin fiziksel anlamda yaşadığı değişimler çevrenin ve doğal kaynakların hızla tahrip olmasına neden olarak kentlerin ekolojik yapılarına zarar vermiştir. Bu sebepler insanları sürdürülebilir çevre ve doğa arayışlarına sürüklemiştir. Ekokentler bu negatif etkilerin daha kötüye gitmesini önlemek, kaynakları sürdürülebilir kullanmak, daha yaşanabilir çevre oluşturmak düşüncesiyle ortaya çıkmıştır. Ekokent kendi kendine yetebilen bir kent modelidir. Bu model kaynakların rasyonel ve sürdürülebilir kullanımını teşvik eder. Bu çalışma kentsel, kırsal ve kıyı, alanları ile önemli kaynaklara sahip Bartın Kenti'nde yapılmıştır. Bartın kentinin sahip olduğu ve ekokent olabilmeye uygun potansiyelleri

coğrafi bilgi sistemleri aracılığı ile analiz edilmiştir. ArcGIS 10.8 yazılımı verilerin depolanması, analiz ve tematik haritaların yapılması amacıyla kullanılmıştır. Haritaların üst üste çakıştırılması ve sorgulanmasıyla uygunluk haritaları oluşturulmuştur. Kentin ekokent ölçütlerinde vurgulanan parametrelere ne kadar uygunluk gösterdiği bu şekilde saptanmıştır. Çalışmanın sonucu Bartın kentinin ekokent olmak için yeterli potansiyelde olduğunu göstermiştir. Çalışma sonucunda sürdürülebilirlik kapsamında Bartın kentinin ekonomik, sosyal, kültürel kazanımları ile geleceğe yönelik ekokent model önerisi sunulmuştur.

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1. Introduction

Population growth, rapid advancement of technology, and the growing need for development with the industrial revolution have led to the emergence of many problems in urban areas and the problems to become more appreciable. In today's cities, where many problems are experienced, the solution is not to flee from the cities to the countryside or migrate to other areas. It is necessary to change the existing conditions, which is a new understanding, in order to protect the rest of nature and improve the quality of life. With this understanding, solutions are produced that integrate sustainability and ecology concepts and principles with the components in the city. One of these solutions is the creation of "environmentally friendly" cities that meet their own consumption needs with their own production within the urban ecosystem (Işıldar, 2012). As a result, new city forms have appeared to prevent our cities from getting worse and to ensure the comfort of living spaces. In these city forms, priority is to ensure the sustainable use of natural resources that exist today by prioritizing the needs of the future (Nami, 2014). Cities are the common living space of people and all habitat. By minimizing the conscious or unconscious pressures of people on the components of the city and by ensuring the balance between the ecosystem and the human, the city should be harmonized with the ecological conditions.

According to Samur (2010), natural areas have been damaged due to the misuse of users and this case has cause to a decrease in the species. As these problems continue, the rapid decrease in species diversity and the ecological, economic, spiritual and cultural damage we obtain from natural resources are inevitable. Therborn (2000) argued that migration from cities, which are the source of many environmental problems, to rural areas or other areas is not a solution, and that the current conditions of cities should be improved in order to protect the remaining part of nature. This is an idea that has integrated the concepts and principles of sustainability and ecology with the components in the city. Işıldar (2012) stated that balancing production and consumption in natural ecosystems and creating "environmentally friendly" cities that meet their own consumption needs through their own production has become a necessity. The search for a non-polluting, environmentally friendly, ecological urban model instead of a polluting and consuming city (Göksu, 2011).

We carried out this study in Bartın City to determine and improve the situation in which urban, rural and coastal areas are in integrity. Bartın City is one of the rare cities with its 59 km coastline in the

Black Sea, economic product power in rural areas, natural vegetation diversity and historical city structure. The aim of the study is to highlight the potentials of this city, which is close to the Filyos port and natural gas reserve, to adapt the ecological city principles to the city and to evaluate the suitability of the city as an ecocity. In the case of realization of the suggestions in the study, it is thought that the city can be a model for other cities by reducing the effects of people on the environment and shaping the city-human relations correctly. It is known that the concept of sustainability is an important instrument in determining the future and in studies to prevent environmental problems. The realization of the suggestions suitable for the area in the study is possible by reducing the effects of humans on the environment and shaping the city-human relations correctly. It is thought that the city could create a suitable model for other cities by planning in a sustainable and ecological way and realizing design proposals.

1.1. Ecocity

Throughout history, urban areas and the lost urban identity have led to many environmental problems as a result of misuse. The concept of ecocity has come to the fore especially as a result of changes such as global warming, unconscious consumption of water resources, environmental pollution, air pollution, and rapid consumption of natural resources. Thus sustainable use of natural areas and resources were understood to be important (He et al., 2017).

Ecocity covers minimizing the rapid consumption of resources, developing resources, ensuring waste recycling, improving urban agriculture, reducing energy consumption, ensuring clean energy production and saving water. Providing the maintenance of buildings and infrastructure, prolonging their life, supporting the production of housing suitable for nature by preventing illegal housing, and making use of the existing building stock in the most efficient way are other features (Samur, 2010).

While cities are centers of development and civilization, on the other hand, they are the focus of rent that puts pressure on the natural environment and ecosystems (Meydan Yıldız, 2016). Ecocity supports sustainability at different spatial scales; it is based on the balance between environmental factors, economic resources and urban dwellers. Therefore, the city model that encourages the rational and sustainable use of resources is called an ecocity.

The legal and administrative structure of environmental problems should be handled with a historical approach and human-environment unity and economy-ecology balance should be established by reconciling them with their cultural values (Meydan Yıldız, 2016). The efforts of cities to develop only economically will not leave us areas where we can live in the future. At the same time, it will leave tomorrows where our needs cannot be met in any way. It is necessary to think about the living spaces of future generations, to adopt fair protection and balanced use and to provide the benefit of nature by giving more than we consume to nature. It is observed that in ecocities are taken into account, initiatives that offer better conditions to urban people, aim to live away from excessive consumption, reduce the use of motor vehicles, and prioritize the development of environmentally

friendly transportation systems, more public spaces and green spaces (Nami, 2014). In some countries around the world, new cities are produced that are planned holistically to achieve these goals. The ecological urbanization projects are partially implemented through transformation studies in certain parts of the cities (Tosun, 2017).

In order for the city to become an ecocity, it must comply with some planning principles (Aytis and Polatkan, 2009; Göksu 2011; Çetin, 2015).

These principles are:

- Creating ecological awareness,
- Planning and designing the city with its natural features,
- Use of non-toxic, renewable and local materials in the buildings,
- Ensuring public participation,
- Prevention of environmental pollution,
- Protection of plant and animal communities and species,
- Increasing the efficient use of water resources, ensuring the recycling of waste water,
- Using renewable energy to reduce fossil energy use,
- Using environmentally friendly transportation systems, planning pedestrian and bicycle road networks,
- Spreading green areas in the city and improving them in terms of quality and quantity,
- Recycling of wastes,
- Ensuring the continuity of ecological life in the city.

The criteria developed for ecocities and the indicators used to measure these criteria are given in Table 1.

Table 1. Ecocity criteria (Ecocity Builders, 2011; Işıldar, 2012)

	Criteria	**Indicators**
Scope	Location	Urban infrastructure (accessibility to existing potential and basic needs)
		Affordability of the land demand (idle area, green area, urban area)
Urban texture	Building density	Area density
	Multiple usage	The ratio of residential area to non-residential area in the total area
		Access to basic amenities: school, playground, shopping center, recreational areas, etc.
	Public spaces	Its size and quality
	Landscape area (accessibility and surface quality)	Accessibility to green areas, number of people living near green areas
		Ecological quality of open green areas (trees, water, grass areas, etc.)
Transportation	Transport infrastructure	Reducing private car traffic
		Length of highways / working population ratio
		Bicycle paths / working population ratio
	Close to public transport	Access to public transport within a 300m radius or being at a distance of 150 m to stops
	Noise (noise from transport)	The amount of day and night noise exposure, the number of people exposed to noise that exceeds the limits
	Parking areas	Comparison of transportation with private cars and public transportation
Energy Flow	Energy requirement	Maximum energy requirement for heating, cooling and other purposes

	Energy efficiency	The amount of solar energy used, thermal insulation
	Greenhouse gas emissions	Share of renewable energy sources, their contribution to global warming (CO_2eq / non-renewable energy generation / MWh)
Material Cycle	Construction materials	Minimum use of materials, use of renewable, recyclable and local materials
	Earth movement	-
	Water management	Measures to minimize water usage
Socio Economic Values	Social infrastructure	Social infrastructure index - social diversity and integration
	Economic infrastructure	Economic infrastructure index
	Labor	Job and unemployment rates
	Profitability	Benefit-cost analysis
Processes	Holistic Planning	Multidisciplinary planning team and examination of different scenarios
	Public participation	Indices measuring public participation in the processes and the quality of participation

Urban green spaces are very important in the way of becoming an ecocity, as they directly or indirectly meet the above-mentioned functions.

These functions are;

• Saving energy; green areas provide cooling in buildings in summer. In winter, they create a buffer zone and save energy by protecting the buildings against cold weather.

• Improving air quality; trees have the ability to filter by absorbing impurities in the air or by keeping them on the leaf surfaces. Trees absorb CO_2 from the atmosphere by performing photosynthesis and store it in their structures.

• Climate regulation; green areas keep the temperatures in the city under control, reducing the heat in the summer and keeping the air warm by keeping the cold in the winter. Thus, plants balance the climate of their environment. Trees not only reduce the warming of nature by spreading the water they take from the soil into the air, but also prevent the light from contacting the surface by refracting the light through their leaves, while cooling the area. These functions are particularly important in terms of global warming.

• Effect on relative air humidity; plants prevent soil erosion by reducing the speed of the wind. At the same time, plants secrete moisture into the environment, keeping the soil warm and moist.

• Capturing carbon in the atmosphere and reducing the greenhouse effect; plants reduce the greenhouse gas effect by trapping CO_2, N_20, CH_4, water vapor, and other gases.

• Improvement of soil quality-biodegradation; the mixing and disintegration of organic materials such as branches, leaves, fruits and flowers feeds the soil creatures, enriches the soil in terms of nutrients and increases microorganism activities. In soils with vegetation, plant roots help aeration of the soil and infiltration of water into the soil (Hepcan, 2019).

• Flood and flood prevention; vegetation, especially trees, reduces the speed of precipitation water, allows water to pass to the soil and reduces the amount of water passing into the surface flow. Thus, they prevent the damage that may arise from flood and overflow situations.

• Ecological restoration and biodiversity conservation; water resources, soil and similar natural elements in green areas can preserve their natural structures without being affected or slightly affected by the pollution of the city. These areas protect biological diversity by creating important habitat areas for the protection and development of birds, insects and other wildlife in cities (Önder and Polat, 2012).

• Noise reduction; green spaces have the potential to reduce the bad effects of urbanization, make cities more usable for living, reverse inappropriate urbanization and reduce transportation demand. While cleaning the air, it helps to create suitable microclimatic conditions by reducing noise pollution (Ceylan, 2007).

• Facilitating educational and cultural activities; urban open green spaces have recreational functions that provide entertainment and recreation to the people of the city, regardless of their age, gender, social class, and the opportunity to participate in various sports and cultural activities. These functions of urban open green spaces are important for the citizens to use their free time (Ceylan, 2007).

2. Materials and Methods

2.1. Material

Bartın city with 19 neighborhoods connected to the city center was evaluated in the study. The photographs of the city of Hamburg taken from the city (2019), which was examined as an example of an ecocity.

The Black Sea surrounds the north of Bartın, which is located in the Western part of the Black Sea Region, with a 59-kilometer coastline. Kastamonu is located in the east of the province, Karabük in the southeast, and Zonguldak in the west (Figure 1). Its area is 2099 km² and its altitude is 25 m. Four districts in the province, namely Merkez, Amasra, Ulus and Kurucaşile; and there are 4 towns: Hasankadı, Kozcağız, Kumluca and Abdipaşa. There are 138 villages in the central district and 265 villages in the province (Görmüş et al., 2016).

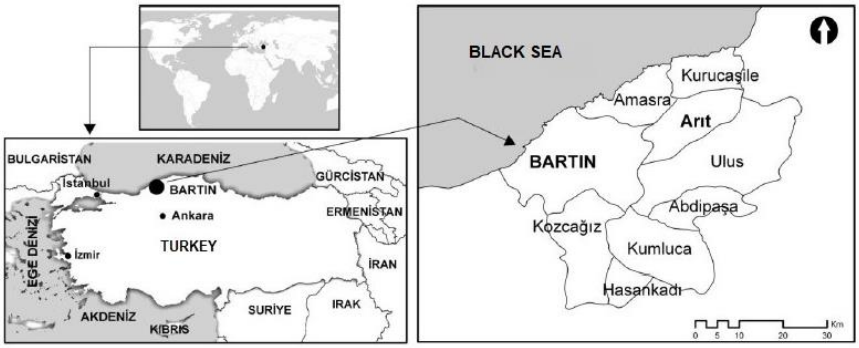

Figure 1. Location of Bartın province

2.2. Methods

The reports of the relevant institutions were used. Neighborhood boundaries of the study area were created in ArcGIS 10.8 software using TURKSTAT and Openstreetmap (2020). Using Openstreetmap

and Google Earth Pro (2020) satellite bases, the types of land use in the city were digitized for land classification. High resolution 12.5 × 12.5m digital elevation models of the study area were downloaded from Earth Data (2020) and made available in ArcGIS 10.8 software. The slope map was produced from these data. LANDSAT 8 satellite images from Earth Explorer (2020) were used and controlled classification was made in ArcGIS 10.8 software. As a result of the classification, the distribution of these areas is shown on the map. 1 / 100.000 landslide inventory of MTA was used in the preparation of the landslide map (Earth Sciences, 2020). The cartography application HGM Atlas Kure (2020) of General Directorate of Maps was used to determine the presence of water. Soil and land use capability maps were created by using the data of the Ministry of Agriculture and Forestry (2020). Photoshop CS6 program was used to organize the necessary data on the computer schematically. Maps were created by determining the facilities available in the city of Bartın. Evaluations were made regarding the potential of Bartın to become an ecocity; and recommendations were made in line with these goals.

3. Result

The findings of the study regarding the slope, soil, land feasibility classes, erosion risk, and water availability for the study area are given in this section. Later, the ecocity criteria of Bartın city was determined.

The dominant slope group in the study area is 0-5%. Flat and slightly inclined areas make up 75%. 5-10% slope values are suitable for settlement map (Figure 2). They contribute to the economic infrastructure due to their intended use such as agricultural development, transportation routes, etc. In Orduyeri, Ağdacı, Gölbucağı, Karaçay neighborhoods, which are within the study boundaries, there are slopes and multi-slope areas in places. Misuse of land in these areas can cause disasters (Table 2).

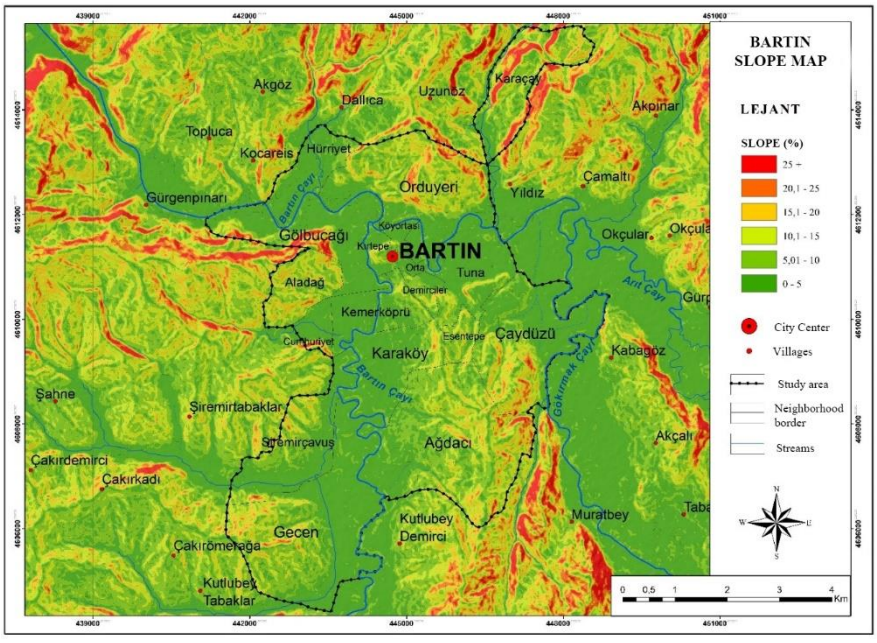

Figure 2. Map of the slope groups of the city center and its surroundings

Table 2. Area and percentage distributions of slope groups

Slope groups (°)		Area (ha)	Percent (%)
0-5	Flat	2027.75	50.01
5-10	Slightly sloping	1025.06	25.28
10-15	Less inclined	624.07	15.39
15-20	Inclined	255.91	6.31
20-25	Very inclined	76.23	1.88
25+	Slope	45.34	1.12
Total		4054.35	100.00

