

**VULNERABILITY OF CULTURAL HERITAGE TO
ANTHROPOGENIC IMPACTS: A CASE STUDY OF THE
STEĆCI NECROPOLIS IN THE CITY OF EAST SARAJEVO**

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ABSTRACT

Stećci are medieval stone tombstones that represent a unique cultural phenomenon in both Europe and the wider world. Dating back to the late Middle Ages, they are distributed across almost the entire territory of Bosnia and Herzegovina. Throughout history, stećci have been exposed to various natural and anthropogenic influences, which have resulted in a gradual decline in their number. Human activities have frequently caused their destruction, most notably during wars, treasure hunting beneath the tombstones, construction activities, and agricultural practices on arable land. Today, stećci are exposed to anthropogenic impacts such as urbanization and unplanned construction, pollution and waste disposal, the construction of road infrastructure, as well as various economic activities. Such treatment of stećci, combined with the negative effects of natural processes, has highlighted the need for serious consideration of their protection and the development of effective preservation models. The most vulnerable necropolises are those located near cities experiencing rapid urbanization. Examples can be found in the area of the city of East Sarajevo. The aim of this paper is to analyze anthropogenic impacts on three stećak necropolises—Crnač, Pavlovac, and Krupac—located in the area of the City of East Sarajevo. The research methodology includes the application of geospatial technologies in the implementation of both direct and indirect research methods. The research results showed that the Pavlovac and Crnač necropolises belong to the category of highly vulnerable sites, while the Krupac necropolis belongs to the category of moderately vulnerable sites.

Keywords: stećci, urbanization, cultural heritage vulnerability, East Sarajevo

INTRODUCTION

Cultural heritage, especially when it is unprotected, is exposed to the negative impact of various natural as well as anthropogenic factors. Human-related processes including technological advances, population growth, pollution, or planned landscape development have massively affected archeological sites, resulting in partial damage or total loss of cultural heritage; additionally, these sites are sometimes affected by management problems, such as lack of financial resources and knowledge and inadequate or absence of site management [1].

Stećci are autochthonous cultural and historical monuments dating from the 12th to the 16th century. They are most commonly found in Bosnia and Herzegovina, and to a lesser extent in Serbia, Montenegro, and Croatia. As a distinctive element of cultural heritage, stećci represent a potential tourist attraction and offer opportunities for the development of cultural tourism. However, not enough has been done to preserve, protect, and promote stećci for tourism in Bosnia and Herzegovina. According to some estimates, nearly 20% of the total number of stećci in Bosnia and Herzegovina has been destroyed, submerged, or lost [2]. Throughout history, anthropogenic pressures have repeatedly led to their destruction, especially in the context of warfare, treasure hunting, infrastructure development, and intensive agricultural practices. In some areas of Bosnia and Herzegovina, complete necropolises were removed and reused as construction material for roads, public facilities, housing, and the restoration of religious buildings.

The spatial framework of the research is the City of East Sarajevo, more precisely the municipality of East Ilidža, one of the six municipalities that constitute the city. In this municipality, three endangered necropolises of stećci have been recorded and are analyzed from the perspective of their vulnerability to anthropogenic influences. These are the stećci necropolises Crnač in Donji Kotorac, Krupac, and Pavlovac. Since stećci originated as a manifestation of the social status and power of the ruling medieval nobility, the necropolises analyzed in the municipality of East Ilidža can be associated with the Pavlović noble family and the territory of the medieval Pavlović Land. Over 340 stećci necropolises have been recorded within the area of the former Pavlović Land [3].

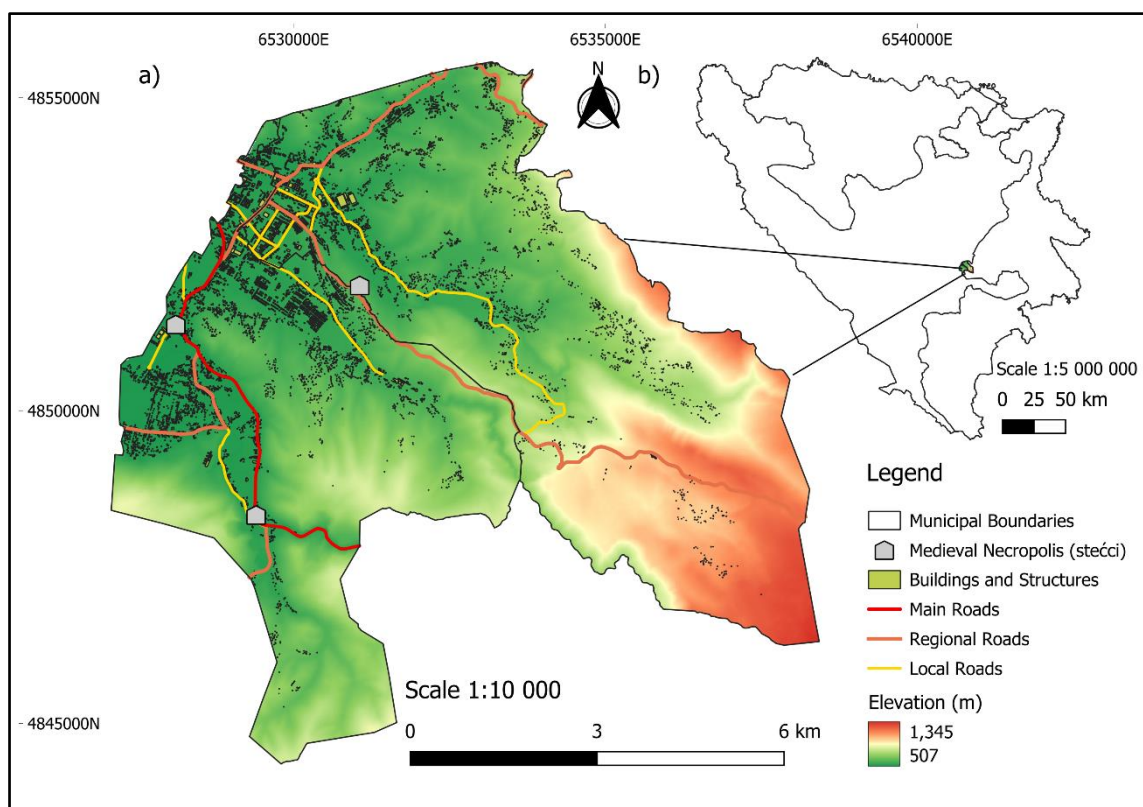


Figure 1. a) Municipalities of East Ilidža and East Novo Sarajevo; b) Location of the municipalities within Republic of Srpska/Bosnia and Herzegovina

Since this study analyzes the vulnerability of cultural heritage to anthropogenic impacts, it is necessary to consider certain socio-geographical processes that are characteristic of the research area. During the inter-census period (1991-2013) the City of East Sarajevo achieved an increase in the number of inhabitants by 12376 (number of inhabitants increased by 26 %). The city recorded positive demographic growth thanks to the positive inter-census change in three municipalities (East Ilidža, East Novo Sarajevo and Pale), which was a consequence of migration, refugees coming back and positive migration balance of internal migrations. It is important to emphasize that from the perspective of population biodynamics, all municipalities have a negative natural increment [4]. According to the estimates of the Statistical Office of the Republic of Srpska, in 2024 the City of East Sarajevo records a slight increase in population. Over an eleven-year period, the population increased by 0.8%, or by 503 inhabitants; thus, in 2024 the city has 60,419 inhabitants [5].

The City of East Sarajevo comprises five urban settlements with a total area of approximately 35 km², accounting for 2.4% of the city's total territory. According to the 2013 Census, 65.4% of the population resides within this area. The highest level of urbanization is recorded in the municipality of East Ilidža, at 93.7%. Specifically, in two settlements out of a total of five, covering approximately 44% of the municipality's territory, 93.7% of the population resides. In the municipality of East Novo Sarajevo, 73% of the population lives in a single settlement occupying 17.9% of the municipality's total area [6], [7].

By analyzing CORINE Land Cover (CLC) data for the area of the City of East Sarajevo in 2018, the urban area covers only 0.91%. If the data from 2000 and 2018 are compared, there was an increase of urban areas in the researched area by 4.7 km², i.e. in 2000 urban area occupied a surface of 8.5 km² and in 2018, it was 13.2 km², which represents an increase of about 55 % compared to 2000. Urban areas were expanding the most in municipalities of East Ilidža and East Novo Sarajevo, while other municipalities recorded just a slight increase. An increase of urban area in municipality of East Ilidža in 2018, compared to 2000, exceeded 400% and in municipality of East Novo Sarajevo 200% [8]. Spatial transformation, the expansion of urban areas, and the construction of urban infrastructure and transport networks exert a negative impact on the environment of this area, as well as on its cultural heritage. Research conducted in the municipalities of East Ilidža and East Novo Sarajevo identified the presence of 29 illegal depots. Most of these depots are located within 2 km of urban settlements, while 60% are situated at less than 100 m from roads and within densely populated areas. Furthermore, approximately 45% of the illegal depots are located within forest belts, and 70% are positioned at less than 50 m from watercourses [9].

East Sarajevo and Sarajevo are situated in the Sarajevsko polje, a basin-type depression enclosed by high mountain massifs. Such a topographic setting, typical of the Dinaric geomorphological system, plays a significant role in shaping local atmospheric dynamics. During the winter months, stable anticyclonic conditions and frequent temperature inversions restrict vertical air circulation, leading to the accumulation of air pollutants. Most local air pollution originates from individual heating systems and road traffic, which further exacerbates the situation during the heating season [10]. Elevated concentrations of air pollutants also negatively affect cultural monuments, including stećci.

METHODS

The analysis of the vulnerability of cultural heritage to anthropogenic impacts in the area of the City of East Sarajevo was based on the application of geospatial technologies in the implementation of both direct and indirect research methods. Direct research methods included fieldwork and the collection of data directly at the sites.

In this study, three stećak necropolises were selected as case studies. