

Evaluation of landscape qualities with development guidelines of the Fužine municipality

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The landscape of the municipality of Fužine is characterized as a mountainous landscape of rural settlements. The area faces problems of depopulation and pressures of tourism development on the environment. Basic premise of this paper is derived from the assumption that the values of the landscape are not fully recognized and can become endangered due to implementation of development projects. The aim of the paper is to identify highly valuable areas of the municipality's landscape in order to create guidelines for the development of the area, along with the project program that will preserve important features. The analysis of spatial planning and strategic documentation provides an overview of developmental guidelines, the position of planned interventions, the goals and visions of the progress of the municipality. The landscape evaluation is carried out through analysing the factors of the landscape – natural, anthropogenic and structural – with the available literature and spatial data. The product of analysis and evaluation are models, created using the GIS tool of the QGIS application. Based on the analysis, landscape quality modelling was carried out with the ProVal2000 program, where the factors were grouped in order to evaluate the natural-ecological, social-cultural and visual-experiential qualities of the landscape, with combined quality model indicating where the most valuable spatial zones with high quality landscape features are.

Keywords: municipality of Fužine, natural-ecological values, social-cultural values, visual-experiential values

1 Introduction

1.1 General characteristics of the Fužine municipality

Fužine Municipality is situated in the western part of the territory of the Republic of Croatia (Figure 1), being part of the Primorje-Gorski kotar County since the year 1992 (Ampelos d.o.o., 2016). The Municipality has an area of 86.34 km² and the population of 1,404 residents (Croatian Bureau of Statistics – Population, 2021) which makes a low population density of 16.3 people per km² (Ampelos d.o.o., 2016). The Municipality is part of the mountainous region of Gorski kotar. Fužine has a favorable geospatial position in the County due to its closeness to the County's center Rijeka (Figure 1), and to Karlovac and the country's main capital Zagreb. This is all due to the Municipality's position on the regional highway A6 (A6 Croatia, 2023) and two historical roads Karolina and Lujzijana (JU Zavod za prostorno uređenje Primorsko-goranske županije, 2021) which enabled in the first place the formation of settlements in the Municipality. The microregion

of Gorski Kotar and its local self-government units have been experiencing continuous demographic regression for 100 years or more (Lajić & Klempić Bogadi, 2010). From the beginning of the 20th century until the 21st century, the number of inhabitants in the Municipality decreased by 39% (Lajić & Klempić Bogadi, 2010) due to the consequences of long-term emigration of inhabitants, low birth rates and high mortality (JU Zavod za prostorno uređenje Primorsko-goranske županije, 2021). The area of the Municipality is of a rural character with mountainous landscape and scattered rural settlements, therefore there is a tendency for developing rural tourism. This type of tourism is based on the agritourism offer, recognition and inclusion of local agricultural products in the tourist offer, local customs and manifestations, elements of cultural and natural heritage (Adria Bonus d.o.o., 2019) with the development of recreational infrastructure (Adria Bonus d.o.o., 2019), which contributes to a higher quality of tourism in the area of the Municipality. There is also a certain

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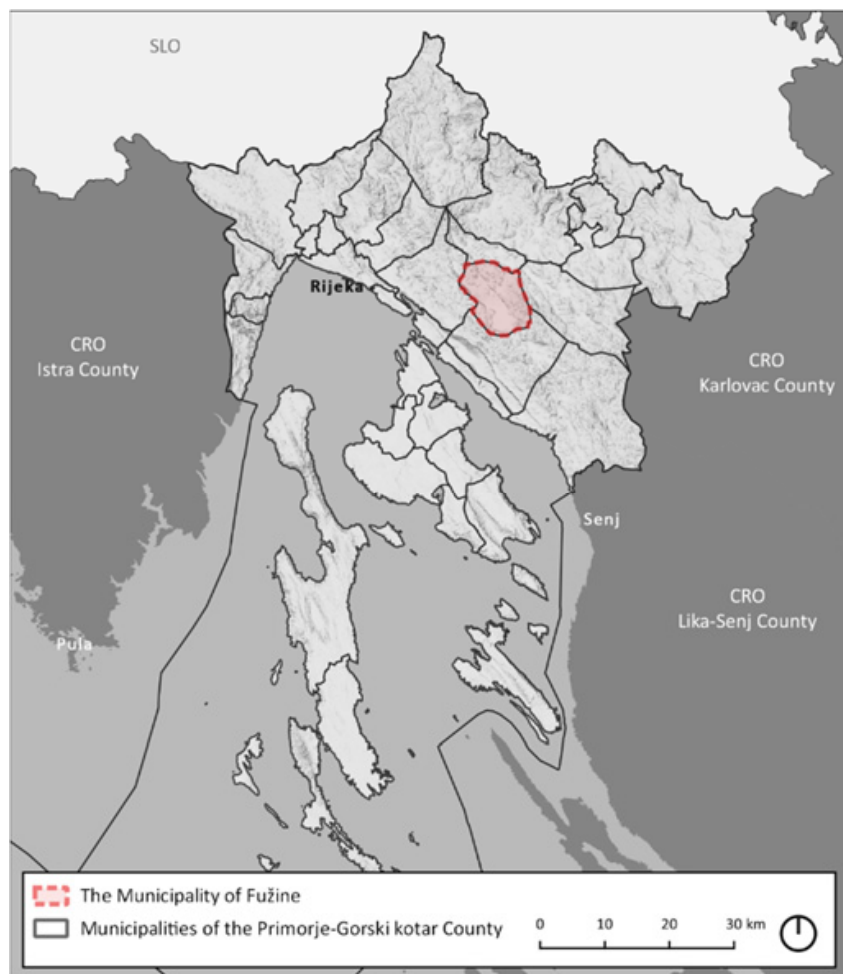


Figure 1 The geographical position of the location within a wider area

resiliency of rural landscapes due to its small settlements and spatial seclusion. The number of tourists visiting the Municipality is therefore growing each year (Croatian Bureau of Statistics – Tourism, 2021).

1.2 Spatial planning documentation and strategic documents

The Spatial Plan of the Primorje-Gorski kotar County (JU Zavod za prostorno uređenje Primorsko-goranske županije, 2018) and the Spatial Plan of the Municipality of Fužine (Plan 21 d.o.o., 2020) were analysed, as well as their planned land uses and development projects. The areas of interest are hospitality-tourism and sports and recreational type with their development

projects. These types of projects tend to develop on vulnerable and valuable areas of landscape so it was necessary to determine their position in the Municipality.

Along with Spatial Plans, Strategic documents were analysed as well – Local Development Strategy of LAG Gorski kotar (Centum Percent d.o.o., 2014), Developmental Strategy of the Municipality (Ampelos d.o.o., 2016) and Developmental Strategy of Tourism (Adria Bonus d.o.o., 2019). The Developmental Strategy of the Municipality was written for the period from 2016 to 2020. The development goals are still in the initial phase of realization, as well as development projects. It is necessary to create a new strategy that will more thoroughly elaborate

the existing goals, introduce new ones that are more based on the evaluation and preservation of the natural qualities of the landscape. The goals of the LAG and the Municipality largely coincide. What is missing from both documents is one of the goals that will be based on the protection of the existing values of the landscape and natural heritage, the evaluation and recognition of its quality, the aspiration to introduce certain areas under spatial planning protection as it is proposed in Spatial Plan of Municipality (Plan 21 d.o.o., 2020). The Developmental Strategy of Tourism, written for the period from 2019 to 2025, in contrast to the Developmental Strategy of the Municipality, does not have sufficiently precisely designed goals – they are based on general guidelines such as: improving the standard of living, forming a tourist offer based on sustainable development and ecology, improving the existing and creating new tourism offers, and overall social development.

The goals of all the strategic documents aim to prevent the depopulation of the Municipality, encourage economic and social development, and strengthen the tourist offer by creating year-round rural tourism. The goals recognize the value of the municipality's natural heritage and landscape quality, but there is a lack of defined activities that would preserve and develop these values.

2 Material and methods

2.1 Description of the area

As a summary of all factors of the landscape, an adapted spatial analysis according to Kevin Lynch (Lynch, 1960) was carried out. Five structural elements that make up the landscape of the municipality of Fužine have been singled out – areas, edges, roads, nodes, and landmarks.