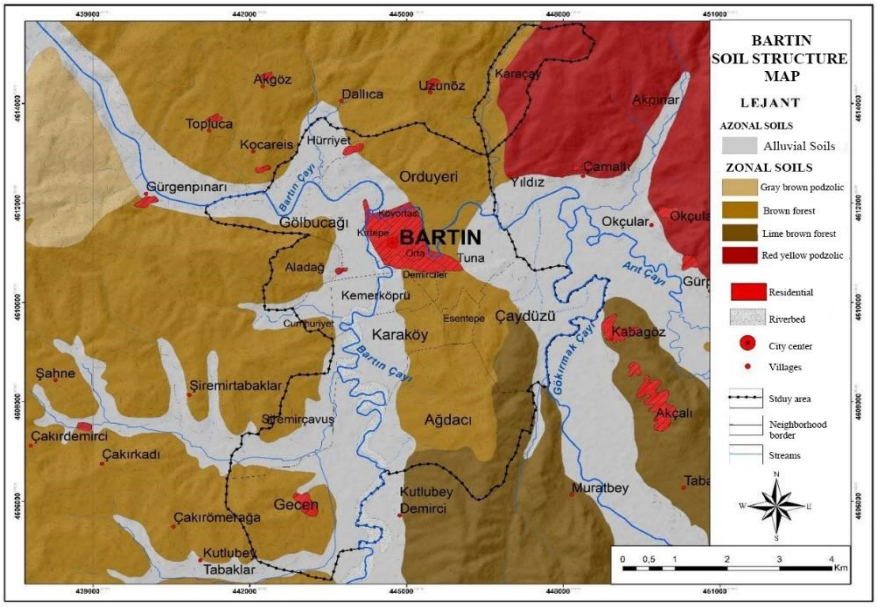

Figure 3. Soil structure of the city center and its surroundings

Due to the frequent rains in the province, it makes positive changes in the vegetation and soil structure of Bartın. The soil structure of the city center and its surroundings is given on the map (Figure 3). Soil groups in the study area and the area they cover are given in Table 3.

Table 3. Soil groups area and percentage rates

Soil groups	Area (ha)	Percent (%)
Alluvial	1613.96	39.81
Riverbed	143.59	3.54
Brown Forest	1692.22	41.74
Calc Free Brown	281.58	6.95
Red Yellow Podzolic	157.68	3.89
Settlement	165.31	4.08
Total	4054.35	100.00

81.55% of the study area, which is 4054,35 ha in total, is brown forest soils and alluvial soil. Since brown forest soils are rich soils, it should be evaluated. The prevalence of Bartın creek in the whole city and the fact that it passes through every region of the city contributed to the formation of alluvial soil in the city. Land capability classes have an impact on the topographic structure and land use potential of the city. Study area soil capability classes are given in Figure 4. In the province, the land

capability classification is mostly I. class and IV. Class. Settlements located on the II and III class soil structure in the province (Table 4).

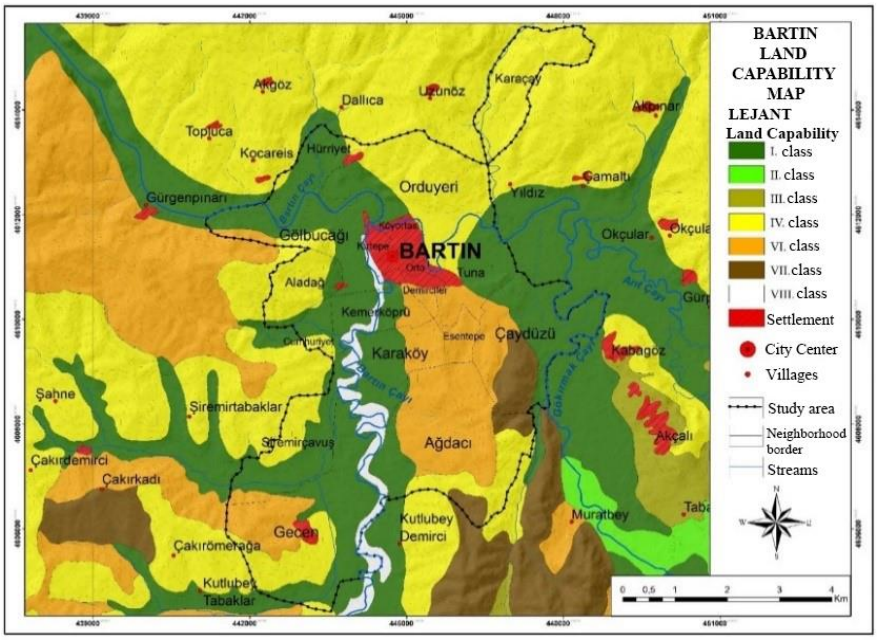

Figure 4. City center and surrounding land capability map

Study area soil capability classes are shown in Table 4. As the slope of the river basin in study are increases, the risk of landslides increases. The risk increases with floods and floods, especially in the period when rainfall is high. Areas with landslide risk are given in Figure 5. The area covered by the landslide risk is 236.38 (ha) in total.

There are three main streams in Bartın. These are Bartın, Arıt and Kozcağız. Bartın city center is 15 km from the sea. It is built on the plain formed by Bartın River and its branches. Bartın Stream constitutes the irrigation water source of the basin (Tuncer, 2010). Among the formations that make up the soil structure in the Bartın basin, there are fine-textured limestones and blue marls and groundwater in the valley alluviums. These comply with drinking and potable water standards. It is observed that the groundwater level is close to the surface in the wells drilled in alluvium. It has good quality drinking water (Aytekin, 2008). Streams and seasonal river surfaces in Bartın province are given in Figure 6.

Table 4. Soil capability classes, their area and percentage rates

Soil capability classes	Area (ha)	Percent (%)
I. Class	1613.96	39.81
IV. Class	1147.05	28.29
VI. Class	826.46	20.38
VII. Class	157.98	3.90
VIII. Class	143.59	3.54
Settlement	165.31	4.08
Total	4054.35	100.00

Until the 1980s transportation was possible from the Black Sea to the city center (Yalı Pier) with ships of 500 tons in Bartın Stream. As a result of natural processes (1998 big flood) and human intervention, changes occurred in the streambed. For this reason, today only small tonnage boats can be accessed (Ankaralı, 2019). Bartın River and the flat areas near it constitute the agricultural areas of the city. It is located in the inner city and close to the river *Salix alba, Populus nigra, Robinia pseudoacacia, Platanus orientalis, Ailanthus altissima, Fraxinus angustifolia subsp. oxycarpa, Alnus glutinosa, Juglans regia, Ficus carica, Cornus sanguinea, Rubus sanctus. Salix alba* and *Populus nigra* are the dominant species (Yılmaz, 2001; Ankaralı, 2019).

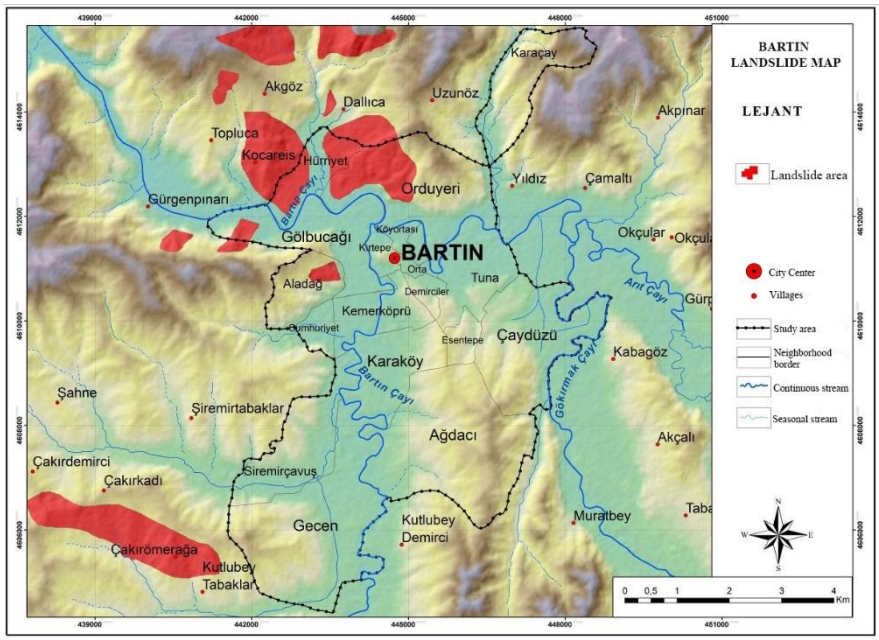

Figure 5. City center and surrounding landslide risk map

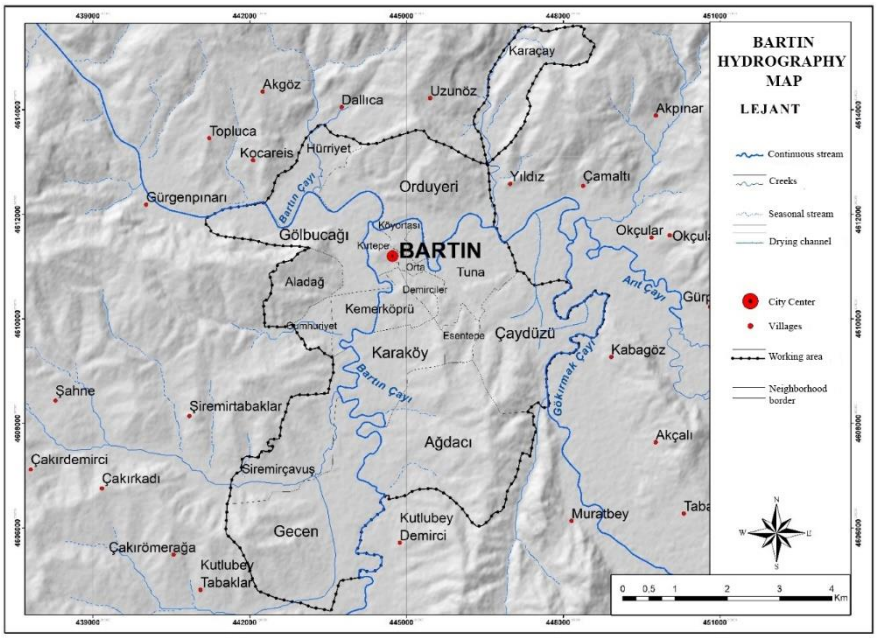

Figure 6. Hydrographic map of the city center and its surroundings

170 mammal species found in Türkiye (Classis: Mammalia) of 56 mammal species belonging to 20 families (32%) are located in Bartın. In addition, 483 species found in Turkiye (Classis: Aves) of 200 bird species belonging to 42 families (41%) are located in Bartın (Görmüş et al., 2016).

Bartın has a mild maritime climate (Black Sea Climate), with hot summers and cool winters. The annual average temperature is 12.8°C and the annual average rainfall is 1046.2 mm (General Directorate of Meteorology, 2020).

There are 19 neighborhoods in the study area (Figure 7). The total area of Bartın city is 209.900 hectares.

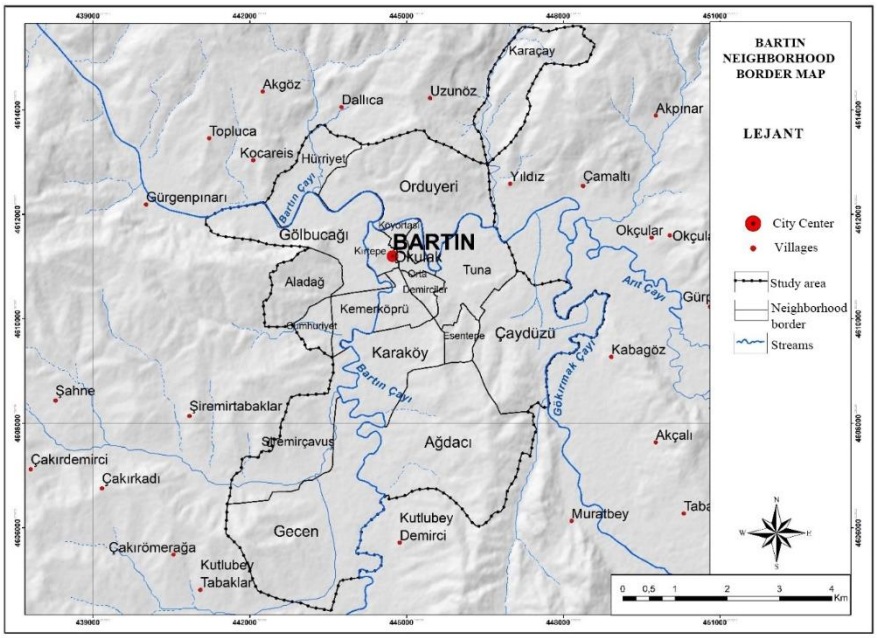

Figure 7. Study area neighborhood boundaries map

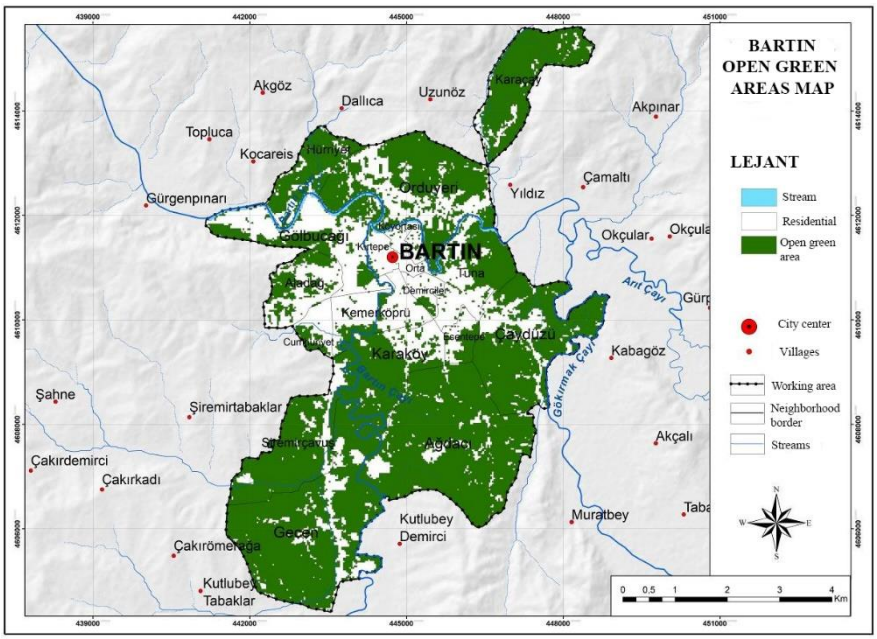

Figure 8. Study area green space-urban relationship map

The total area of the study area is 4094 hectares. Bartın city, corresponds to approximately 1/51 of the provincial borders. Among the central districts of Bartın, Gecen, Ağdacı, and Orduyeri neighborhoods have the largest area. Okulak, Orta, Kırtepe, and Demirciler neighborhoods are the smallest. It is observed that the users concentrate around Bartın Stream, where recreation areas are located. Neighborhood boundaries are shown in Figure 7 and residential area-green area relationship is shown in Figure 8.

The population of Bartın province is 198.249 according to 2019 data. 49% of the population is male and 51% is female. Bartın population density is 95/km^2 (Figure 9). Bartın central district population is 155.765 according to 2019. The total population of the study area is 74.609 according to 2019 data.

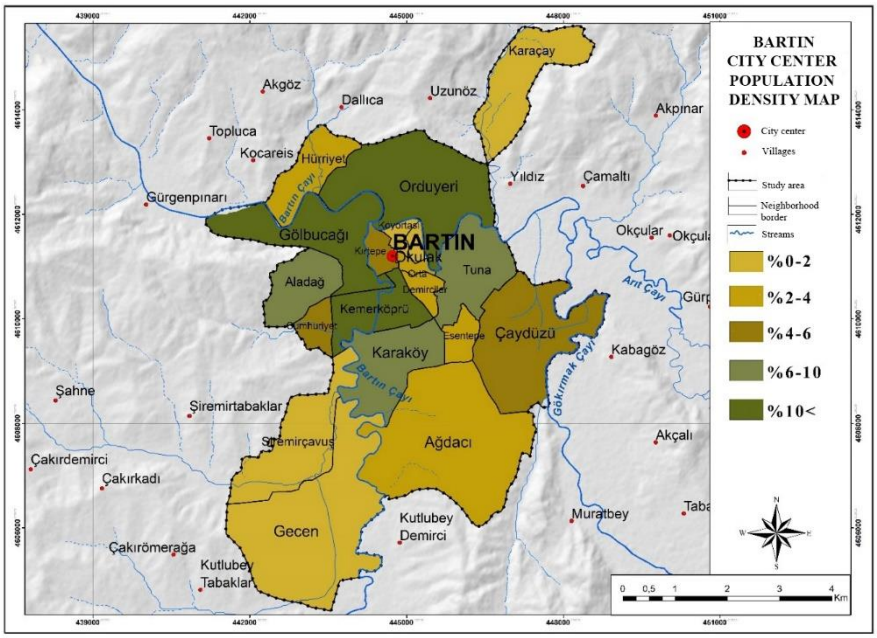

Figure 9. City center population density

When the distribution of the population by neighborhoods is examined, it is seen that there are 11.712 people in Kemerköprü District, 7.991 people in Orduyeri District, 7.616 people in Gölbucağı District and 5.951 people in Tuna District. 44.58% of the urban population lives in these 4 neighborhoods (Türkiye Population, 2020). The population density is shown in Figure 9 and the housing density is shown in Figure 10. Considering the green area density of the study area, it was observed that the ratio was sufficient in the total area (Table 5).

Table 5. Study area green space amount and percentage

Green area	**Area (Ha)**	**Percent (%)**
Stream	49.92	1.23
Residential	1211.13	29.90
Green area	2789.94	68.87
Total	4050.99	100.00

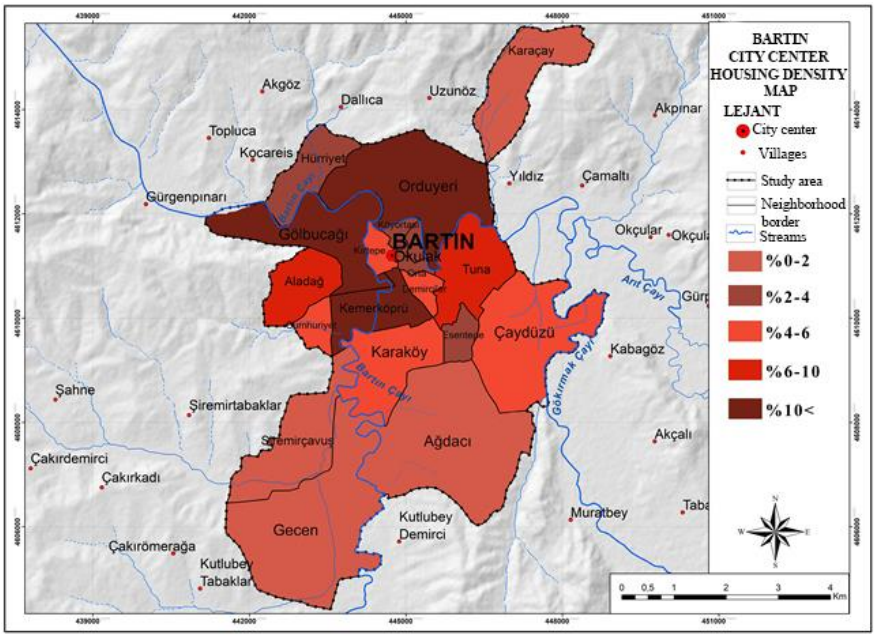

Figure 10. Urban center housing density

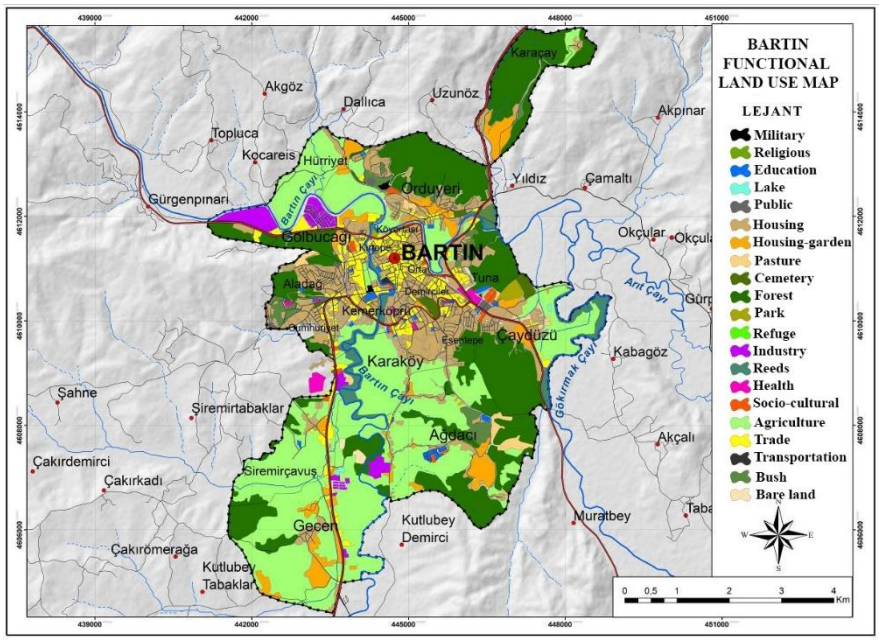

Figure 11. City center functional land use map

Historical residences and buildings that require restoration in Bartın city are abundant in the first residential areas of the city. In the developing neighborhoods, the buildings are constructed in reinforced concrete and in separate order. The study area land use map is given in Figure 11 and its rates are given in Table 6.

Table 6. Study area functional land use areas and densities

Functional Land Use	Area (Ha)	Percent (%)
Military	3.58	0.11
Public	15.41	0.48
Bush	71.60	2.25

Bare Land	6.64	0.21
Religious	2.34	0.07
Education	24.09	0.76
Lake	2.82	0.09
Housing	505.28	15.88
Housing - Garden	193.29	6.07
Pasture	41.12	1.29
Cemetery	23.58	0.74
Forest	448.44	14.09
Park	17.44	0.55
Refuge	1.77	0.06
Health	20.07	0.63
Industry	73.89	2.32
Reeds	112.31	3.53
Socio-cultural	18.05	0.57
Agriculture	139.41	43.82
Trade	203.90	6.41
Transportation	2.08	0.07
Total	3182.10	100.00

According to the survey conducted by Karayılmazlar (2017), 35% of the citizens prefer public transportation and 31% prefer public transportation as a private vehicle. Public spaces and parks are shown in Figure 12.

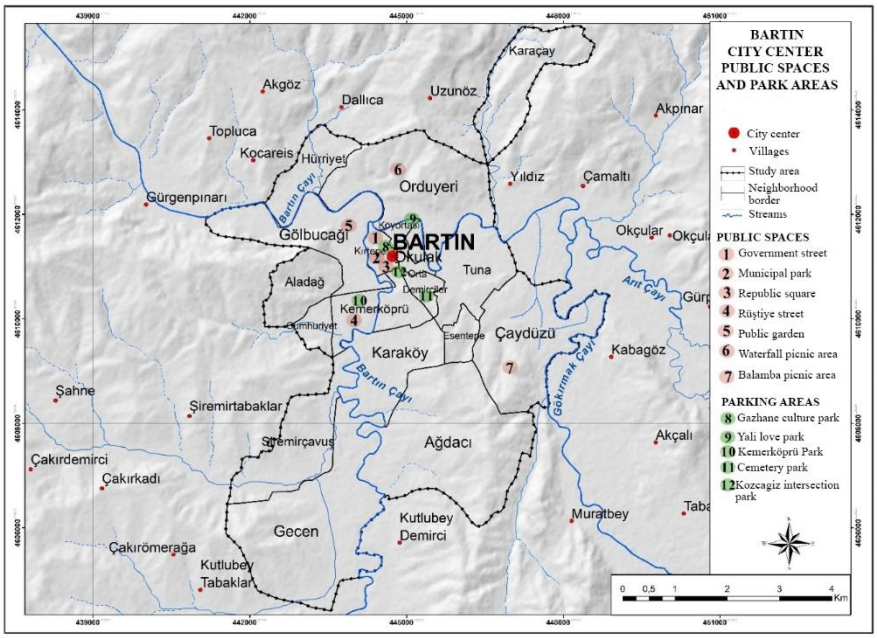

Figure 12. Public spaces and parks that are heavily used in the city center

Children's parks and neighborhood parks were determined within the scope of green spaces in Bartın city. Considering that the users can reach these areas within walking distance without the need for a private vehicle, a 300 m distance transportation analysis was made (Figure 13).

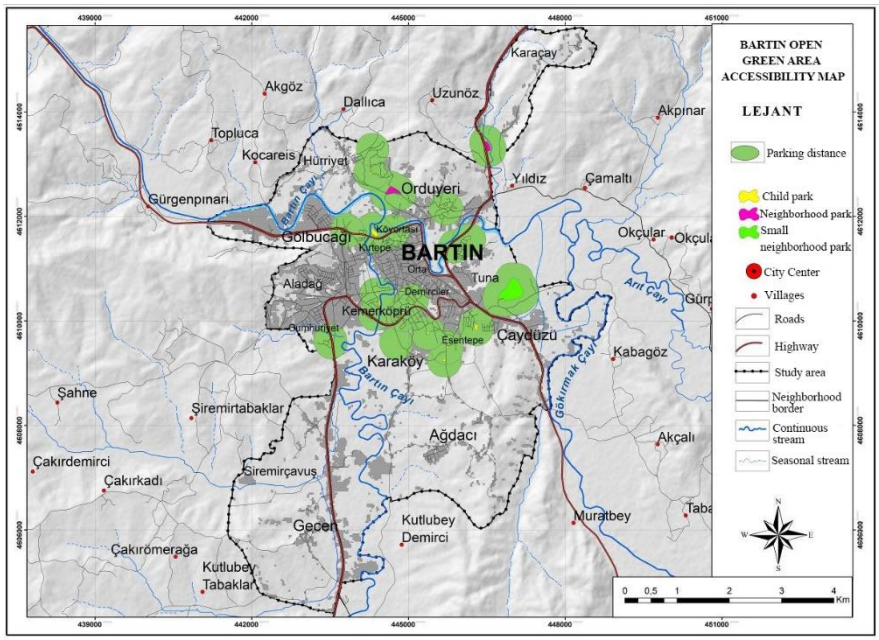

Figure 13. Transport map, 300 m to the green areas

Urban transportation in Bartın is provided by the municipality's public buses. There is no holistic planning for transportation in areas outside the city center. There are transportation problems for developing areas. There is no airport or railway in Bartın city. Apart from these, transportation is provided on foot (Figure 14, 15).

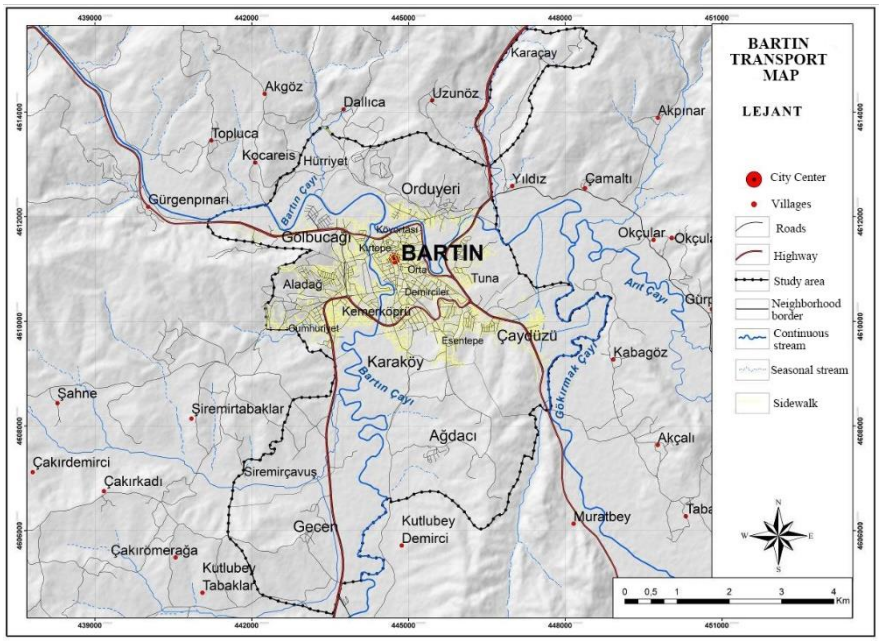

Figure 14. City center vehicle-pedestrian transport map

There are no planned bicycle paths in the city center and throughout the city. However, there is a bicycle path planning. Talay et al. (2010) in the study to determine the recreational tendencies of the Bartın city stated that the majority of the participants went to the recreational areas in the city on foot

(75.1%) to the recreational areas outside the city by private auto (65.1%) or public transportation (33.8%).

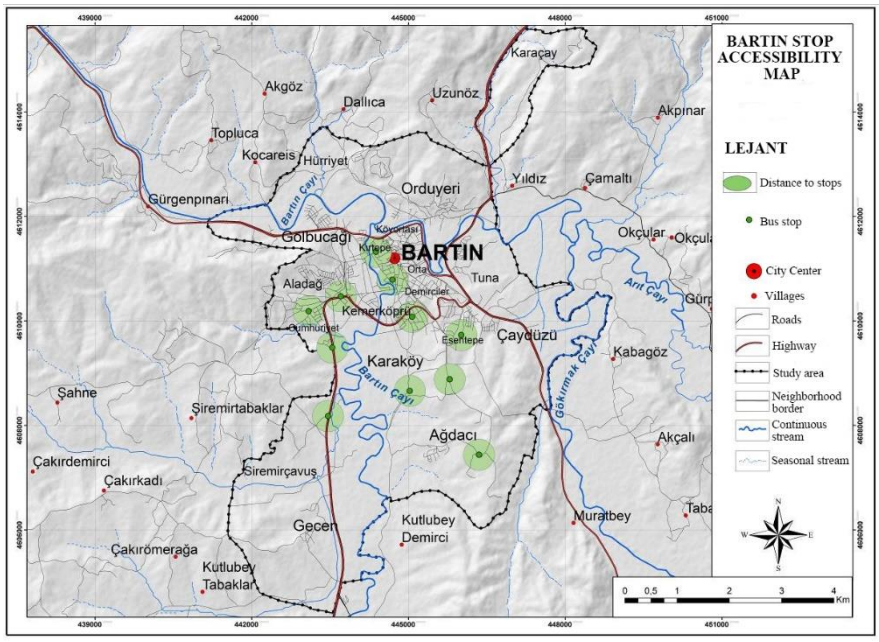

Figure 15. Transportation map to the stops as 300 m in the city center

Delikanlı et al. (2015) in their study stated that the main source of noise in Bartın city is traffic which is because the streets are narrow and the buildings are adjacent, and the noise is echoing. Equivalent noise levels were found between 52.8-77.5 dB (A) as a result of the measurements made at designated points within the settlement. The highest value was determined as 70.3 dB (A). The noise levels of all points measured in the city center exceed the limit values in the morning and evening.

When the natural gas data used throughout the province are examined; while the usage rate was 1% in 2013, this rate reached 28% in 2016. While the solid fuel usage rate was 99% in 2011, this rate decreased to 72% in 2016 (Anonim, 2018).

Bartın solar power plant has the potential to meet the daily electrical energy needs of 84 people with an average of 276.500 kWh electricity generation (Energy Atlas, 2020). According to Gümüşcü (2010), 103 m^3 of biogas production per day and 37.080 m^3 per year is provided from 100 cattle. If this gas is converted to electrical energy, 174.276 kWh of electrical energy is generated annually. Electricity unit amount is 0.06 euro (2021 year). If these figures are adapted to the study area; it has been determined that there are approximately 40.000 cattle in Bartın city center, and 41.200 m^3 of biogas per day and 14.832,000 m^3 of biogas per year will be produced. The annual cost of 69.710,400 kWh of electrical energy is 4.344.500 euro. According to 2018 data, it was determined that there are 34.818 houses in Bartın city center. Assuming that a 100 m^2 house needs approximately 15.000 kWh of energy per year. The annual electricity requirement of the residences in Bartın city center is 522.270,000 kWh per year. It has been concluded that 7.4% of the annual energy need can be met from biogas. Carrying out the necessary studies in this issue will provide benefits both for city users and economically, socially and environmentally.

Bartın is inadequate in terms of water pollution and water management in the city center. Domestic wastewater and solid wastes in the city are directly or indirectly dumped into river beds and these wastes reach the sea. A wastewater treatment facility was established in the city in 2017 and waste water was prevented from flowing into the Bartın river. The project will be implemented in 2021 for the ecological restoration of the Bartın River.

A significant portion of the population in Bartın city center works in the agriculture and mining sector. The fact that the industry and service sectors are not developed enough in the province causes the wage earners and employer ratios to be low (Aytekin, 2008). Approximately 9000 people are employed in the industrial sector. Unemployment rate is 6% (Tulu, 2017). Tourism is another factor that will contribute to the economic infrastructure of Bartın city.

According to Bartın strategic plan external stakeholder analysis results, traffic is at the top of the city's problems. External stakeholder analyzes conducted in previous years showed that water quality and air pollution was the leading problems. Successful results have been obtained from the studies carried out for these in the city. Solid fuel consumption, which is the biggest factor of air pollution, has been reduced and natural gas usage has been increased with the works carried out by the municipality. In addition, investments were made for cultural and sports activities (Anonim, 2019).

The studies have been carried out to raise awareness of the public by organizing panels and seminars on heat insulation, energy saving and similar issues in buildings. With the "Renewable Energy and Energy Efficiency Technical Support Project" carried out within the scope of Bartın University, cooperation between municipalities and universities has been established. Studies on recycling have been initiated and its continuity is ensured (Haber Türk, 2020).

4. Conclusion

Since natural and cultural factors are different in cities, each city should be evaluated and planned in its own conditions. The evaluation of Bartın city within the scope of the ecocity criteria is shown in Table 7.

Table 7. Evaluation of Bartın city in terms of ecocity criteria

	CRITERIA	INDICATORS	BARTIN
Scope	Location	Urban infrastructure	+
		Affordability of the land demand	+
Urban	Building density	Area density	+
Texture	Multiple use	Residential area/non-residential area ratio in the area	+
		Access to basic facilities	-
	Public spaces	Its size and quality	-
	Landscape area	Accessibility to green areas	+
	(accessibility and surface quality)	Ecological quality of open green spaces	-
Transport	Transport infrastructure	Reducing private car traffic	×
		Length of highways	
		Working population	×
		Bicycle paths	-
	Proximity to public transport	Access to public transport within a 300m diameter	-

	Noise	The amount of noise exposed during the day and night	-
	Parks	Comparison of transportation with private cars and public transportation	-
	Energy requirement	Maximum energy requirement	
Energy Flow	Energy efficiency	The amount of solar energy used	-
		Thermal insulation	×
	Greenhouse gas emissions	Share of renewable energy sources	+
	Construction materials	Minimum use of materials and use of renewable, recyclable and local materials	×
Material Cycle	Earth movement		
	Water management	Measures to minimize water use	
		Management of wastewater	+
	Social infrastructure	Social infrastructure index	
Socio Economic Values	Economic infrastructure	Economic infrastructure index	
	Labor	Job and unemployment rates	+
	Profitability	Benefit cost analysis	+
	Holistic Planning	Multidisciplinary planning team	+
		Examination of different scenarios	×
	Public participation	Indices measuring public participation in the processes and the quality of participation	+

In Table 7, evaluations have been made for the city of Bartın in line with the ecocity criteria and it is stated whether the city meets the ecocity criteria. The areas marked as (+) in the table indicate the result that "positive results have been obtained and studies on this issue are continuing". The areas marked as (-) in the table indicate the result that "there are suggestions although there is no study done". The fields marked as (×) in the table indicate the result that "no study was found and no progress was made in this direction". The maps produced within the scope of the study were overlapped with each other. The Bartın city suitable for being an ecocity are determined and shown in Figure 16.

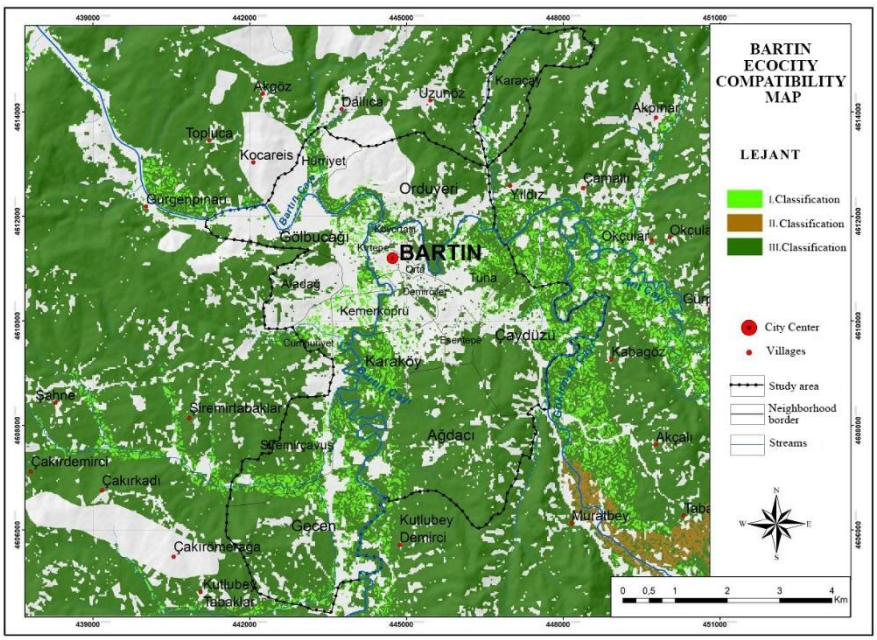

Figure 16. Compliance map of Bartın city for ecocity

Class I is the most suitable for being an ecocity, II. classification 2nd degree suitable area III. classification was determined as the 3rd degree suitable area (Table 8).

Table 8. Titles evaluated for Bartın province ecocity compliance map

Topics evaluated	I. Classification	II. Classification	III. Classification
Slope	%0-5	%5-10	-
Land capability	I. Class	II. Class	-
Landslide free areas	+	+	+
Green areas	+	+	+
300 m to green areas in transport	+	+	+
300 m to stops in transport	+	+	+

There are 8 main headings on the evaluation of the ecocity criteria. The study area was evaluated based on these headings and recommendations were made.

