sciendo

DOI: 10.2478/ahr-2022-0003
Acta hort regiotec, 25, 2022(1): 21–27

Research Article

Landscape values of the Island of Jakljan, Dubrovnik – Neretva County in Croatia

Dora Tomić Reljić[1]*, Lara Bogovac[2], Višnja Šteko[2], Petra Pereković[1], Monika Kamenečki[1], Ines Hrdalo[1]

[1]*University of Zagreb Faculty of Agriculture, Division of Horticulture and Landscape Architecture, Croatia*
[2]*Green Infrastructure LTD., Croatia*

Article Details: Received: 2022-02-01 | Accepted: 2022-03-09 | Available online: 2022-05-31

This paper aims to present an approach to landscape evaluation, on the example of the island of Jakljan, which is a part of the Elaphiti Islands in the Dubrovnik Neretva County. Special emphasis is placed on the evaluation of natural, cultural, and visual qualities, which were identified in order to direct their protection in future development processes taking into account their role in the landscape. After determining the main qualities, the submodels of individual landscape qualities were determined. Next, the relationship between landscape quality and potential quality degradation was analysed, and a database of spatial data was prepared. Natural qualities included biodiversity valuation and perception of naturalness of the most dominant landscape patterns in this area. Cultural qualities included agricultural landscape evaluation and cultural-historic heritage. Finally, based on the evaluation of the visual units and visually attractive and authentic elements of the landscape and the analysis of visual exposure, a final model of visual landscape qualities was carried out. Evaluation maps were obtained using the GIS tools. The paper pointed out the most important values which must not be lost if the existing character of the space is to be preserved.

Keywords: landscape qualities, evaluation, Jakljan island, modelling

1 Introduction

Landscape is not just space and it is not an objective thing; it is an expression of the perception of space that people share, value and use (Olwig, 2007). Landscape can also be defined as a historical document that contains evidence of a long process of interrelationships between society and its material environment (Eiter, 2010). Given that the landscape is a complex system (Jorgensen, 2015), a great deal of effort is needed to simplify this complexity. According to Deming and Swaffield (2011) modelling is a research strategy based on simplification. Namely, most methods of landscape valuation are focused on the qualities of landscape forms, which are determined by geographical methods such as; mapping certain landscape features and attributing importance to these features or transferring analysis results in the form of landscape typologies or value maps (Stephenson, 2010). However, the determination of landscape qualities that are related to a person's relationship to the landscape cannot be conveyed by a geographical approach, and therefore social research that focuses on perception can be used (Stephenson, 2010). In interdisciplinary research, the classical division into quantitative and qualitative research is almost non-existent or completely unclear, which is especially noticeable in landscape analyses that seek to understand different socio-ecological relationships (Tobi & van den Brink, 2017).

The island of Jakljan, the research area, has a predominant natural character of the landscape which, in addition to valuable natural heritage and visual qualities, also has a valuable cultural heritage. Planned construction of tourist and recreational facilities and transport infrastructure will partially or significantly change the area; its completeness will be dissipated. The aim of this paper is to reconcile the interests between landscape protection, cultural heritage and the development of the Island of Jakljan. Therefore, it is necessary to enable the preservation of the existing landscape and cultural values of the research area, with the development of planned contents. An evaluation of the natural, cultural,

***Corresponding Author:** Dora Tomić Reljić, University of Zagreb Faculty of Agriculture, Zagreb, Croatia
ORCID: https://orcid.org/0000-0002-9774-4158

and visual values of the entire island of Jakljan has been made. The paper will propose guidelines for protection and regulation that will be based on evaluation, but will also take into consideration development potentials and needs of the Island. The main goals of this paper are (1) analysis of all natural, cultural and visual features of the subject area, (2) typological classification of visual landscape units in the observed area, and (3) assessment of existing landscape qualities (natural, cultural, visual qualities).

2 Material and methods

2.1 Description of the area

The southernmost county in Croatia, the Dubrovnik-Neretva County, consists of a coastal zone and a sea area with islands and peninsulas. The research area is located on the island of Jakljan, which is a part of the Elaphiti Islands. As one of the northernmost Elaphiti islands, it administratively belongs to the City of Dubrovnik, and the only area built on it is the former summer resort in the main bay, V. Jakljan (Fig. 1).

The design of the structural and visual characteristics of the subject area is conditioned by the pronounced natural features of this abandoned and uninhabited island. Spatial structure of the island of Jakljan is determined by its relief characteristics, since in terms of vegetation, the entire area is now dominated by forest vegetation. Main feature of the island is the division into an undivided, very narrow and steep SW ridge, facing the open sea and the wider, flatter NE slopes of the island facing the end of the Koločep Channel. The observed area of the island of Jakljan is irregular in shape, indented in relief. It includes an area of a more pronounced homogeneity, determined by the dominant forest vegetation. Anthropogenic impact is only slightly more pronounced in recent times, with the clearing of forest vegetation on the slopes in the bay V. Jakljan and the establishment of fig plantations, which significantly changed the visual characteristics of this part of the bay. Other anthropogenic elements, also located and concentrated only in the bay of V. Jakljan, today are slowly being lost within the forest vegetation and enhance the natural character of the rest of the Island. Overgrown area with forest vegetation and the varied relief make it impossible to see the wider area.

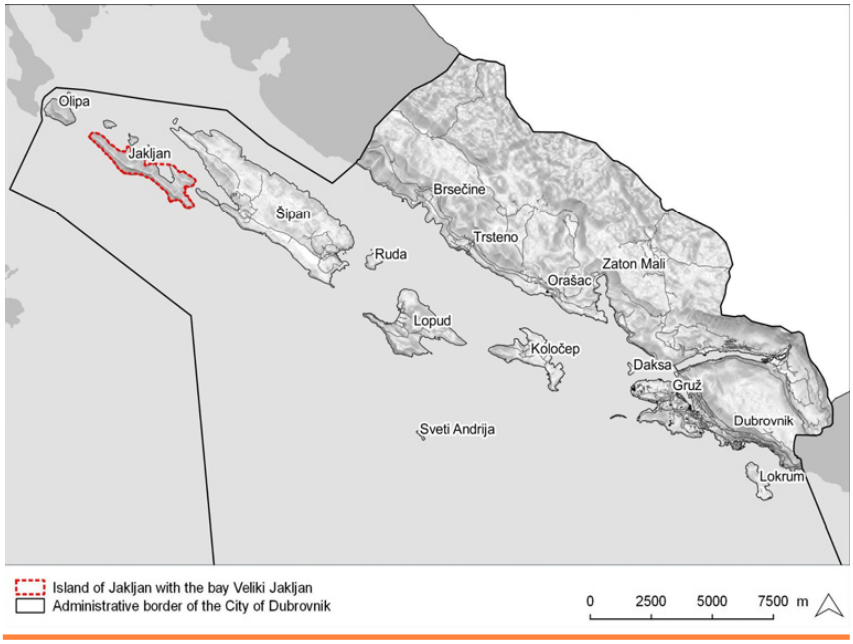

Figure 1 The geographical position of the location within a wider area

Observing the island of Jakljan (Fig. 2), the area under natural forest vegetation dominates (mostly high, mixed vegetation, but also transitional stages of the same), which is significant and the only contrast is the newly established

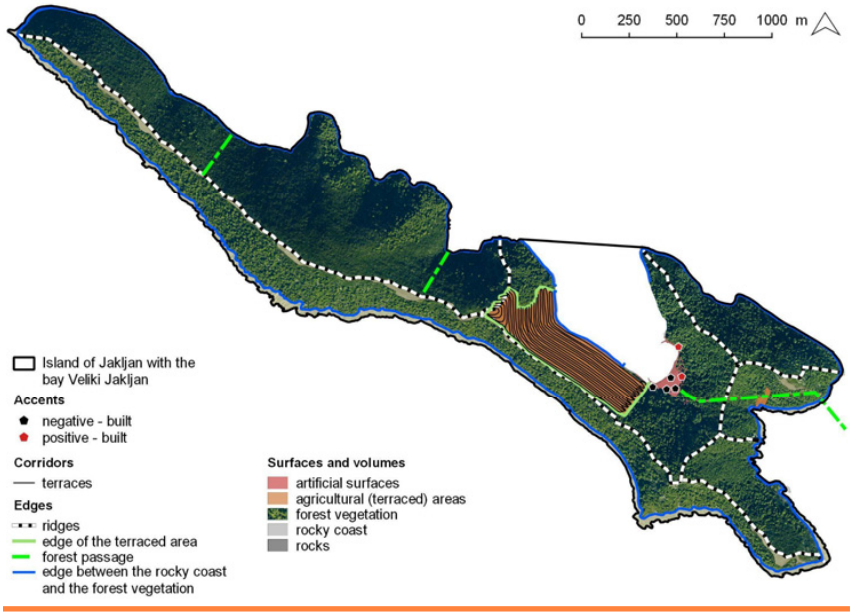

Figure 2 Structural map of the wider coverage area – the island of Jakljan

fig plantation in the bay V. Jakljan, and slightly less built coastal edge/ promenade, beach, piers next to the former resort complex.

Structures that stand out from the environment with their height, shape or purpose are important as structures for navigating space, and they are the accents within the observed area. On the island they are represented by the neglected church of St. Izidore, and in the bay V. Jakljan there are several buildings but all neglected and in ruins.

2.2 *Evaluation of existing landscape qualities*

Evaluation involves identifying the quality and value of the landscape and determining the level of integrity of all components that define and constitute its dominant characteristics.

Methodology of landscape evaluation, the basic issue of this paper, is one of the most frequently used research strategies in environmental design. Marušič (1991) defines it as the recognition of the person´s relationship towards landscape. Modelling is recognized as an appropriate evaluation method because it interprets and simplifies complex systems of environmental quality in the planning context, especially considering their reflection on its future state, which cannot be scientifically verified in the present (Butula et al., 2009). Falconer et al. (2013) believe that the use of modelling in GIS contributes to the accessibility but comprehensibility of a large number of complex issues to the public.

After determining the main qualities, the submodels of individual landscape qualities were conceptually determined. Next, the relationship between landscape quality and potential quality degradation was analysed, and a database of spatial data was prepared. It was used for modelling three specific landscape qualities; natural, visual and cultural. Evaluation modelling was performed in GIS applications ProVal2000 and QGIS, and the homogeneous spatial unit was 5 × 5 m in size. Polygonal spatial data were evaluated directly through value matrices, while other spatial data were evaluated through distance buffer zones. The obtained matrices are connected by arithmetic functions Multi sum and Multi max (ProVal2000) which, after overlapping, calculate the value of each spatial unit with respect to the values of all input matrices. When using the arithmetic function Multi sum (ProVal2000) to connect two or more matrices, depending on the need, weighting factors were used. By including a weight, all values are multiplied by the value of the same, which increases their value in the further process of merging and overlapping. Weights were used in the evaluation of terrestrial and marine habitats for natural and ecological qualities and cultural heritage sites (churches, fortifications and archaeological sites in the sea) for cultural and historical qualities.

3 Results and discussion

3.1 *Natural landscape qualities*

Values of natural landscape qualities are defined primarily with regard to the (a) biodiversity (Fig. 3a) and (b) perception of naturalness of the most dominant landscape patterns in this area (Fig. 3b): the sea with associated rocky and pebble shores, and forests and forest vegetation. In the evaluation of the area from the aspect of biodiversity, terrestrial and marine habitats were evaluated. Maps of terrestrial and marine habitats of the coverage area served as the basis for the evaluation. The evaluation criteria are based on the quality of the present habitat types and their importance for the overall biodiversity of the island of Jakljan. Diversity of the shores of this area is an important element of the naturalness of the landscape, and is therefore taken into account when making submodels. Vegetation of macchia

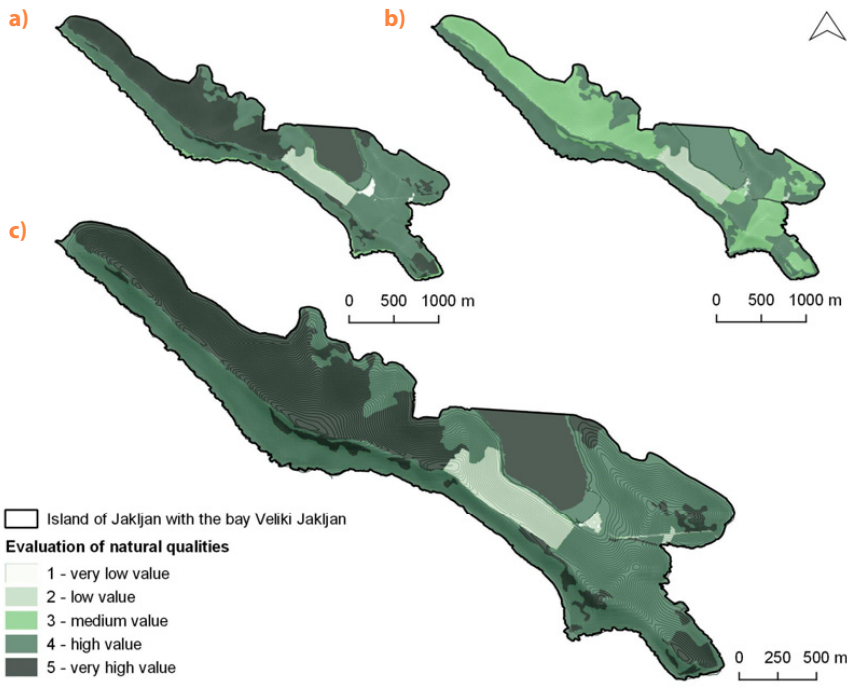

Figure 3 Overview of natural qualities of the wider observed area

and forests, and rocks and rocky shores are valued mainly because of their naturalness, but also their role in the structure and perception of the landscape. Furthermore, the values are determined by the distances from the water elements – springs and torrents, where the value decreases with distance. An important component of the natural qualities of the landscape of the researched area are the relief forms that significantly contribute to the perception of the natural structure of the island space. Therefore, rocky shores are defined as the highest quality of the relief structure of the natural landscape. The final model of natural qualities was obtained by overlapping and merging the sub-model of natural qualities from the aspect of biodiversity (Fig. 3a) and from the aspect of natural qualities of the landscape (Fig. 3b). The final result is an evaluation model of natural qualities, on a scale of one (1) to five (5) (Fig. 3c).

3.2 Cultural landscape qualities

Agricultural landscapes in the investigated area were evaluated from the aspect of structure and from the aspect of the existing and historical way of land use. The first aspect was evaluated by a direct approach based on the criteria of the importance of agricultural land in spatial integrity, readability of structural features, which included terraces and canals. The second aspect was evaluated on the basis of the potential for future use in the case of restoration of now neglected and overgrown areas that according to the interpretation of orthophotos from 1968 and the Austro-Hungarian cadastre from 1837 were once used as olive groves and vineyards. Furthermore, due to the possibility of expanding these zones, agricultural areas in today's land use (orchards) and partially neglected agricultural areas that are still read in the area were taken into account.

Although it was not permanently inhabited, the island of Jakljan contains historical physical structures and archaeological remains that testify to the continuity of living and using this area in close connection with the neighbouring island of Šipan. The mentioned historical architectural structures have been preserved in the bay of V. Jakljan, in the northern part of the island (remains of the fort) and in some southern parts of the island, which has preserved traces of intensive agricultural cultivation.

The final model of cultural qualities was obtained by overlapping and merging the sub-model of quality and potential of the agricultural landscape and the sub-model of cultural heritage. The final result of the association is a value map with rated areas of overall cultural and historical qualities, on a scale of one (1) to five (5). (Fig. 4)

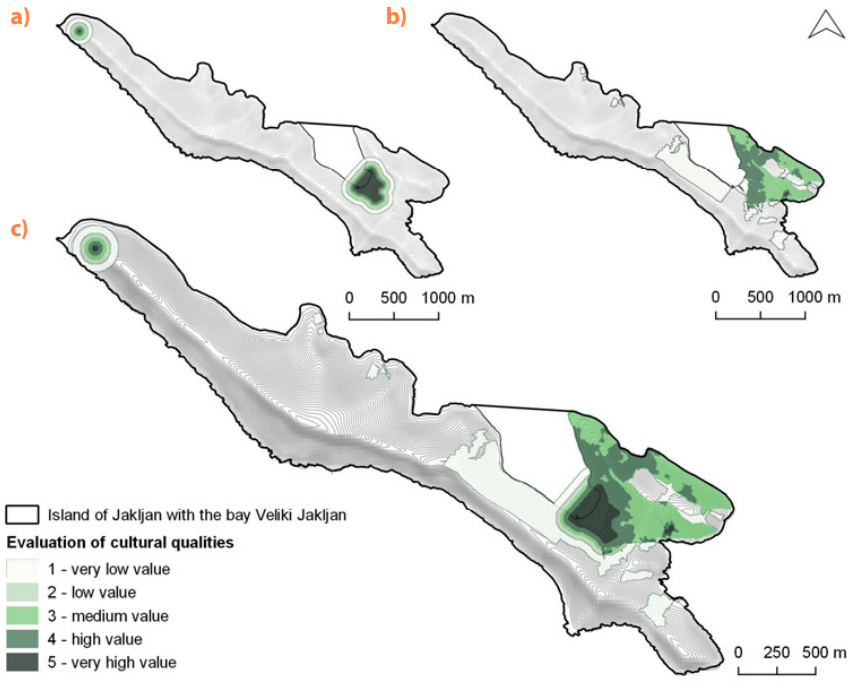

Figure 4 Overview of cultural qualities of the wider observed area

3.3 Visual landscape qualities

Values of visual qualities of landscape are modelled through the function of observation intensity and quality of observed; intensity is determined through frequency of observation (visual exposure), and quality of observed through landscape elements, their interrelationships and evaluation of visual units:

$$(Vij = ƒIij, Kij) \qquad (1)$$

where: V – visual quality; i – object of observation; j – observer; I – observation intensity; K – quality of observed

Therefore, (1) visual completeness of the whole space was evaluated according to the criteria of representativeness/typicality, visual integrity, coherence, complexity, overall impression that represents a complete experience of the visual whole regardless of individual criteria (Bogovac et al., 2021) and (2) visually attractive, authentic elements such as rocky shores, beaches, rocks, forests, and spatial accents

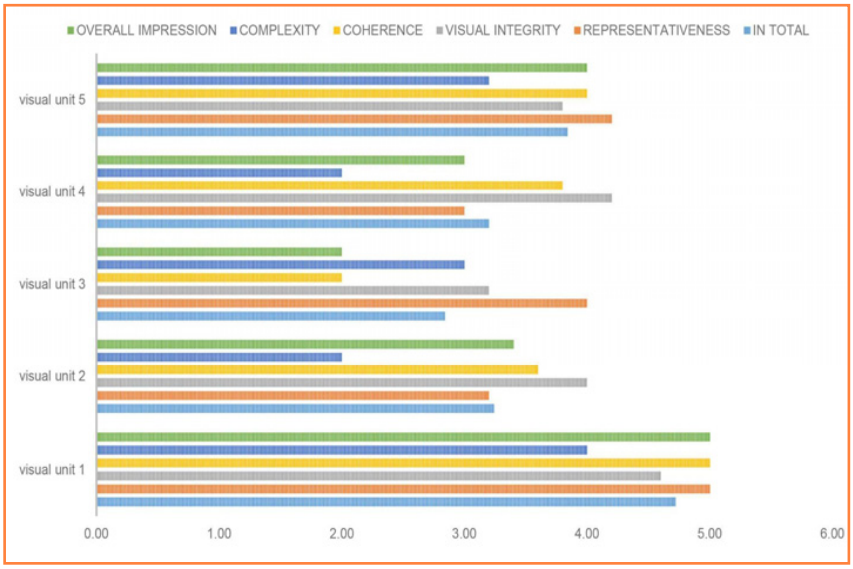

Figure 5 Evaluation of visual units according to different criteria

such as the church of St. Izidor. The mentioned submodels were then combined with the model of visual exposure by the folding technique in order to obtain a complete value map of the visual qualities of space. Identification of visual units is an analytical procedure which, on the basis of visual boundaries, determines spatial units which are later qualitatively evaluated on the basis of visual criteria. Visual units were determined on the basis of field research, interpretation of photographs, and digital elevation model. In the mainland, the boundaries have been determined in the areas of the ridges of the highest relief forms or cuts that represent a visual barrier.