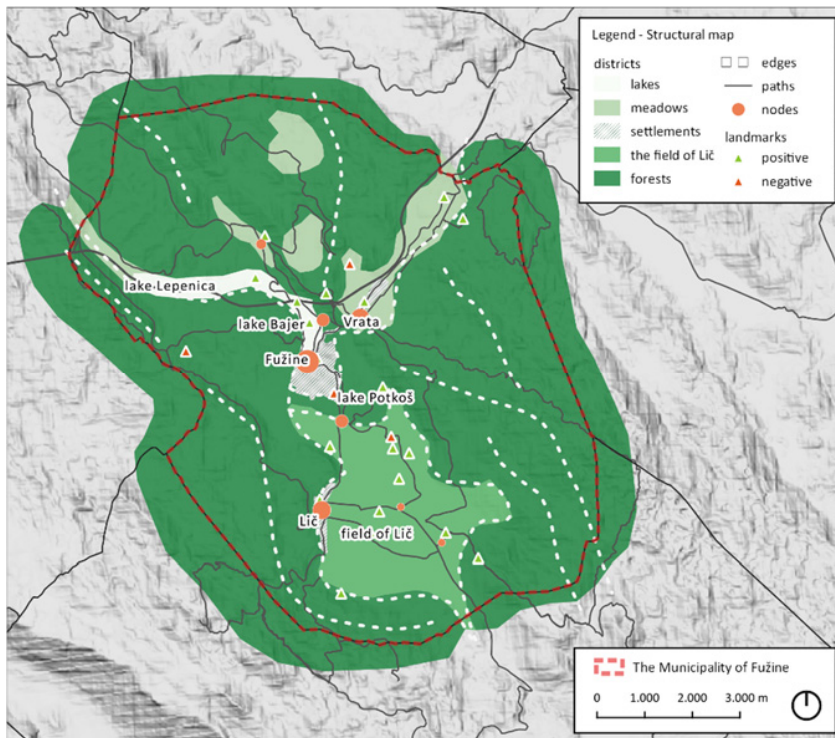


Figure 2 Structural map of the wider coverage area – the Municipality of Fužine

The analysis is based on a personal assessment of the area, but also an assessment based on spatial data and literary sources analysed through the work in the period from December 2021 to March 2022.

In the territory of the Municipality, the most dominant areas are forested areas of beech and silver fir (Figure 2) in areas of indented terrain at high altitudes (Plan 21 d.o.o., 2020). In contrast to the forests, the Lič field (Figure 2) forms on a flattened terrain, containing various of small habitats of agricultural fields and pastures (Ampelos d.o.o., 2016). The edges (Figure 2) that define the landscape are most noticeable as the edge of the forest areas, but also the edges of the mountain slopes, only as a visual break in the landscape plans. Paths are formed according to the existing abundant infrastructure (JU Zavod za prostorno uređenje Primorsko-goranske županije, 2021) of major roads – state roads and highways – and bicycle and pedestrian paths which are recognized as valuable

elements of main communications within the Municipality (Figure 2). Despite the naturalness of the area, the network of roads is very branched and allows the user to access and experience all the interesting features that the landscape has to offer. Nodes emerge from the paths (Figure 2) as moments of confluence of a large number of users in certain areas. These meetings are strongest in the center of the settlement Fužine. The next important point is in the village Vrata (Figure 2) due to the arrival of users via highway A6. An important junction is also in the settlement Lič (Figure 2), where several cycling and pedestrian routes connect (Cycling Trail of Gorski kotar, 2022), thus achieving a greater flow of users.

Landmarks are structurally and visually prominent elements of the Municipality. Negative landmarks represent industrial and business zones located in settlements and two quarries (Figure 2). Positive landmarks (Figure 2) represent the natural and

cultural values (Registar kulturnih dobara, 2023) of the landscape, alongside with recreational and tourist offer (Tourist info Fužine, 2023). Here are also singled out lakes Bajer, Lepenica and Potkoš, microelements of puddles in Ličko polje and several natural springs, sacred buildings and viewpoints above the settlement of Fužine, from which picturesque views are opened of the rural landscape of Fužine.

