

# Spatialization of ECOS method at micro-basin level in rural development-oriented ecotourism planning

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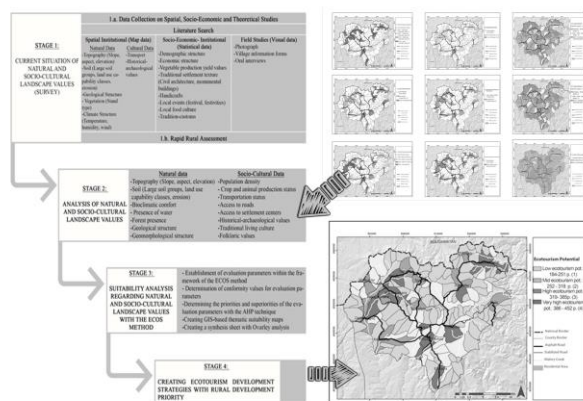
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## Graphical abstract



## Abstract

This research discusses the prediction that “within the framework of the principles of sustainable development; in regions deemed suitable for ecotourism activities, spatial planning is required, which includes a ‘spatial sensitivity’, ‘participatory understanding’ and ‘holistic use’”. Within the framework of the hypothesis developed; a new method approach was developed for Kofçaz/Kirklareli sample, located in northwest Turkey, that could be incorporated into future ecotourism policies and plans with ECOS and AHP Method, which can be adapted to the space on a micro-basin basis. During the inventory phase of the study and determination of the current situation, a database was created in the GIS environment on the basis of 145 micro-basins determined by the philosophy of the basin and sub-basin of the data on natural and cultural landscape elements. 6 basic criteria, 23 evaluation factors and 73 sub-evaluation criteria were determined with ECOS method developed in the light of RRA Technique and literature findings to be applied in the field. To determine the priority values and ranking of the main and lower criteria, weight scores related to evaluation criteria were determined from 12 individuals via the AHP technique. Conformity values and conformity

coefficients for the specified basic and sub-criteria were analyzed at 145 micro basin levels and thematic maps were created. With overlay analysis, synthesis pad was created, appropriate areas for ecotourism were determined, and ecotourism management strategies focused on rural development were developed. These results can be integrated into basin-scale spatial planning that stands out both nationally and internationally.

**Keywords:** Ecotourism, ECOS, Kirklareli.

## 1. Introduction

Rural areas are complex structures with limited relations with urban centers, that show diverse income distribution, limited access to services, basic features such as history, natural, local values, climate, as well as the development of settlement models linked to areas connected to natural structure and where cultural interaction occurs (Ortiz-Guerrero, 2013). At this point; supranational institutions such as the World Bank (WB), the United Nations (UN), the Organization for Economic Development and Cooperation (OECD) and the European Union (EU) have developed approaches to rural development. The World Bank (WB) promotes sustainable and attractiveness of rural areas, harmonization of economic, social, cultural, environmental and technological changes, poverty reduction within the framework of the United Nations Millennium Development Goals; OECD aims at developing economic growth linked to agricultural production, as well as the development of competitiveness based on various sectors such as tourism, manufacturing, information and infrastructure; on the other hand, the European Union promotes quality of life and diversification of the rural economy in rural areas (Gülçubuk *et al.*, 2016; Çelik, 2006; Yenigül, 2017).

Likewise, with the change in their understanding of rural development; tourism has been a solution in the focus of development, and especially it is aimed to improve ecotourism as a priority. As a matter of fact, in the report

titled “Strategy for Rural Europe” prepared by ECOVAST; tourism is envisaged in the revival of rural economies (ÇEKÜL, 2012). By the United Nations; 2002 was declared as “International Year of Ecotourism,” and 2017 was declared as “Sustainable Tourism Year for Development”. So much so that ecotourism contributes to the economic improvement of the local community with a focus on protecting natural resources, local identity and cultural values (Ashok *et al.*, 2017; Kiper, 2012; Gigović *et al.*, 2016; TIES, 2015). However, as Roger and Bhatta (2013) indicated; “In the effectiveness of ecotourism in sustainable development, it is important how it is planned, implemented and managed”. Sustainable development is based on a viable economy, responsible governance, social cohesion and ecological integrity (Alexander and Whitehouse, 2004; Cheia, 2013). Ecotourism has also been cited by many researchers as a tool for achieving sustainable development (Li, 2004; Telfer and Sharpley, 2008; Tran and Walter in 2013; Moeljad, 2015; Safarabadi, 2016; Seifi and Janbaz Ghobad, 2017).

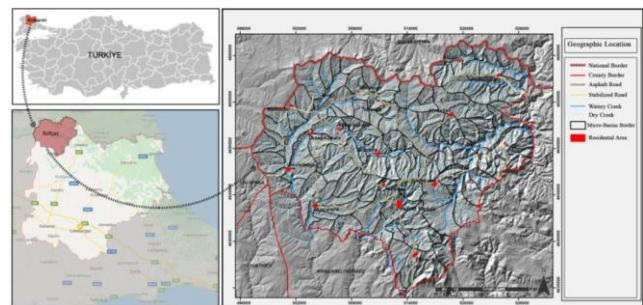
In the study; on the basis of the development of a new methodology that can be included in ecotourism plans in rural areas; answers to the questions such as “What should tourism development be spatially like in areas preceded as ecotourism development areas in high scale plan decisions?” and “What should be the prediction of development-first ecotourism strategies?” were searched. In this direction, in the case of the Forties/Kofçaz micro basins in northwestern Turkey, it is aimed to plan a sustainable, economically viable and socially acceptable

ecotourism based on development-first local identity values and to develop management strategies.

**2. Materials and methods**

**2.1. Materials**

In the selection of the main material of the study, sub-basins and micro-basins within each sub-basin were taken into account, taking into account natural thresholds rather than administrative boundaries. However, in many ecology-based spatial planning studies, it is stated that the basin and micro basin scale should be used effectively for rural and urban areas (Forman, 1995; Jones *et al.*, 1997; Uzun *et al.*, 2015; Kiper *et al.*, 2017; Yüksel *et al.*, 2020). In this context; the study was based on the Kofçaz/Kırklareli micro-basins and on 145 micro basins in the processing, evaluation and analysis of data within the framework of the method process. While creating micro-basins; based on the sub-basins used by DSI; micro-basins within sub-basins were determined based on water separation lines and leveling curved maps (Figure 1 and Table 1).



**Figure 1.** Location of study area.

**Table 1.** Coding studies of Meriç and Marmara main basin micro-basins

| Turkey main watershed | Turkey main watershed code | Subwater no | Subwater code | Micro-basins code | Micro-basins count |
|-----------------------|----------------------------|-------------|---------------|-------------------|--------------------|
| Meriç                 | 01                         | 30          | 130           | 130001-130086     | 86                 |
| Marmara               | 02                         | 50          | 250           | 225001-225059     | 59                 |
| Total                 |                            |             |               |                   | 145                |

The working field of the study is located in the Thrace part of the Marmara Region at the foot of the Yildiz (Istranca) Mountains in northwestern Turkey. Kofçaz District was defined as the “rural center” and considered as the area where agro-ecotourism would be developed and was included in the “eco-agro tourism corridor” (Anonymous, 2009; Anonymous, 2014).

**2.2. Methods**

When the studies on the planning of ecotourism areas are analyzed, it is seen that methods like, Recreation Opportunities Spectrum (ROS), Water Recreation Opportunity Spectrum (WROS), Water and Land Recreation Opportunity Spectrum (WALROS), Tourism Sectorization Opportunity Spectrum (TSOS) and Forest Recreation Opportunity Spectrum (FROS) have been used. In this study, ECOS method created by combining and adapting Recreation Opportunities Spectrum (ROS) and Tourism Opportunities Spectrum (TOS) approaches was used. ECOS method in the study includes a technically usable, environmentally sustainable, socially acceptable,

economically viable approach that supports local resource values (spatial sensitivity), takes into account the opinions and expectations of relevant stakeholders (participatory approach), where land and office work is carried out together, information-based, natural and cultural data are processed, stored and queried through GIS (based on the data information system). ECOS Method was used in the conformity analysis phase by detailing the evaluation criteria created by making various changes and adaptations in the field of study in Arc GIS environment at the lower-basin and micro-basin level. The general method was carried out in 4 basic stages (Figure 2).