Interpretation identified five visual units that were directly evaluated by several experts for the purpose of creating value models of visual qualities of the landscape (Fig. 5). The criteria taken into account were as follows:

a) Representativeness/typicality – number of combinations of common and essential features that make the area representative in the region to which it belongs; the landscape may contain certain character and/or features and elements that are considered representative by stakeholders.

b) Visual integrity – includes assessment of visual integration of space, character and number of different views that open from individual points in space, visual relationships of elements that make up space, visibility of the wider island space, the existence of visual corridors, barriers and edges.

c) Coherence – a measure of the harmony of the organization of space; the degree to which different factors are interrelated in space and time, the consistency of the alternation of one or more anthropogenic and/or natural patterns.

d) Complexity – a measure of the richness of a scene is manifested in the diversity of spatial patterns of some and/or individual elements within a particular pattern. It may be due to the complexity of natural conditions (relief, combination of different units of the ecosystem, etc.) and/or specific cultural and historical context.

e) Overall impression – refers to the overall experience of the visual whole regardless of individual criteria.

The highest value of visual units was obtained by visual unit 1 (4.60), while the lowest value was obtained by visual unit number 3 (2.44 small value). Visual units 2 and 4 were also rated with moderate values (3.20 and

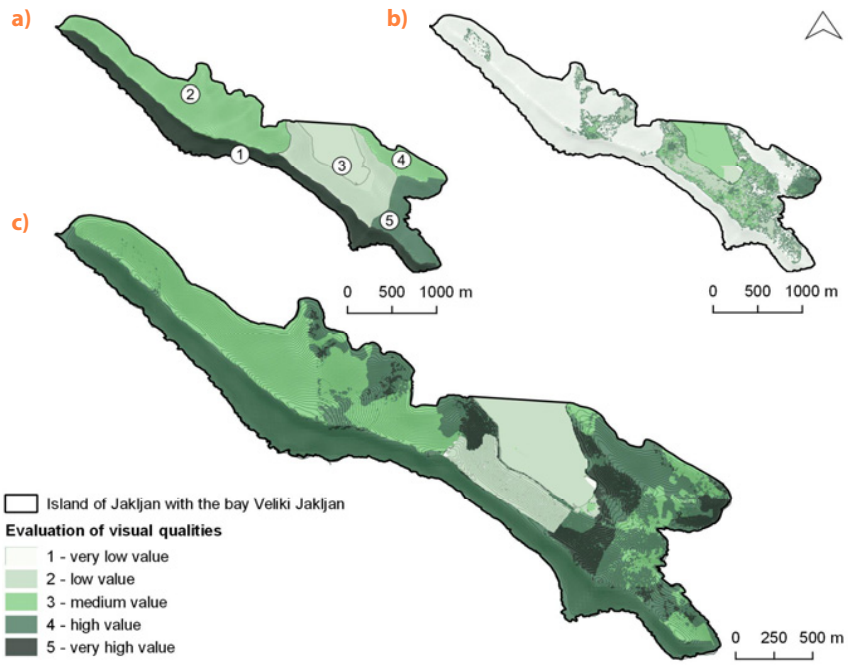

Figure 6 Overview of evaluating the visual quality of visual units

3.24), while visual units 5 were rated as highly valuable (3.8). Visual unit 1 received the highest values (5.0) on the basis of the criteria of overall impression, representativeness/ typicality and coherence, while on the basis of the criteria of complexity it was evaluated on average by the lowest score (4.0) of all criteria.

Based on the evaluation of the overall visual potential, which included the evaluation of visual units and visually attractive and authentic elements of the landscape and the analysis of visual exposure, the final model of visual landscape qualities of the wider area was obtained (Fig. 6). Value of visual qualities grows with the increase of visual potential, i.e. visual qualities and visual exposure. The most visually exposed areas are those that are visible from the highest points of observation (pedestrian and waterways, roads, settlements), i.e. from places where people reside and constantly passing. The range of values is determined by the scale of values from one (1) to five (5), with value 5 representing the areas of the highest values of visual qualities of the landscape, and value 1 the lowest values.

From the map of combined visual qualities, it can be seen that the most valuable areas (value 5) are those that belong to the wider area of V. Jakljan Bay and its wooded slopes. Large homogeneous area, visual unit 1, primarily of natural character defined by steep rocky shore and rocks above which forest vegetation (coniferous and mixed forest, macchia), has a high value (4) due to exposure from waterways and very high visual quality of the unit. Areas of high mixed vegetation on slopes and neglected agricultural areas, which extend above the bays V. Jakljan and M. Jakljan with high exceptions of anthropogenic elements within the same and neglected tourist settlement, are also of high value (4). Visual qualities of the observed parts of the island are emphasised mainly due to the visual exposure of the most frequent observation points. Larger areas of the northern part of the island have a moderate value (value 3) of visual qualities, mostly covered with macchia, without spatial accents that would add value to the space. Only smaller areas in V. Jakljan Bay have a low value (value 2) of visual qualities, which are not observable from many points due to their position, and therefore their value of visual exposure is lower. The area of fig plantations was assessed as low and very low (1 and 2).

3.4 Final model of landscape qualities

The final model was obtained by overlapping and merging sub-models of natural, cultural and visual qualities of the landscape (Fig. 7). By overlapping all the above sub-models of landscape quality, a joint model of landscape quality for the area of the island of Jakljan was obtained.

The most valuable areas are those that are characterised by high natural, cultural and visual qualities. The final result of the association is a value map with estimated areas of total quality value in the rating scale from one (1) to five (5), where the association method uses a multi max function which retains the highest values of all input submodels.

The final model of landscape quality indicates that almost the entire island belongs to the most valuable (44.28%) and highly valuable areas (50%) (grades 4 and 5), with the exception of low value (grade 2) active fig plantations on the slopes of the bay V. Jakljan (5.33%). Most valuable areas are those covered with macchia in the northern part of the island, and visually exposed areas of mixed forests that surround the bay. The coasts are recognized as the most valuable zones, as well as the sea part of the coverage area, which covers the Posidonia habitat. Areas of cultural and historical heritage that include the historical complex around the church of St. Izidore and utilitarian buildings and coastal infrastructure (the remains of a pond built by the Benedictines, and an old pier located on the north side of the bay made of stone), are also recognized as the most valuable.