4.1. Suggestions for the urban texture

- The settlement established in different neighborhoods in the city accelerates the division and fragmentation of natural areas, therefore, the continuity of the spaces should be ensured as well as the connection of the spaces with each other in the city of Bartın.
- Ensuring the continuity of the spaces as well as the connection of the spaces in the city.
- Increasing the open green spaces in the neighborhoods within the boundaries of the study area, thus preventing urban sprawl and non-sustainable areas.
- The green belt effect will be an application that directs growth and provides many benefits to the city as well as its ecological effect.
- Determining the dense areas in the city center, preventing the accumulation of concentration at a single point and ensuring its homogeneous distribution.
- Ensuring the use of renewable energy uses not only for residences but also in common urban areas. The use of rivers, which surround the city and have a strong water potential, for energy purposes, and the energy that can be produced by the effect of waves in the Black Sea has the potential to be used for urban needs. Because the city's topography and access to potential resources are easy.
- Raising the awareness of the public about the ecocity. The city of Bartın, with its urban, rural and coastal city features mentioned in the study, has rare features. However, the people in the city have taken these features for granted and do not have the awareness that they can be improved.
- The creation of green spaces and recreational areas that create attraction in neighborhoods with low area density will provide the city with access to quality spaces as a whole.
- Building the main areas such as shopping, entertainment, etc. at certain distances across the area, thus ensuring ease of access by foot.

- Reducing the use of nature-damaging gas in vehicle fuels and providing the necessary sanctions in this regard. In this regard, the transition to the use of electric vehicles will reduce the use of fuel that harms the environment.
- Generalizing wastewater treatment processes and purification of Bartın River from pollution. Today, there are industrial facilities established by the river, the control of wastewater discharged from these establishments into the river, the implementation of legal penalties for uncontrolled use, the separation of wastes by taking the necessary precautions for domestic waste, and zero waste projects are important.

4.2. Transportation recommendations

- Planning urban transportation for city users without loss of time and space and making the necessary investment. In this regard, the rail transportation system in the city should be introduced urgently. With this system, people's demands for public transportation will also be met and unnecessary crowds in traffic will be prevented. Because the city of Bartın is a city that can be reached everywhere on foot.
- Public transportation options in the city need to be developed. In the current situation, the fact that minibuses are used and the connection between certain neighborhoods cannot be provided by public transport directs people to private vehicles.
- Holistic and continuous bicycle path planning is required in the city center and surrounding neighborhoods. The linear line of the Bartın River, which surrounds the city, is a line that can be used for a bicycle path, and the utilization of this potential will provide access to people in a healthy atmosphere while cycling.
- Having shared bicycle parking spaces at every 300 meters in the city and establishment of bicycle rental points will facilitate access to bicycles for each individual.
- Considering the ease of access to green areas, it is necessary to ensure social integrity in urban users. Because open green spaces are common places where people gather and come together for many purposes.
- Pedestrian transportation should be arranged as a priority and walking paths should be created. In this regard, urban multi-storey parking solutions and roadside parking of cars should be prevented or reduced. Thus, the connection of the pedestrian roads will be undivided, people will not encounter the negative image caused by the vehicle image while walking and they will feel themselves in nature.
- Pedestrianization projects should be given priority in the city. It is an important comfort and privilege that people living in the city can access the uses on foot and perceive the whole city as pedestrian.

- Transportation should be provided at a distance of 150-200 meters from the bus stops. Ensuring this will create trust in people and strengthen the circulation of urban constructions.

4.3. Energy recommendations

- Buildings reflecting the traditional (wood, stone, masonry, adobe, etc.) urban architecture should be widespread in the city and the continuity of these structures should be ensured in all neighborhoods. It is possible to transfer these local materials used in historical houses to today's architecture and structures. Thus increasing energy efficiency with traditional materials. The benefit and harmony of these materials, which have been used and preferred for centuries, should not be ignored.
- It is necessary to ensure the continuity of adjacent structures due to heat exchange, to save energy with central heating systems and to increase the use of renewable energy sources.
- Building facades should be positioned appropriately in order to provide ventilation and lighting systems in buildings by natural means. It is important to prefer the areas where daily life passes a lot as living spaces, the use of areas where the aspect of the buildings is taken into account, and spatial settlements. Building facades with at least 2-3 facades will provide more benefit from daylight and sunlight and energy savings.
- The usage areas of solar energy should be increased. In this context, solar energy requirement may be imposed on the roofs of the buildings. In addition, solar energy can be used by establishing solar farms.
- The biogas system, which is one of the renewable energy sources, should be supported. In the city of Bartın, which has 265 villages and where rural production and settlement is intense, the potential for obtaining biogas should be evaluated.
- In the city, which receives heavy rainfall in all seasons, rainwater must be collected and used and water harvested. Today, this issue has a special importance due to water scarcity. The potential needs to be evaluated.

4.4. Suggestions for the material cycle

- The continuity of wooden structures reflecting the traces of the past should be ensured. Their transfer to future generations should be ensured by preserving, re-functioning and using them. Repair and reuse will save material and energy.
- In the selection of materials for newly constructed buildings, it is necessary to be in harmony and integrity with the building tradition and material selection in the past of the city.
- Minimizing the ecological footprint in the urban area by planning green areas for at least 40% of the area covered by the buildings.

4.5. Recommendations for land use

- It is necessary to plan the construction according to the soil classes and to apply the construction restriction on fertile soils. In addition, it is necessary to increase the tax collected from the structures according to the soil classes and to make gradual tax applications.
- Developing and protecting green areas in the city periphery and green belt implementation will be beneficial for controlling urban sprawl.

4.6. Suggestions for water management

- Artificial lake areas and natural ponds should be created in public areas such as city parks and hospital gardens by collecting rain water. Thus, the element of water is gained in public spaces. This application will benefit ecologically and visually.
- The Bartın River should be cleaned and used as a natural recreation area for users. In recent years, applications have been made in parts at certain stages. These practices have responded positively to the quality of the city and the recreational needs of the citizens. Supporting the application by expanding it to cover the entire river will be a big step towards becoming an ecocity.
- It is necessary to determine the areas with past floods and to construct flood protection facilities to prevent possible floods in the city. It is necessary to take measures that will cause the least harm to nature to prevent floods. It should be ensured that the causes of flooding are resolved on-site and the measures to be taken should be compatible with nature.
- The utilization of gray water and its use in agriculture and green field irrigation should be expanded. Thus, by reducing the consumption of clean water and ensuring the reuse of water, savings will be achieved and natural resources will be protected.

4.7. Recommendations for socio-economic indicators

- The river transport of the Bartın river should be revitalized. While river transport was possible until 30 years ago, transportation service stopped as a result of the mismanagement of the river and the accumulation of its bottom with mud and sediments. Re-establishing this is important for the revival of the urban memory and for its ecological and economic benefits.
- It will be beneficial to encourage urban, rural and coastal tourism, to increase the workforce and economic returns of tourism, and to use this income for the maintenance, ecological restoration, development and investments of the city.
- The fishing sector should be encouraged and the potential of the sea coasts and Bartın River should be used better. With the development of this sector, clean food, raising healthy individuals and economic contribution will be increased.

- Thanks to the soil properties and the suitability of the groundwater level, more products can be obtained by promoting urban agriculture. Thus, the income groups polluting the environment and the agriculture sector, which has a more compatible business opportunity with industry and nature, can be developed.
- Developing the city and making future investments, increasing new job opportunities, preventing unemployment, preventing migration and being a self-sufficient city will increase the opportunity to become an ecocity.

4.8. Recommendations for holistic planning

- Getting the ideas and support of the society in planning studies by raising awareness and, getting their opinions on the applications to be made will facilitate the acceptance and implementation phases of the ecocity idea.
- By supporting young entrepreneurs and women entrepreneurs, equal distribution of labor and income in the city will be ensured.
- Increasing the sharing of ideas and practices with universities and other public institutions will ensure control in the decision-making and implementation processes and the implementation of the right decisions for the city.
- Carrying out the necessary studies on recycling will contribute economically, prevent the pollution of natural areas and reduce the depletion of natural resources.
- These suggestions will support potential of Bartın to become an ecocity and help us protect our living spaces. Considering many implemented ecocity projects, it is seen that cities are planned with an environmentalist and focusing on common social life areas. The implementation of these and similar studies will benefit the ecological sustainability of cities. As a result, Bartın city is a city that makes life easier with its natural designs as an "Ecocity", where the urban texture is preserved and can be ecological city as an international focal point.

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Statement of Conflict of Interest

Authors have declared no conflict of interest.

Author's Contributions

The contribution of the authors is equal.

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