Stage I: This stage is at the core of the approach that “supports local resource values”. This section is supported in 2 subdivisions (Table 2).

Stage II: Developed based on office and field studies, this stage was conducted based on thematic maps based on GIS (Table 3).

Stage III: ECOS method was used to demonstrate the potential of ecotourism and to determine the priority

areas for ecotourism. ECOS method is an important tool in determining resource values and ecotourism opportunities for ecotourism and determining relative priorities for ecotourism activities and contributes to ecotourism planning and management (Boyd and Butler, 1996; Fagence, 2001; Neth, 2008; Ajlaoni, 2011). According to With (2011), ECOS is a tool for the analysis of ecotourism-prior development and is crucial for developing environmentally and socio-economically sustainable ecotourism strategies (Poyyamoli, 2018). The ECOS method was first used by Boyd and Butler in 1996.

Within the framework of the ECOS method, 8 basic criteria ((1) accessibility, (2) the relationship of ecotourism with other sources, (3) regional attractiveness, (4) touristic infrastructure, (5) the ability and knowledge of ecotourists, (6) the level of social interaction, (7) the impact of visitors on the source of ecotourism and the management style developed for the long-term protection of the area) used by Boyd and Butler (1996) were then developed by applying various changes and adaptations, and these criteria were evaluated in various forms (Table 4).

**Table 2.** 2-step method that supports local resource values

| 1. Chapter   | 2. Chapter  |
|--|---|
| Current due diligence based on spatial, socio-economic criteria and field trips  | Rapid Rural Assessment  |
| Subject (Rural development, rural planning, ecotourism development, rural landscape planning, ecotourism planning, ECOS method, etc.) and literature (thesis, article, report) studies on the field were examined. | This section constitutes the essence of the participatory approach that “takes into account the opinions and expectations of the relevant stakeholders” within the framework of the method. It is the stage at which the current situation is determined and the answer to the question of “Where” is determined. |
| Prepared by the relevant institutions and organizations; spatial and socio-economic plans, reports, printed and/or numerical maps, statistical data were provided at the upper scale.                              | RRA was carried out with 12 people consisting of local institution representatives.   |
| Village information forms and Rapid Rural Assessment forms were prepared.  |   |
| Visual materials were provided with land works and interviews were held with local people and local authorities.   |   |

**Table 3.** Processes carried out within the scope of the current situation analysis and related data sources

|                | Natural Data  |   |
|----------------|---|---|
|                | Source  | The data obtained   |
| Office studies | General Command of Mapping 1/25.000 scale digital map   | Elevation groups (m), Slope (%),  |
|                | General Directorate of Rural Services 1/25.000 scale digital soil map   | Large soil groups, landuse capability classes, erosion  |
|                | Climate data of the General Directorate of Meteorology  | Bioclimatic comfort   |
|                | Ministry of Agriculture and Forestry Kirklareli Forestry Directorate Forest Management Plan                                     | Forest stand canopy cover   |
|                | <b>Culturel Data</b>  |   |
|                | Population data   | Population distribution, population density   |
|                | Kirklareli Provincial General Directorate of Agriculture and Forestry   |   |
|                | Koçgaz District Directorate of Agriculture and Forestry   | Agricultural and animal production  |
|                | General Command of Mapping 1/25.000 scale digital map   | Transportation status, access to road, access to residential areas  |
|                | Kirklareli Culture and Tourism Directorate  | Historical and archeological structures, tourist infrastructure facilities, socio-cultural values, local architecture |
| Field studies  | Data Usage Type: Field observations, interviews with local people, interviews with central and local government representatives |   |
|                | Hydrology, landforms, vegetation  |   |
|                | Historical background of the village (foundation year, ethnicity, etc.), livelihoods, infrastructure situation                  |   |
|                | Public perspective on ecotourism  |   |

Making use of 18 different studies regarding the EKOS method used in the study (Boyd and Butler, 1996; Topay, 2003; Bi, 2005, Khalid *et al.* 2010; Khalid, Nasir and Ahmad, 2010; Jurowski, 2010; Açiksöz *et al.* 2010; Uzun *et al.* 2010; Türker, 2013; Yassera and Sharma, 2014; Gültekin, 2014; Uzun *et al.*, 2015; Kiper *et al.*, 2015; Salıcı 2018; Kabataş, 2020;), 6 basic criteria, 23 evaluation

factors and 73 sub-evaluation criteria were determined in the field of research (Table 5).

The high number of criteria and basic criteria evaluated and the fact that they are varied has increased the sensitivity of the ecotourism study. The 4-point Likert scale (4: Very high, 3: High, 2: Medium, 1: Low) was used

for the numerical expression of the conformity values of the criteria and sub-criteria. Studies by Türker (2013) and Görmüş (2017) were referred in the scoring.

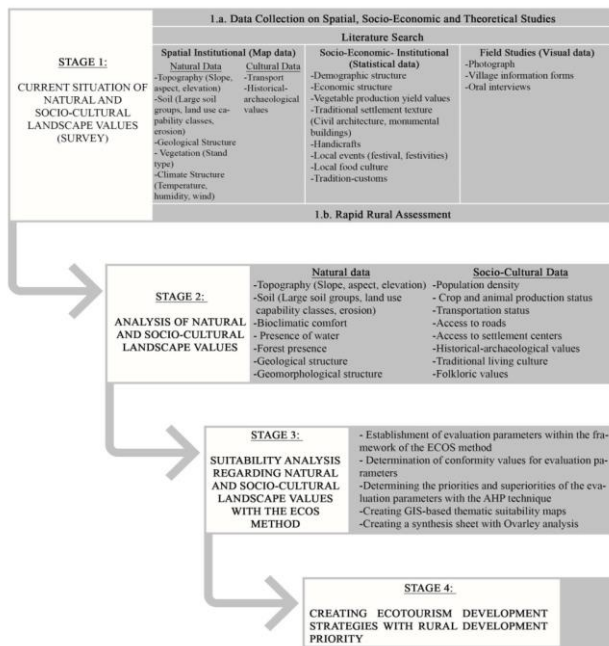


Figure 2. Flowchart of the study method.

With AHP Technique, weight scores of evaluation parameters regarding importance and priorities were determined. In the AHP process; firstly, a total of 12 people were selected from among the professions related

to the subject of the study (Landscape architect, Urban Regional Planner, Forest Engineer, Geographer); after a hierarchical diagram was defined with criteria and sub-criteria, comparison matrices were prepared to indicate the relative importance or effect of a factor. After a hierarchical diagram was defined with criteria and sub-criteria, comparison matrices were prepared to indicate the relative importance or effect of a factor (Table 6).

The forms regarding the evaluation criteria expected to be evaluated were sent to the experts via e-mail. A total of 6 evaluations were made in which the experts evaluated the main topics and rated the factors under the main heading. The scores received were evaluated with the help of Expert Choice program. Samples with a coefficient of consistency less than 0.1 were evaluated, and a total of 8 evaluations were obtained. These 8 evaluations of 8 specialists were collected with arithmetic mean, and the factor coefficient was obtained (100 criteria of the factor coefficients were evaluated) and the factors were obtained by sharing them to the analyses to which they belong. The specified factor scores were entered into the database in ArcGis program (Table 7).

After all the values were processed and the relevant maps were created, the synthesis pad was created with Overlay Analysis (Mc Harg, 1969). In the synthesis map where all the studies are combined, priority areas for ecotourism are determined for Kofçaz.

Table 4. Evaluation criteria based on the ECOS method

| Evaluation criteria   | Neth (2008) | Açkösöz et al. (2010) | Uzun et al. (2010) | Türker (2013) | Hardy et al. (2014) | Rahman (2014) | Kiper et al. (2015) | Cengiz et al. (2016) | Salıcı (2018) | Rudianto et al. (2019) | Alam (2019) | Meydan (2020) | Fattah et al.2021 | Kabatay (2020) | Yigit (2020) |
|---|-------------|-----------------------|--------------------|---------------|---------------------|---------------|---------------------|----------------------|---------------|------------------------|-------------|---------------|-------------------|----------------|--------------|
| Accessibility   | x           |                       |                    | x             | x                   | x             | x                   |                      | x             | x                      | x           |               | x                 | x              | x            |
| Level of responding to distinct ecotourism activities                         | x           |                       |                    |               | x                   | x             |                     |                      | x             | x                      |             |               |                   |                |              |
| Attractions in a region   | x           |                       |                    |               | x                   | x             |                     |                      |               | x                      | x           |               |                   |                |              |
| Available tourism infrastructure  | x           |                       |                    | x             |                     |               | x                   |                      | x             | x                      | x           |               | x                 | x              | x            |
| Level of user skill and knowledge required                                    | x           |                       |                    |               | x                   |               |                     |                      | x             |                        | x           |               | x                 |                |              |
| The correlation between ecotourism and other sources                          |             |                       |                    |               | x                   | x             | x                   |                      | x             | x                      | x           |               | x                 |                |              |
| Effects of visitors to ecotourism source                                      |             |                       |                    |               |                     |               |                     |                      |               |                        |             |               | x                 |                |              |
| Type of management needed to ensure the viability of areas on long-term basis | x           |                       |                    | x             |                     |               |                     |                      |               | x                      |             |               |                   |                |              |
| Source diversity of the focus   |             |                       |                    |               |                     |               |                     |                      |               | x                      |             |               |                   |                | x            |
| Available tourism superstructure  |             |                       |                    | x             |                     |               | x                   |                      | x             |                        |             |               |                   | x              | x            |
| Sociocultural structure   |             | x                     | x                  | x             |                     |               | x                   | x                    |               |                        |             |               |                   | x              | x            |
| Economic structure  |             | x                     | x                  | x             |                     |               |                     | x                    |               |                        |             |               |                   | x              | x            |
| Bio-physical structure  |             | x                     | x                  |               |                     |               |                     | x                    |               |                        | x           |               |                   |                |              |
| Source diversity of the naturel   |             |                       |                    |               |                     |               | x                   |                      | x             |                        |             |               |                   | x              |              |
| Visual attractiveness   |             |                       |                    |               |                     |               |                     |                      | x             |                        |             |               |                   |                |              |
| Protected ecosystem elements  |             |                       |                    |               |                     |               |                     |                      | x             |                        |             |               |                   |                |              |

**Table 5.** Evaluation criteria and sub-units of the ECOS method

| ECOS EVALUATION CRITERIA AND SUB-UNITS                   |   | SCORE* (1-4)              |   |
|--|---|---------------------------|---|
| 1 Access to roads and volume situation                   |   |                           |   |
| 1.1 Access to roads                                      | Micro-basin where the mainland passes                 | 4                         |   |
|  | Micro-basin where stabilized roads                    | 2                         |   |
| 1.2 Access density to roads                              | Road rate (length) per km <sup>2</sup> in micro-basin | 0-400m/km <sup>2</sup>    | 1 |
|  |   | 400-800m/km <sup>2</sup>  | 2 |
|  |   | 800-1200m/km <sup>2</sup> | 3 |
|  |   | 1200m >km <sup>2</sup>    | 4 |
| 2. Access to Settlements                                 |   |                           |   |
| 2.1 Access from micro-basin to settlements               | Tertiary micro-basin in contact with settlement       | 4                         |   |
|  | Secondary micro-basin in contact with settlement      | 3                         |   |
|  | Primary micro-basin in contact with settlement        | 2                         |   |
|  | Quaternary micro-basin in contact with settlement     | 1                         |   |
| 3. Access to Ecotourism Resources                        |   |                           |   |
| 3.1 Access from micro-basin to recreational activity (m) | 0-5000 m  | 4                         |   |
|  | 5001-10000 m  | 3                         |   |
|  | 10001-15.000 m  | 2                         |   |
|  | 15.001 m>   | 1                         |   |
| 3.2 Access from micro-basin to water resources (m)       | 0-1000 m access to watery streams                     | 4                         |   |
|  | 1000-2000 m access to watery streams                  | 3                         |   |
|  | 2000-5000 m access to watery streams                  | 2                         |   |
|  | 5000 > m access to watery streams                     | 1                         |   |
| 4. Bioclimatic Comfort                                   |   |                           |   |
| 4.1 High bioclimatic comfort value (18-23 OC)            |   | 4                         |   |
| 4.2 Moderate bioclimatic comfort value (13-18 OC)        |   | 3                         |   |
| 5. Variety of Topographic Structures                     |   |                           |   |
| 5.1 Height Group Variety                                 | Micro-basin with 4 diff. height groups                | 4                         |   |
|  | Micro-basin with 3 diff. height groups                | 3                         |   |
|  | Micro-basin with 2 diff. height groups                | 2                         |   |
|  | Micro-basins with single group height                 | 1                         |   |
| 5.2 Average slope (%)                                    | Micro-basin where the average slope is % 0-18         | 4                         |   |
|  | Micro-basin where the average slope is % 18-30        | 3                         |   |
|  | Micro-basin where the average slope is % 30>          | 2                         |   |
| 5.3 Aspect Density                                       | South, southeast, southwest aspect                    | 4                         |   |
|  | East, west, straight aspect                           | 3                         |   |
|  | Northeast, northeast aspect                           | 2                         |   |
|  | North aspect  | 1                         |   |
| 6. Forest Presence                                       |   |                           |   |
| 6.1 Forest stand canopy cover                            | % 10> closed microbasin with space                    | 4                         |   |
|  | % 11-40 loose covered microbasin                      | 3                         |   |
|  | %41-70 mid covered microbasin                         | 2                         |   |
|  | %71-100 covered microbasin                            | 1                         |   |
| 7. Water Presence  |   |                           |   |
| 7.1 Stream density in forest areas in microbasins        | %75-100 stream density                                | 4                         |   |

1. ACCESSIBILITY

2. LANDSCAPE NATURAL  
ATTRACTION VALUES

|   |  |  |   |
|---|--|--|---|
|   |  | %50-75 stream density  | 3 |
|   |  | %25-50 stream density  | 2 |
|   |  | %0-25 stream density   | 1 |
|   | 8. Soil  |  |   |
|   |  | Low or no erosion  | 4 |
|   | 8.1 Erosion in microbasin  | Moderate erosion   | 3 |
|   |  | Severe erosion   | 2 |
|   |  | Very severe erosion  | 1 |
|   |  | I., II , VII. Class LLC.   | 4 |
|   | 8.2 Landuse capability classes in microbasins  | III, VI. class LLLC  | 3 |
|   |  | IV. and V. class LLC   | 2 |
|   |  | VIII. classs LLC   | 1 |
|   | 9. Folkloric Values (Traditional food, handicrafts and festival, celebration, ceremony etc.) |  |   |
|   |  | Micro-basin with 3 folkloric value   | 4 |
|   | 9.1 Availability of folkloric values in micro-basins   | Micro-basin with 2 folkloric value   | 3 |
|   |  | Micro-basin with 1 folkloric value   | 2 |
|   | 10. Historical Archaeological Values   |  |   |
|   |  | 4 and more historical archaeological values  | 4 |
|   | 10.1 Accessibility to historical archaeological values in micro-basins                       | 3 historical archaeological values   | 3 |
|   |  | 2 historical archaeological values   | 2 |
|   |  | 1 historical archaeological values   | 1 |
| 3. LANDSCAPE CULTURAL ATTRACTION VALUES         | 11. Local Architectural Structures   |  |   |
|   |  | Micro-basin with local architecture  | 4 |
|   | 11.1 Micro-basins with local architectural structures  | Microbasin without local architecture  | 2 |
|   | 12. Traditional Life Culture   |  |   |
|   | 12.1 Diversity of traditional life culture in micro-basins                                   | Micro-basin with a traditional life culture  | 4 |
|   | 13. Agriculturel Production Status   |  |   |
|   |  | 4001> da cultivation area  | 4 |
|   | 13.1 Density of plant production planting area in micro-basins                               | 2001-4000 da cultivation area  | 3 |
|   |  | 1001-2000 da cultivation area  | 2 |
|   |  | 100-1000 da cultivation area   | 1 |
| 4. ECONOMIC STRUCTURE DIVERSITY                 | 14. Animal Production Status   |  |   |
|   |  | 3501 > animals   | 4 |
|   | 14.1 The total amount of cattle and ovine in micro-basins                                    | 2001-3500 animals  | 3 |
|   |  | 1001-2000 animals  | 2 |
|   |  | 300-1000 animals   | 1 |
|   | 15. Availability of Drinking Water, Electricity, Communication Tools                         |  |   |
|   |  | Availability of infastructure  | 4 |
|   | 15.1 Presence of drinking water, electricity, communication tools in micro-basins            | Availability of other infrastructure elements that the internet and mobile phone signal cannot reach | 3 |
| 5. TOURISTIC INFRASTRUCTURE OPPORTUNITIES       |  | Microbasin without infastructure   | 1 |
|   | 16. Population Density   |  |   |
|   |  | 1,24-1,84 popu./km2  | 4 |
|   | 16.1 Population density per sqm in micro-basins  | 0,63-1,23 popu./km2  | 3 |
|   |  | 0,01-0,62 popu./km2  | 2 |
| 6. LEVEL OF ORGANIZATION AND SOCIAL INTERACTION | 17. Level of Organization  |  |   |

|  |                       |   |
|--|-----------------------|---|
| 17.1 Union-cooperative containing micro-basins | Union cooperative     | 4 |
|  | Non-union cooperative | 1 |
| 18. Perception of Ecotourism                   |                       |   |
| 18.1 Locals' view of ecotourism                | Positive              | 4 |

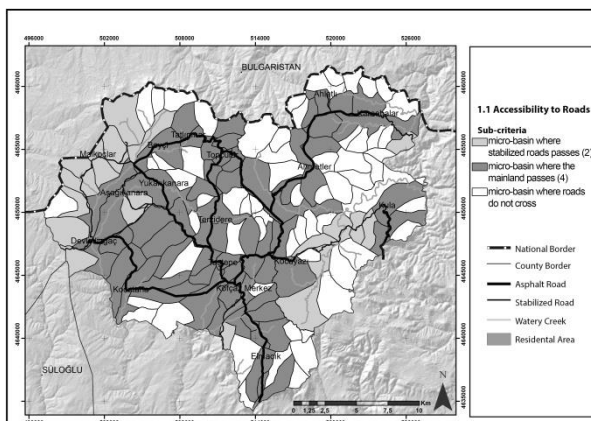
\*Scores are given in accordance with the literature review on the subject.

**Table 6.** Analytical Hierarchy Process (AHP) Value Scale (Saaty, 2008)

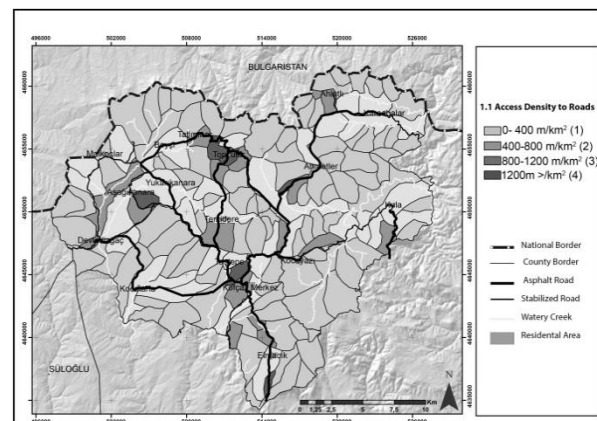
| Value scale (n) | Definition  |
|-----------------|---|
| 1               | Both elements are equally important                     |
| 3               | One element is slightly more important than the other   |
| 5               | One element is more important than the other            |
| 7               | One element is far more important than the other        |
| 9               | One element is absolutely more important than the other |
| 2,4,6,8         | The mean between two adjacent value consideration       |

**Table 7.** Determination of the relative criterion weight

|  | Urban and Regional Planning | Urban and Regional Planning | Geography | Landscape Architect | Landscape Architect | Forest Engineer | Urban and Regional Planning | Landscape Architect | Factor coefficients out of 1 | Factor coefficients out of 100 |
|--|-----------------------------|-----------------------------|-----------|---------------------|---------------------|-----------------|-----------------------------|---------------------|------------------------------|--------------------------------|
| Accessibility to Roads   | 0.154                       | 0.031                       | 0.059     | 0.043               | 0.004               | 0.015           | 0.019                       | 0.006               | 0.041                        | 4,1                            |
| Accessibility to Residential Areas                               | 0.154                       | 0.031                       | 0.044     | 0.043               | 0.021               | 0.015           | 0.022                       | 0.014               | 0.043                        | 4,3                            |
| Access to Ecotourism Resources                                   | 0.154                       | 0.031                       | 0.197     | 0.043               | 0.021               | 0.015           | 0.004                       | 0.034               | 0.062                        | 6,2                            |
| Bioclimatic comfort  | 0.01                        | 0.076                       | 0.062     | 0.025               | 0.083               | 0.011           | 0.062                       | 0.083               | 0.052                        | 5,2                            |
| Variety of Topographic Structures                                | 0.061                       | 0.039                       | 0.036     | 0.072               | 0.169               | 0.046           | 0.216                       | 0.17                | 0.101                        | 10,1                           |
| Aspect   | 0.025                       | 0.032                       | 0.005     | 0.021               | 0.021               | 0.026           | 0.05                        | 0.03                | 0.026                        | 2,6                            |
| Forest Presence  | 0.055                       | 0.064                       | 0.011     | 0.138               | 0.119               | 0.2             | 0.089                       | 0.102               | 0.097                        | 9,7                            |
| Water Presence   | 0.055                       | 0.064                       | 0.016     | 0.138               | 0.066               | 0.2             | 0.078                       | 0.102               | 0.090                        | 9                              |
| Soil Characteristics   | 0.025                       | 0.022                       | 0.01      | 0.02                | 0.029               | 0.067           | 0.018                       | 0.016               | 0.026                        | 2,6                            |
| Folkloric Values   | 0.02                        | 0.076                       | 0.062     | 0.113               | 0.042               | 0.071           | 0.011                       | 0.05                | 0.056                        | 5,6                            |
| Historical- archeological Structures                             | 0.061                       | 0.076                       | 0.055     | 0.113               | 0.163               | 0.071           | 0.11                        | 0.109               | 0.095                        | 9,5                            |
| Local Architecture   | 0.061                       | 0.076                       | 0.032     | 0.113               | 0.047               | 0.071           | 0.051                       | 0.028               | 0.060                        | 6                              |
| Traditional Life Culture   | 0.02                        | 0.076                       | 0.059     | 0.038               | 0.047               | 0.071           | 0.023                       | 0.036               | 0.046                        | 4,6                            |
| Agricultural Production Status                                   | 0.023                       | 0.066                       | 0.031     | 0.014               | 0.039               | 0.044           | 0.056                       | 0.057               | 0.041                        | 4,1                            |
| Animal Production Status   | 0.005                       | 0.066                       | 0.062     | 0.014               | 0.039               | 0.044           | 0.056                       | 0.057               | 0.043                        | 4,3                            |
| Availability of Drinking Water, Electricity, Communication Tools | 0.061                       | 0.057                       | 0.075     | 0.025               | 0.042               | 0.018           | 0.067                       | 0.016               | 0.045                        | 4,5                            |
| Population Density   | 0.008                       | 0.013                       | 0.03      | 0.003               | 0.004               | 0.013           | 0.007                       | 0.042               | 0.015                        | 1,5                            |
| Level of Organization  | 0.023                       | 0.048                       | 0.055     | 0.013               | 0.014               | 0.005           | 0.043                       | 0.029               | 0.029                        | 2,9                            |
| Perception of Ecotourism   | 0.023                       | 0.057                       | 0.1       | 0.013               | 0.028               | 0.001           | 0.017                       | 0.02                | 0.032                        | 3,2                            |



**Figure 3.** Access to roads.



**Figure 4.** Access density to roads.

Stage IV: At this stage, various strategies based on protection, planning, development and management have been produced for rural development-oriented ecotourism. In the development of relevant strategies, top scale plans and documents (Anonymous, 2007; 2013; 2014; 2018a; 2018b; 2019a; 2019b; 2020) and studies by Crisman *et al.* (2009), Kiper *et al.* (2015) and Kiper (2017) were effective. Strategy and objectives, taking into account the economic, ecological advantages of the workplace and the rapid rural evaluation method, which addresses the expectations of stakeholders, it was ensured that rural settlements were capable of maintaining and improving their original character.

**3. Results and discussion**

Taking into account the factors, sub-units and evaluation criteria selected within the framework of ECOS method, analysis was made and thematic maps were created in the GIS environment using Arc GIS 10.2 software and accordingly 3D Analyst and Spatial Analyst modules. The evaluations of the analyses are presented below.

Accessibility refers to accessing the objectives and are the main indicators of location and distance. Within the scope of the study and the ECOS method, 18 criteria based on 3 basic, 5 sub-criteria and sub-criteria were evaluated and mapped in the GIS environment (Table 8, Figures 3–7).

Natural Landscape Charms of Ecotourism Source: Ecological resource is the main source of tourism for ecotourism and is an important value that increases the attractiveness of tourism (Mai and Smith, 2015; Choi *et al.*, 2021). Within the scope of the study and ECOS method, 5 basic and 29 sub-criteria were evaluated under this heading and mapped in the GIS environment (Table 9).

Topographic structure diversity; three main criteria and 11 sub-criteria were covered as groups of height, slope, and exposure. This creates interesting possibilities for ecotourism (Figures 8 and 9).

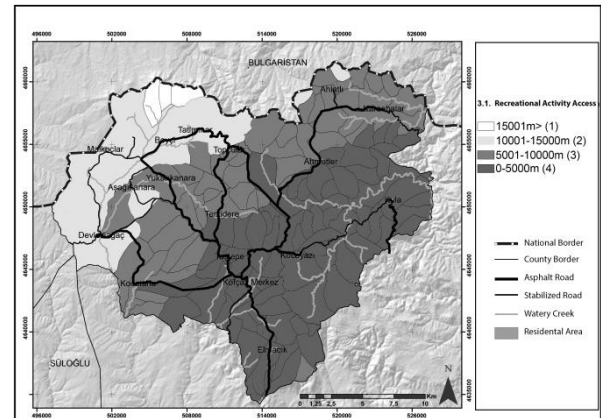


Figure 6. Access from micro-basin to recreational activity (m).

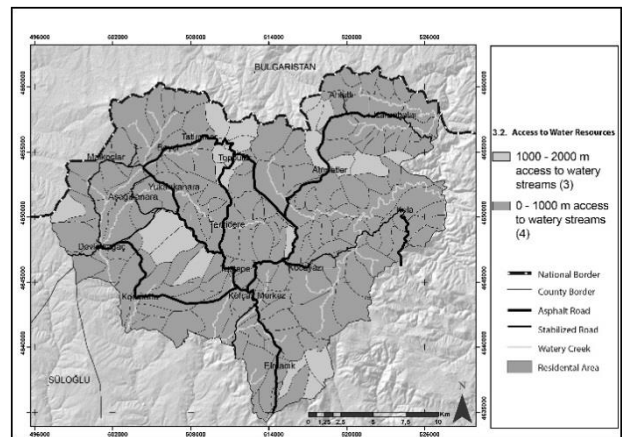


Figure 7. Access from micro-basin to water resources (m).

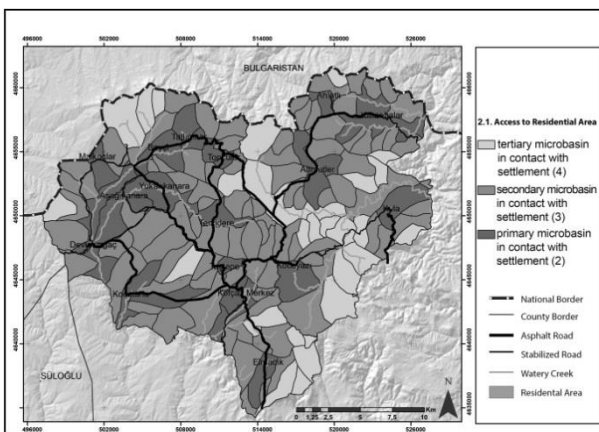


Figure 5. Access from micro-basin to settlements.

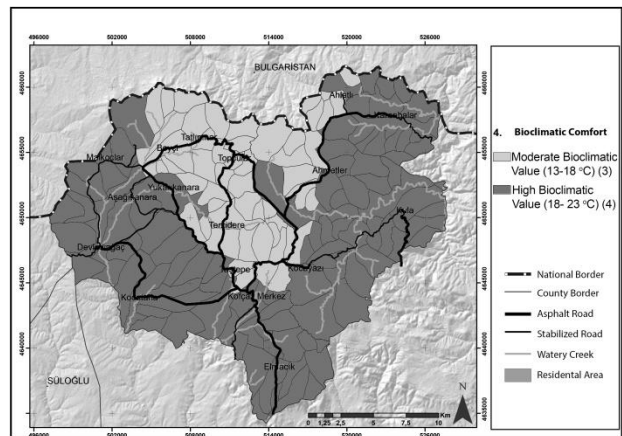


Figure 8. Bioclimatic comfort

Table 8. Accessibility criteria analysis results

| Criteria                                   | Source  | Number of Optimal microcatchments | Number of available microcatchments | Figure number |
|--|---|-----------------------------------|-------------------------------------|---------------|
| 1.1 Access to roads                        |   | 65                                |                                     | Figure 3      |
| 1.2 Access density to roads                | Jones <i>et al.</i> , 1997; Uzun <i>et al.</i> , 2015 | 4                                 | 15                                  | Figure 4      |
| 2.1 Access from micro-basin to settlements |   | 26                                | 80                                  | Figure 5      |



|  |                            |     |    |          |
|--|----------------------------|-----|----|----------|
| 3.1 Access from micro-basin to recreational activity (m) |                            | 80  | 49 | Figure 6 |
| 3.2 Access from micro-basin to water resources (m)       | Kiper <i>et al.</i> , 2015 | 125 | 20 | Figure 7 |

**Table 9.** Natural criteria analysis results

| Criteria  | Source  | Number of Optimal microcatchments | Number of available microcatchments | Figure number |
|---|---|-----------------------------------|-------------------------------------|---------------|
| 4.1 Bioclimatic comfort                           | Javan and Malazadeh, 2013; Ramazani Gourbi, 2010; Gourabi and Palic, 2012 | 90                                | 55                                  | Figure 8      |
| 5.1 Height group variety                          |   | 37                                |                                     | Figure 9      |
| 5.2 Average slope (%)                             | Topay, 2003   | 145                               |                                     | Figure 10     |
| 5.3 Aspect density                                |   | 58                                | 27                                  | Figure 11     |
| 6.1 Forest stand canopy cover                     |   | 85                                |                                     | Figure 12     |
| 7.1 Stream density in forest areas in microbasins | Jones <i>et al.</i> , 1997; Uzun <i>et al.</i> , 2015                     | 27                                | 47                                  | Figure 13     |
| 8.1 Erosion in micro-basin                        | Uzun <i>et al.</i> , 2015   | 45                                |                                     | Figure 14     |
| 8.2 Landuse capability classes in micro-basins    | Anonymous, 2017   | 15                                | 108                                 | Figure 15     |

**Table 10.** Cultural landscape attractiveness criteria analysis results

| Criterion  | Resource       | Evaluation and Figure no.  |
|--|----------------|--|
| 9.1 Availability of folkloric values in micro-basins                   | Gültekin, 2014 | While the micro-basin in which Kocayazi is located was determined as the most suitable, Koçaz center, Kula, Ahmetler, Elmacik, Aşağıkanara and micro-basins were determined as suitable micro-basins (Figure 16)                                 |
| 10.1 Accessibility to historical archaeological values in micro-basins |                | The micro-basins where Devletliğaç, Taştepe, Kocayazi, Ahmetler, Ahlatlı, Karaabalar, Malkoçlar, Aşağıkanara, Yukarıkanara, Taştepe, Tatlıpınar Koçaz centers are located were determined as the most suitable and appropriate ones (Figure 17). |
| 11.1 Micro-basins with local architectural structures                  |                | Micro-basins where Kocayazi, Kula, Ahmetler, Karaabalar, Ahlatlı, Topçular, Beyci, Malkoçlar and Elmacik settlements are located received the most suitable value in terms of ecotourism (Figure 18).  |
| 12.1 Diversity of traditional life culture in micro-basins             |                | Micro-basins containing 16 rural settlements where Amuca, Gacal, Pomak and Bosniak culture are located were determined as most suitable for ecotourism activities (Figure 19)  |

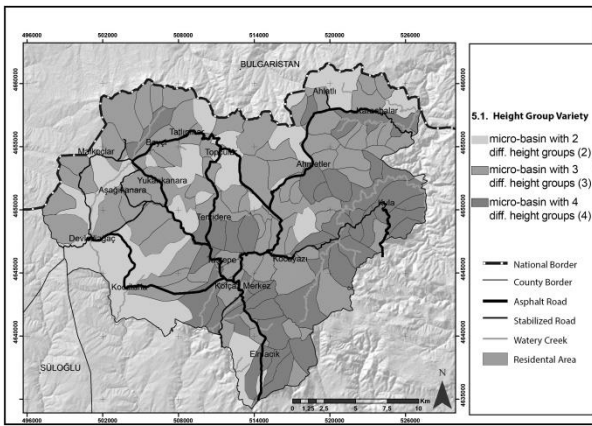


Figure 9. Height group variety

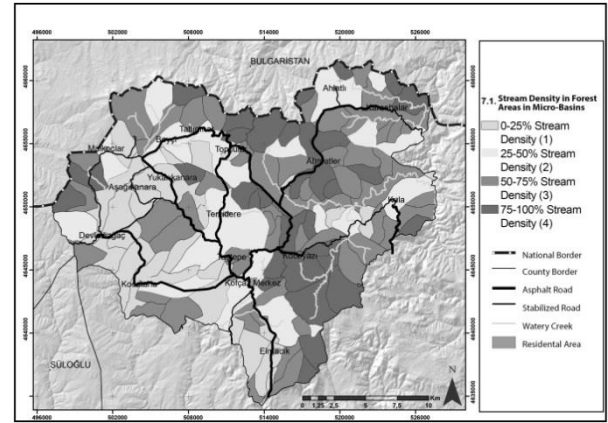


Figure 13. Stream density in forest areas.

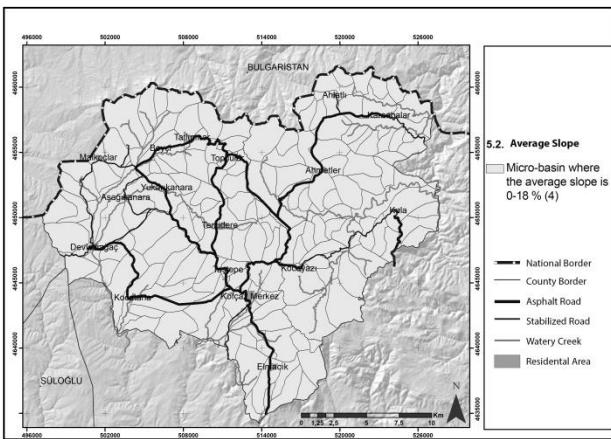


Figure 10. Average slope

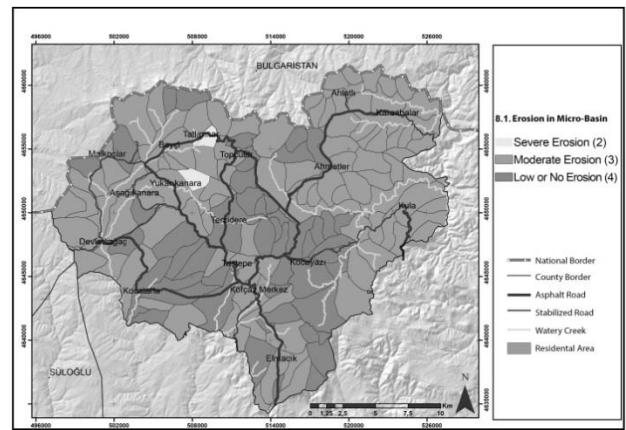


Figure 14. Erosion in microbasin.

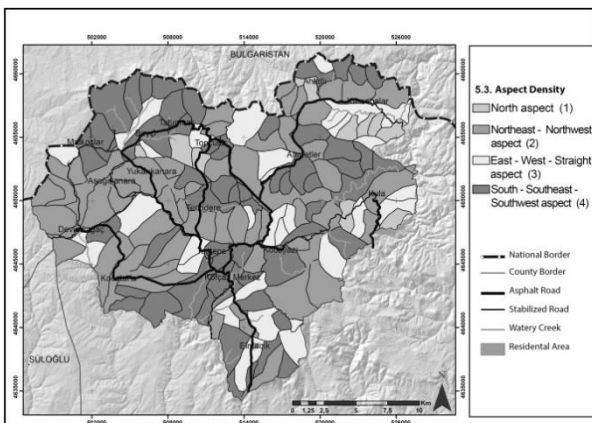


Figure 11. Aspect density

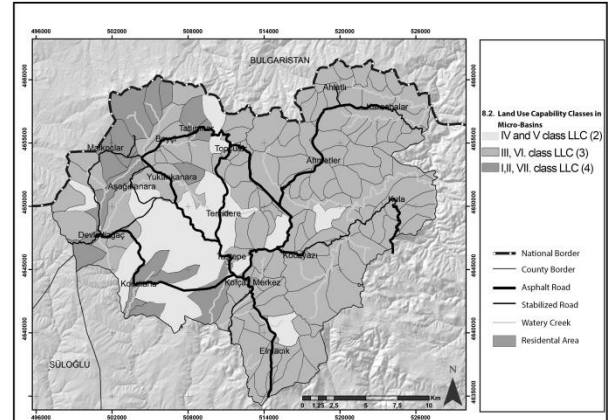


Figure 15. Landuse capability classes.

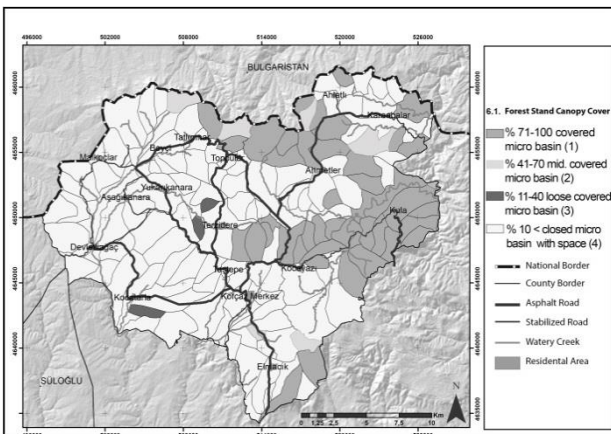


Figure 12. Forest stand canopy cover.

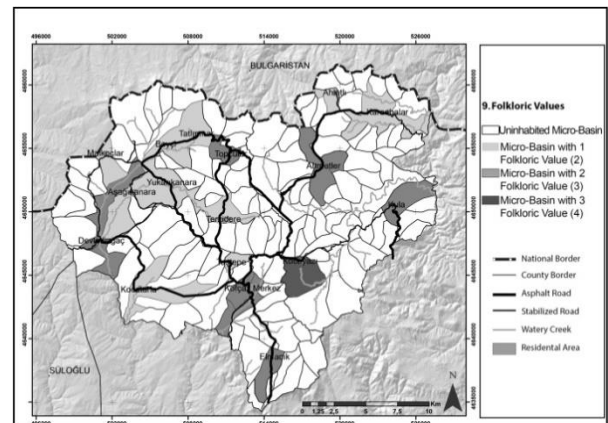


Figure 16. Availability of folkloric values in micro-basins.

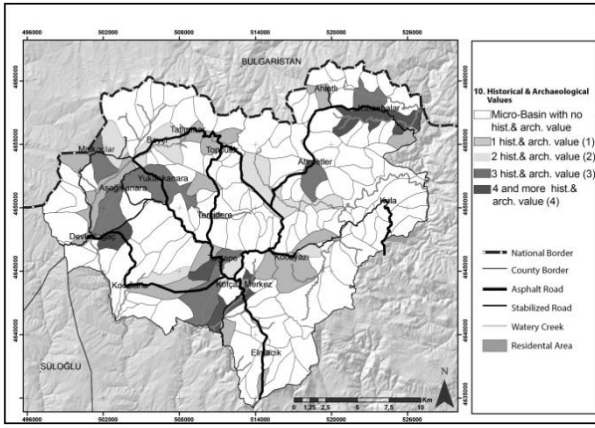


Figure 17. Accessibility to historical archaeological values in micro-basins.