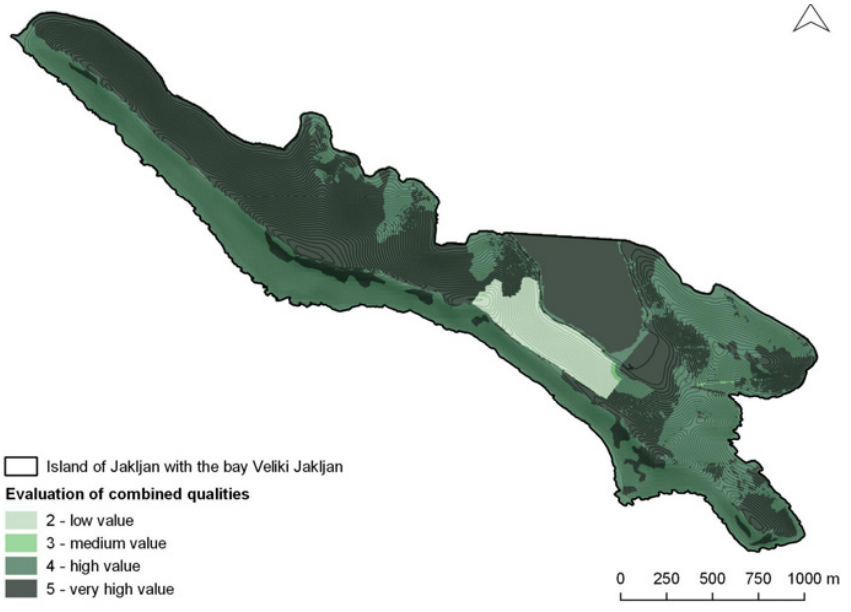

Figure 7 Final model of combined landscape qualities

The entire southern side of the island, which includes rocky shores and rocks, is a high value area (value 4), based on the identified visual and natural qualities. Highly valuable is the area above the bay M. Jakljan, which in addition to these qualities, also has pronounced cultural and historical qualities due to the pronounced agricultural character, or exceptional potential for the restoration of former olive groves identified in orthophotos from 1968 and the Austro-Hungarian cadastre from 1837.

4 Conclusions

The paper showed that the approach used in this paper can be adjusted according to (1) site specificity and (2) spatial problems and conflicts to be resolved before deciding on spatial changes. Such an approach contributes to solving practical problems in the protection of landscape qualities that are essentially a public good and a link between nature and culture and biophysical, experiential, social and developmental elements in space. Such evaluation process can be carried out in the framework of EIA, SEA or spatial planning preparation. At the same time, the disadvantage of these assessments is that the landscape is mostly analysed through the prism of structural features and visual qualities, while neglecting public attitudes and other landscape qualities that may be degraded by future development.

References

Bogovac, L., Butula, S., Andlar, G. & Tomić Reljić, D. (2021). Approaches to landscape evaluation questioning examining landscape vulnerability and sensitivity of the Island of Rab. *Geoadria*, 26(1), 35–58. https://doi.org/10.15291/geoadria.3409

Butula, S., Andlar, G., Hrdalo, I., Hudoklin, J., Kušan, T., Kušan, V., Marković, B., & Šteko, V. (2009). *Projekt COAST: Inventarizacija, vrednovanje i planiranje obalnih područja Dalmacije,* Oikon d.o.o. – Institut za primijenjenu ekologiju, Sveučilište u Zagrebu Agronomski fakultet – Zavod za ukrasno bilje, krajobraznu arhitekturu i vrtnu umjetnost, Urbanistički institut Republike Slovenije, Zagreb.

Deming, M. E. & Swaffield, S. (2011). *Landscape Architecture Research; Inquiry, Strategy, Design.* John Wiley and Sons. Hoboken, New Jersey

Eiter, S. (2010). Landscape as an Area Perceived through Activity: Implications for Diversity Management and Conservation. *Landscape Research*, 35(3), 339–359. https://doi.org/10.1080/01426391003746531

Falconer, L., Hunter, D., Telfer, T. C. & Ross, L. G. (2013). Visual, seascape and landscape analysis to support coastal aquaculture site selection. *Land Use Policy*, 34, 1–10. https://doi.org/10.1016/j.landusepol.2013.02.002

Jorgensen, A. (2015). Editorial: Is landscape an oxymoron? Understanding the focus of Landscape Research. *Landscape Research*, 40(1), 1–4. https://doi.org/10.1080/01426397.2014.998012

Marušič, J. (1991). Oblike vrednotenja v krajinskem načrtovanju. *Urbani izziv*., 18, 37–45.

Olwig, K. R. (2007). The practice of landscape 'Conventions' and the just landscape: The case of the European landscape convention. *Landscape Research*, 32(5), 579–594. https://doi.org/10.1080/01426390701552738

Stephenson, J. (2010). The Dimensional Landscape Model: Exploring Differences in Expressing and Locating Landscape Qualities. *Landscape Research*, 35(3), 299–318. https://doi.org/10.1080/01426391003743934

Tobi, H., & van den Brink, A. (2017). *Research in Landscape Architecture: methods and methodology* (1st ed.). In: van den Brink, A., Bruns, D., Tobi, H., Bell, S. (Eds.). Ch.2: A process approach to research in landscape architecture. Routledge. New York. 24–34.