2.2 Landscape evaluation method

Methodological approaches to the analysis and evaluation of landscape were derived from the field of landscape-ecological planning and assessment. Steiniz's "Framework" method is a process of landscape assessment and the involvement of experts, scientists, and all participants in an informed and participatory planning process (Ahern, 2006). The method is applicable to "ABC" goals (Ahern, 2006) and adaptable to any context of strategic planning. The "Framework" method tends to propose future alternative scenarios, visions of spatial and landscape development. This method served as an auxiliary framework when reviewing the landscape factors of the Municipality, synthesizing their most important items and carrying them through the evaluation process by deciding which elements of the landscape factors are important, what their values are in the context of the natural-ecological, social-cultural and visual-experiential aspect of the landscape. The next method, LANDEP (Kozova & Mišikova, 2008), implies an optimization method of an integrative approach to landscape planning. This method suggests the most suitable spatial distribution of socio-economic activities. The method is conceived through five steps: landscape-ecological analysis, landscape-ecological interpretation, landscape-ecological evaluation,

landscape-ecological proposal (optimization). With this approach, steps 1 and 4 were carried out through the systematization of landscape factors, their analysis and ultimately evaluation as part of point 4. Point 3 was adapted and implemented as part of the analysis of the structural characteristics of the landscape. The last step is carried out in the form of creating guidelines and a project program for the development of the landscape. The last approach to evaluation that was taken into account is "Landscape values and perceptions" (Kozova & Mišikova, 2008) – landscape qualities and their experiences. This method studies how landscape values are perceived by people and how they experience them and thereby create interactions with the space in which they live (Kozova & Mišikova, 2008). This method was taken into account when evaluating the visual-experiential qualities of the landscape and performing the analysis of visual features, based on personal perception.

Landscape evaluation begins with the determination of landscape quality criteria. Evaluation as such implies primarily identifying the quality and value of the landscape based on its spatial components and synthesizing the interrelationship of factors. Value is therefore defined as an attribute of landscape factors based on the objective parameters of the environmental, spatial, social, and visual characteristics of those factors. The areas that are generated in the landscape as the most valuable are also the most sensitive to spatial changes.

The process of creating the paper includes cabinet research methods – a review of scientific and professional literature and the preparation and processing of data using GIS (Geographic Information System) tools. Modelling of quality evaluation was done using the vulnerability method i.e., by adding a degree of value to individual spatial factors. In this work, the models do not indicate the vulnerability of the landscape quality in relation to the planned activity or intervention in the space, but model the values of the landscape as such with the aim of determining them before planning future interventions in the space. The process of evaluation goes by creating simulation models that represent simplified models of spatial characteristics and simulated values depending on the groups of factors that make up one of the three domains of landscape qualities. The models simulate the most valuable spaces. Value modelling was carried out in the GIS applications ProVal2000 and QGIS 3.16.14. Hannover. The spatial scope is all within the boundaries of the administrative unit of the municipality of Fužine, and the homogeneous spatial unit of work in the ProVal2000 application is 5×5 m. The values are graded in a scale from 0 to 5, meaning that grade 0 has no value and grade 5 has very high value. The criteria for grading

models therefore creating the scale from 0 to 5, is based on certain characteristics of landscape factors learned from scientific literature and from personal assessment. Spatial data of landscape factors are grouped depending on the three types of qualities that are evaluated – natural-ecological, social-cultural, and visual-experiential qualities. Polygonal spatial data were directly evaluated by adding certain value ratings through value matrices, while the rest of the data was evaluated through distance buffers that represent influential zones from the factors themselves. The obtained matrices are joined by the arithmetic functions "Multi sum" and "Multi max" which, when overlapping the matrices, calculate the value of each spatial unit depending on the values of the input matrices.

3 Results and discussion

3.1 Natural-ecological landscape qualities

During evaluation, the landscape actors were grouped into four groups. The first group refers to the natural surface cover and habitat types. The second group represents areas of the Ecological Network Natura 2000. The third group includes all elements of the hydrological system of the area, while the fourth group includes the terrain features. The criteria used in the evaluation of the first group refer to the biodiversity of the habitat, the significance of the habitat for flora and fauna, whether the habitats are endangered, and the importance of the habitat for the Ecological Network. The criteria for evaluating the hydrological system also refer to the biodiversity of river courses and stagnant water bodies, the current state of water quality and the way water is used. The criteria for terrain features refer to the accessibility of the territory depending on the percentage of the slope and the spatial orientation of the terrain forms. The criteria for the Ecological Network unite them all. The final model of the natural-ecological qualities of the landscape indicates that the most valuable areas (Figure 3) are the small zone of the Lepenice watercourse up to the point where it flows into the lake of the same name, lake Potkoš, the hills that rise northeast of lake Bajer and the settlement of Fužine, and microlocations along the Kostanjevica watercourse. Areas of high value (Figure 3.) are meadows of the Lič field, a wider strip of water corridors, lake Potkoš, lakes Bajer and Lepenica. This includes parts of forest areas, especially along watercourses.

3.2 Socio-cultural landscape qualities

Elements of evaluating these qualities consist of human infrastructure such as settlement areas, traffic infrastructure, pedestrian and bicycle infrastructure,

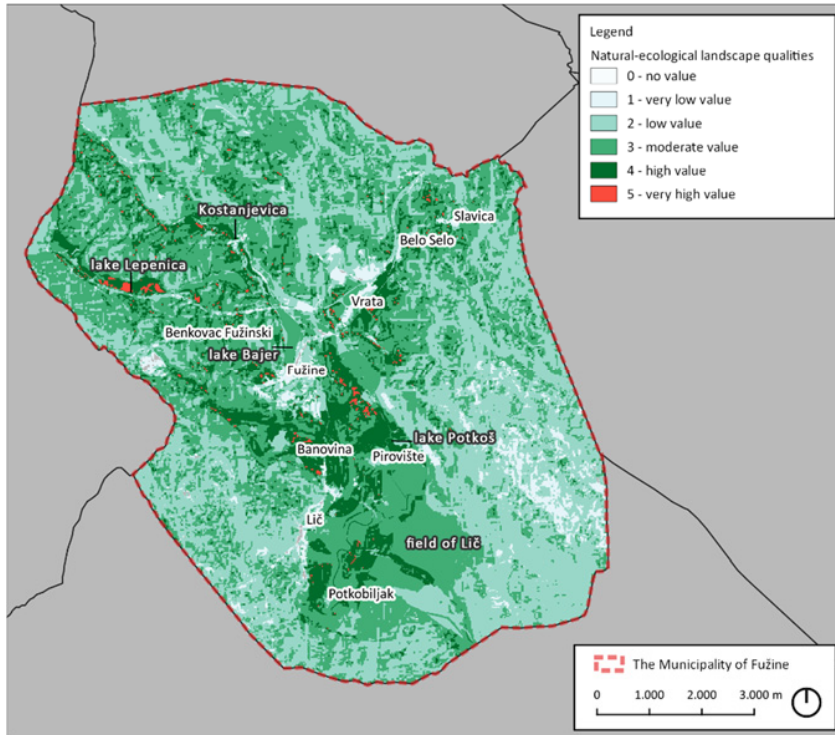


Figure 3 Overview of natural-ecological landscape qualities of the Fužine Municipality

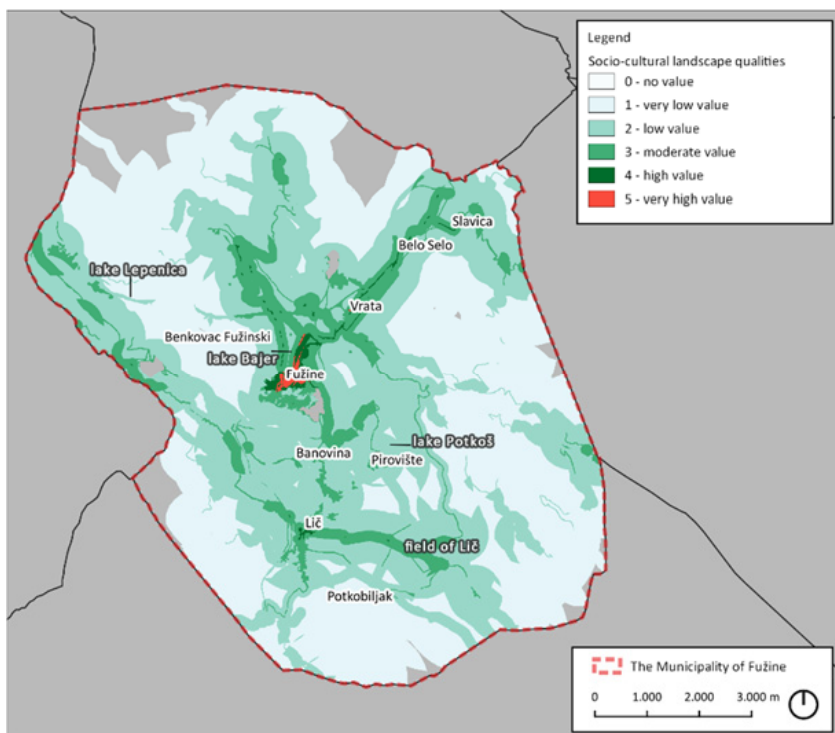


Figure 4 Overview of socio-cultural landscape qualities of the Fužine municipality

cultural heritage, social tourism facilities. The criteria for evaluating the elements that make up the socio-cultural qualities of the landscape are based on the distribution and quantity of social-tourist content, the value of cultural heritage, the condition and distribution of the bicycle-pedestrian network, abundance of the elements of cultural heritage, amount of social, service, business and recreational-tourist type contents. The final combined model of socio-cultural values indicates that the area of the Fužine settlement itself and part of the eastern shore of Lake Bajer are the most valuable (Figure 4). The narrowest zones along the bicycle and pedestrian paths and some of the contents are also recognized as valuable spaces (Figure 4). These paths go north to the center of Fužine along Lake Bajer, northeast through the settlements of Vrata, Belo Selo, and Slavica and pass through the Lič field, where the Lič settlement was generated as one of the valuable spatial points (Figure 4).

3.3 Visual-experiential landscape qualities

The parameters taken into account during evaluation are the visual exposure of the space, interesting natural habitats, and positive and negative landmarks. The criteria for evaluating these parameters refer to the degree of attractiveness i.e., the representativeness of the space, visual integrity, coherence, complexity, and the overall impression of the landscape. Visual and experiential qualities are important in planning the development of the space during the placement of interventions in the space, their construction typology which is ultimately the most perceived by the user. The areas in the town of Fužine and lake Bajer (Figure 5) are of high value, alongside several locations in Banovina, Lič and Lič field (Figure 5). These locations