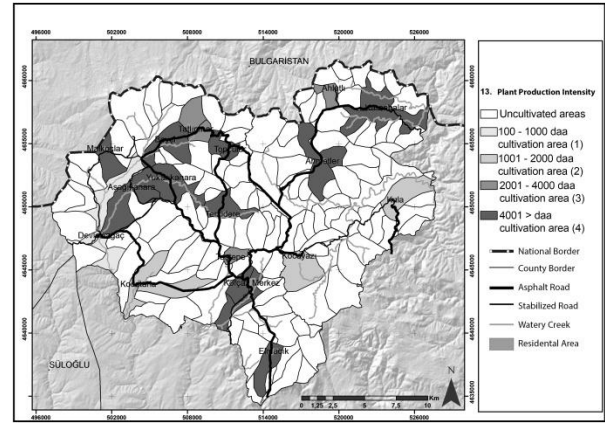


Figure 20. Density of plant production planting area in micro-basins.

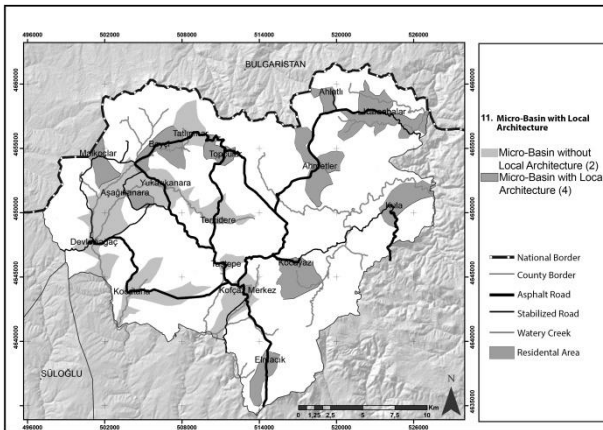


Figure 18. Micro-basins with local architectural structures.

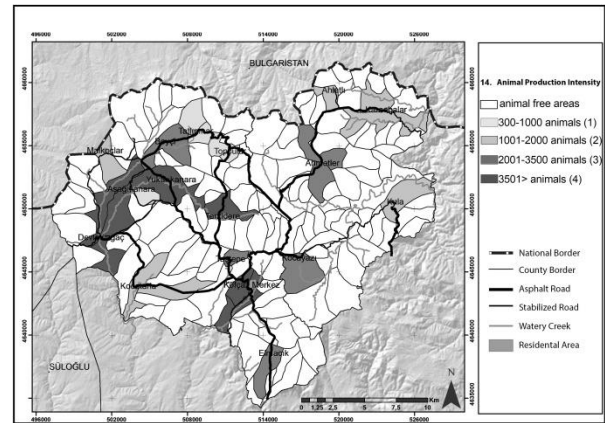


Figure 21. The total amount of cattle and ovine in micro-basins.

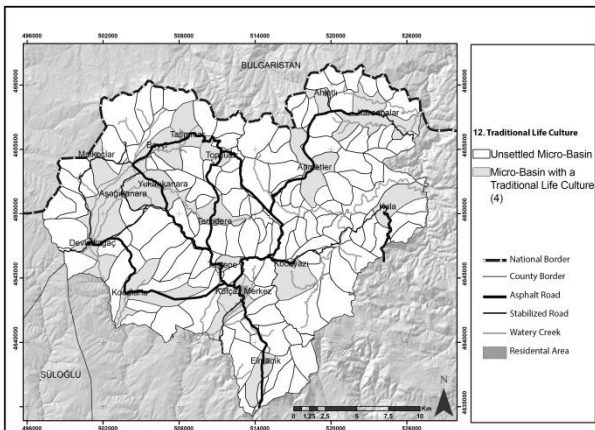


Figure 19. Diversity of traditional life culture in micro-basins.

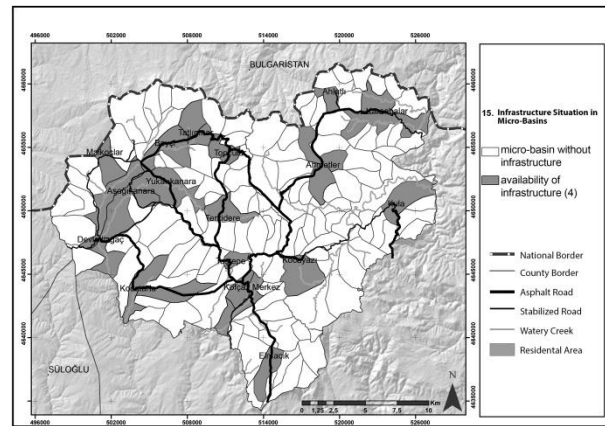


Figure 22. Presence of drinking water, electricity, communication tools in micro-basins.

Cultural Landscape Attractiveness Values of Ecotourism Source: Cultural landscape attractiveness is effective in settlement formation, development of economic structure and shaping of landscape identity (Bahçe, 2009; Erdem, 2012). Within the scope of the study; 4 basic and 7 sub-criteria were evaluated under this title, and mapped in a GIS environment (Table 10; Figures 16–19).

Economic structure diversity: Economic structure forms are the local characteristics of the relevant region and are an important resource value for ecotourism activities. In the study; 2 sub-criteria and 8 parameters related to the diversity of economic structure were discussed (Table 11).

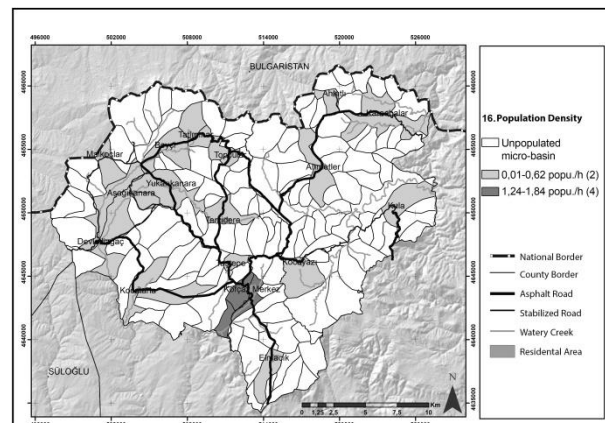


Figure 23. Population density per sqm in micro-basins.

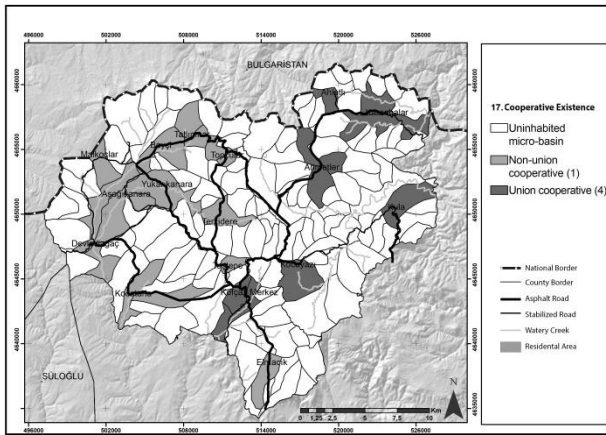


Figure 24. Union-cooperative containing micro-basins.

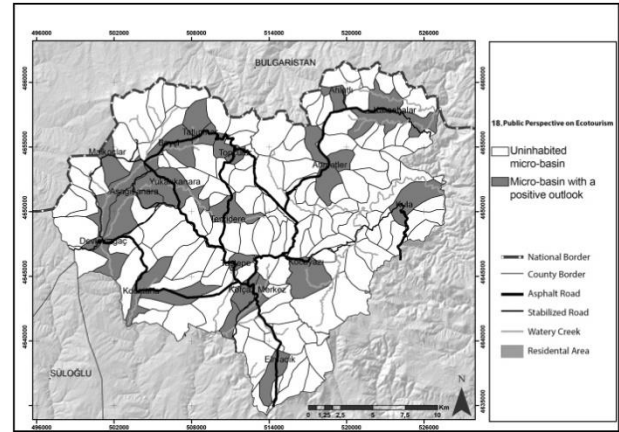


Figure 25. Locals' view of ecotourism.

Status of tourist infrastructure facilities: While infrastructure opportunities in an area where ecotourism development is envisaged are affecting the demand for the region, they are important for increasing accessibility to ecotourism opportunities and continuity of ecotourism (Goeldner and Ritchie, 2002) (Table 11).

Level of organization and social interaction of ecotourism source: In the study; 3 sub-criteria and 6 parameters based on sub-criteria were discussed under this heading (Table 11). All three criteria were values that influence and influence ecotourism.

Table 11. Cultural landscape attractiveness values, economic structure, touristic infrastructure opportunities, level of organization and social interaction criteria of ecotourism source

| Criterion   | Resource  | Evaluation and Figure no.   |
|---|---|---|
| 13.1 Density of plant production planting area in micro-basins                    | Çevik and Tekinel, 1998; Sanır, 2000; Zaman, 2010; Arıbaş, 2010; Tekeli, 2016   | While the settlements of Kofçaz-Center, Elmacık, Ahmetler, Aşağıkanara, Yukarıkanara, Malkoçlar, Terzidere and Karaabalar received 4 points, the micro-basins of Ahlatlı, Tatlıpınar and Taştepe settlements received 3 points (Figure 20). |
| 14.1 The total amount of cattle and ovine in micro-basins                         | Çevik and Tekinel, 1998; Sanır, 2000; Zaman, 2010; Arıbaş, 2010   | The settlements of Aşağıkanara, Yukarıkanara, Devletliagaç, Terzidere and Kofçaz-centeri received 4 points, while the micro-basins of Ahmetler, Kocayazi, Beyci, Elmacik and Taştepe received 3 points. (Figure 21).                        |
| 15.1 Presence of drinking water, electricity, communication tools in micro-basins | Neth, 2008; Türker, 2013; Gültekin, 2014; Kiper <i>et al.</i> , 2015; Salıcı, 2018; Rudianto <i>et al.</i> , 2019; Alam, 2019; Kabataş, 2020; Yiğit, 2020 | All micro-basins with rural settlements received a score of 4 points (Figure 22).   |
| 16.1 Population density per sqm in micro-basins                                   | Şahin, 2009; Tümertekin and Özgüç, 2015).   | Micro-basins in Kofçaz central settlement received a value of 4 points (Figure 23).   |
| 17.1 Union-cooperative containing micro-basins                                    | Anonymous, 2018a  | The micro-basins of Kofçaz center, Ahlatlı, Karaabalar, Ahmetler, Kocayazi and Kula received a score of 4 points (Figure 24).   |
| 18.1 Locals' view of ecotourism   |   | All micro-basins with rural settlements in Kofçaz received a score of 4 points (Figure 25).   |

4. Conclusions

Within the framework of ECOS method developed in the study, the criteria determined within the framework of the 145 micro-basins were applied to the conformity maps created by overlapping the potential field usage

map for ecotourism (Figure 26). In the preparation of ecotourism conformity maps of data layers, the conformity values of the criteria and the weight coefficients determined by AHP technique were based. Afterwards, the total scores for ecotourism compliance of each micro-basin in terms of 23 criteria were calculated

with the collection of points for each micro-basin. The sub-criterion scores obtained in the chart of the method were multiplied by the following weight coefficients obtained as a result of the AHP process, resulting in scores between 184 and 452 for 145 micro-basins. The difference in points is divided into 4 equal parts, sorted according to the value ranges and the number of micro-basins were determined (Table 11).

In addition, various strategies have been developed for the development of areas with less appropriate ecotourism opportunities in the field of study. Strategies were discussed under 6 basic headings aimed at improving ecotourism within the framework of “spatial”, “participatory” and “sustainability” approaches. Related strategies; planning, promotion, entrepreneurship, education and cooperation-organization were shaped in line with the main themes (Table 12).

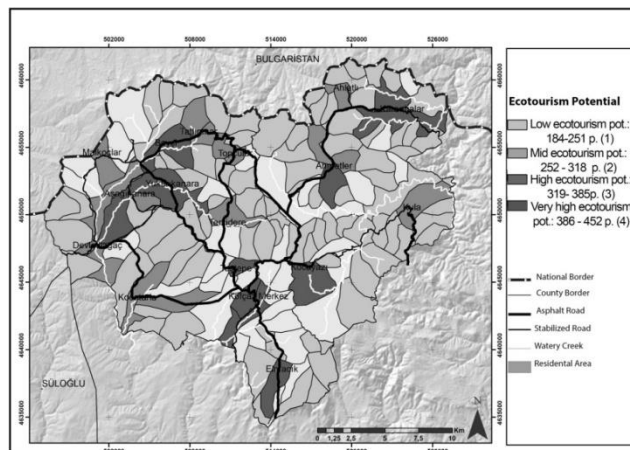


Figure 26. Ecotourism suitability of micro-basin.

ECOS method was used to determine ecotourism development areas within the scope of the study. The related method was developed by differentiating the content, criteria and scope from the ECOS method used in other similar studies. Likewise, in similar studies using ECOS method, evaluations were made based on surveys and expert opinions. Five innovative aspects of this study can be highlighted.

Table 12. Value range of ecotourism opportunity

| Value range of ecotourism opportunity |  | Total |
|---------------------------------------|--|-------|
| between 184-151                       | Low (Microcatchments less suitable for ecotourism)       | 89    |
| between 252-318                       | Mid (Microcatchments mid suitable for ecotourism)        | 31    |
| between 319-385                       | High (Microcatchments suitable for ecotourism)           | 15    |
| between 386-452                       | Very High (Microcatchments very suitable for ecotourism) | 10    |

Table 13. Ecotourism development strategies

| Main theme                  | Strategy   | Approach         |
|-----------------------------|--|------------------|
| Planning                    | Establishment of thematic development corridors for ecotourism   | Spatial          |
|                             | Establishment of thematic development zones for ecotourism   | Environmental    |
| Promotion                   | Creating an ecotourism image   | Social, Economic |
| Promotion, Entrepreneurship | Diversification of economic activities specific to rural settlements within the framework of ecotourism activities | Participatory    |
| Cooperation-Organization    | Ensuring coordination and cooperation among stakeholders for ecotourism and improving organization opportunities   | Social, Economic |
| Education                   | Leadership of local people in ecotourism and raising awareness for tourism   | Social,          |
| Entrepreneurship            |  | Participatory    |

- In different studies, the potential of ecotourism determined at the level of settlements with ECOS method was realized at the level of micro-basins. The micro-basin-level GIS-based data set also contributes significantly to decision makers in managing the potential for that micro-basin and solving the problem of the micro-basin.
- In the study, the use of too many variables within the framework of 23 main and 73 sub-parameters, developed based on natural and cultural landscape attractiveness, accessibility, economic building attractiveness, level of organization with infrastructure possibilities and social interaction, has increased the sensitivity of the study. At the same time, it has ensured that ecological, economic, cultural and social criteria are evaluated together.

- In this study, the integration of bioclimatic comfort with ECOS method is also an innovative approach for recent studies.
- At the micro-basin level, based on space-based data, rapid rural evaluation techniques and participatory understanding of ecotourism strategies are constructed through spatialized data sets at the micro-basins level, making the relationship between space and decision processes concrete and applicable.
- Expert participation in determining the potential of ecotourism (AHP), local government and public opinions were reflected in the decisions in determining the strategy, and participation on different scales was reflected in the process.

As a result, spatialization of ECOS method at the micro-basin level in rural development-oriented ecotourism planning and development of ecotourism management strategies with a participatory process can be effective when done with an interdisciplinary stakeholder group of different scales. The fact that the method approach put forward can be used especially in ecotourism planning on the scale of basins and sub-basins or in studies to be carried out at the provincial level, and that the method is constructed in accordance with universal data sets in different countries, suggests that the method approach put forward by the study can be easily used by experts and decision makers working on the subject at national and international level.

### Acknowledgements

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