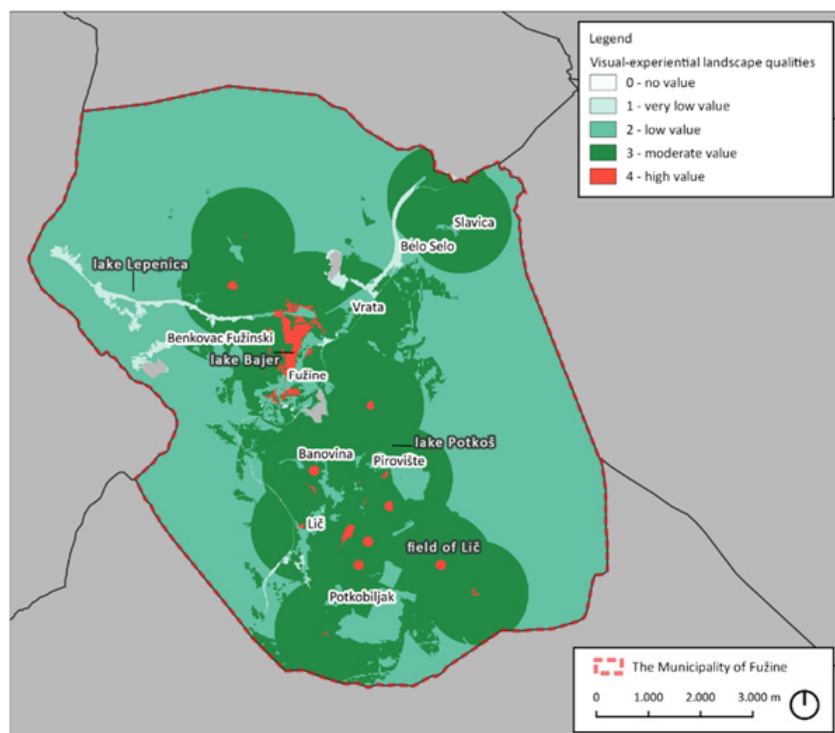


Figure 5 Overview of visual-experiential landscape qualities of the Fužine Municipality

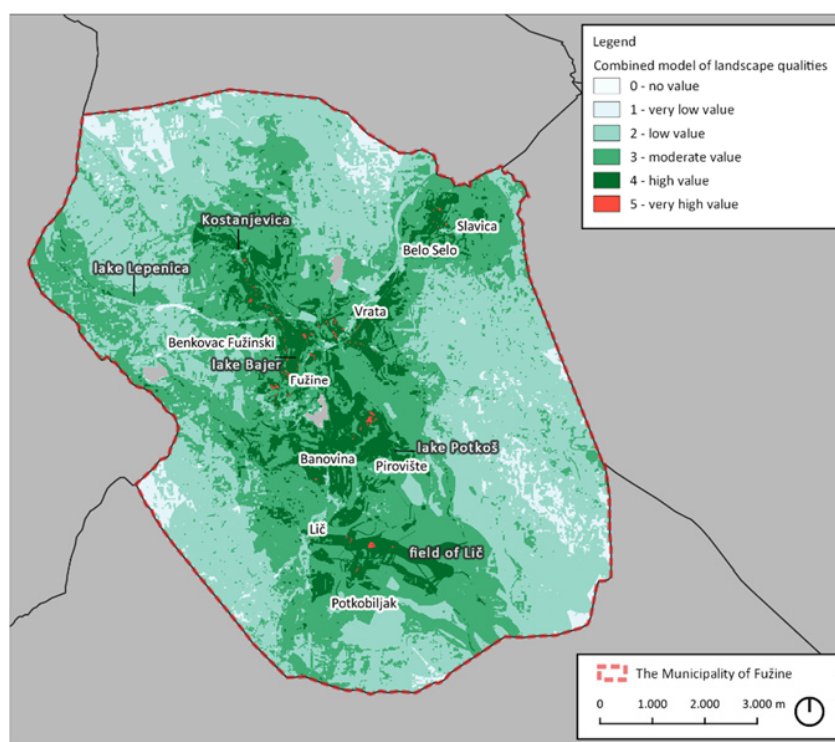


Figure 6 Overview of the combined model of landscape qualities of the Fužine municipality

are attractive, have good visual integrity and are complex because of their biological and social features. The areas of moderate value form visual circles surrounding at the settlements and the whole of Lič field (Figure 5).

3.4 Final combined model

The final quality model concludes that areas of high value are spread across the center of the Municipality (Figure 6) – Lake Bajer with its coastal strip, the Ličanka watercourse along the lake itself to its source and part of the Kostanjevica watercourse, hilly and mesophilic meadows that extend in the northeast of the Municipality in the settlements of Vrata, Belo Selo, and Slavica, and mesophilic meadows to the south in the Lič field, the forest around the lake Potkoš; it also includes parts of the hills where there are viewpoints above the settlement of Fužine and micro-locations in the Lič field. In these areas, interesting socio-tourist contents are also included. These zones are at the same time the most visible from most viewpoints of the Municipality, especially the surrounding hills that border the plain areas. It also includes micro-habitats such as puddles, springs and aquatic vegetation by the lakes. Areas of high value (Figure 6) include parts of some of the cycling and hiking-mountaineering routes, especially in the field.

The final model is then overlapped with the Spatial Plan of the Fužine Municipality (Plan 21 d.o.o., 2020) to see where certain types of development projects and zones are situated. It is seen in the model (Figure 7) that most of the zones are placed on areas of very high or high value of landscape qualities. Most of the projects proposed by the Plan are hotels, camps, ski-resorts, parks, botanical garden, etc. which are desirable projects for the Municipality. Their implementation

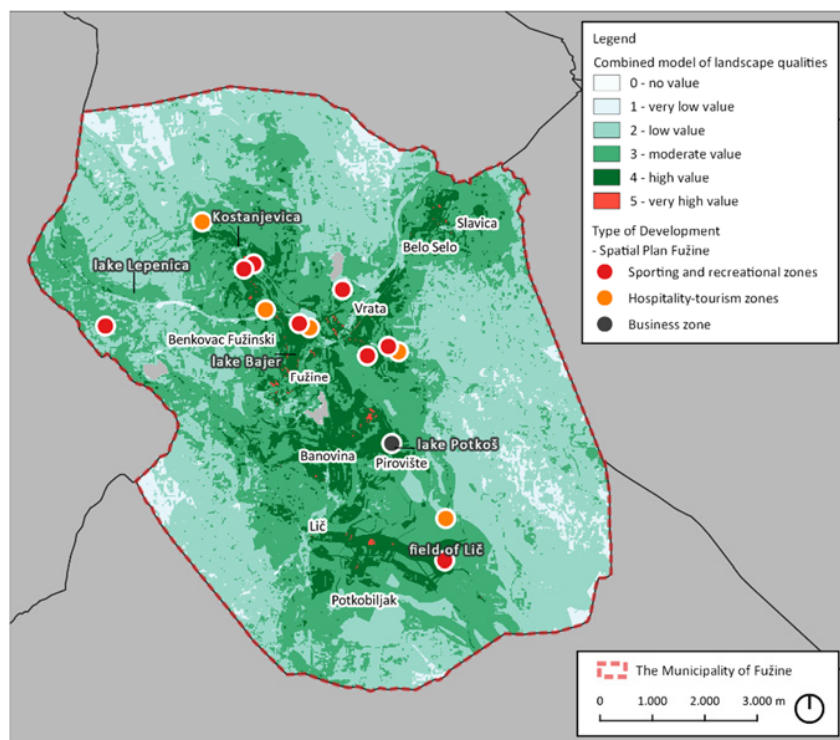


Figure 7 Overview of the overlap of developmental zones of the Spatial Plan and the combined model of landscape qualities of the Fužine municipality

and construction will bring changes to the landscape so it is necessary to take into account these valuable landscapes qualities. Another project that is proposed is a trade center with various small businesses and fairs, located just above Pirovište (Figure 7) on a small patch of wetland. The vulnerability of the habitat needs to be taken into account when developing this project.

3.5 Development guidelines

As a result of landscape evaluation, developmental guidelines were proposed. These consist of:

- guidelines for the preservation and management of the natural and ecological qualities of the landscape of the Municipality which focus on the protection and management of natural and semi-natural habitats; these guidelines are proposed for certain types of natural areas such as forest areas and habitats, mesophilic meadows,

mountain meadows (pastures), abandoned agricultural areas, agricultural areas, standing water bodies, watercourses, springs and puddles, areas proposed for protection;

- guidelines for the preservation and development of the socio-cultural qualities of the municipality's landscape which focus on social and cultural contents, bicycle and pedestrian infrastructure, excursion areas, hospitality-tourism and sports-recreational zones, rural tourism – interactive and educational roads/trails, botanical garden/arboretum;
- guidelines for the preservation and development of visual and experiential qualities of the landscape of the Municipality which focus on preserving the picturesque landscape of the Municipality.

4 Conclusions

The analysis of these valuable areas of landscape and the zones of various uses defined in the Spatial Plan of the Municipality of Fužine show that the areas for hospitality-tourist, sports, recreational, and business activities are planned precisely on these highly valuable areas. The fact that the qualities of the landscape of the Municipality were not fully recognized or evaluated before the creation of the Plan leads to its location in highly valuable areas, thereby the thesis of this paper is confirmed. The planned zones aim at the construction of smaller tourist complexes, camps, ski resorts or the construction of production facilities. These interventions are certainly desirable and needed for the development of the Municipality, but their implementation should be approached with emphasis on the environment, in which they are placed, in order to prevent and reduce negative impacts.

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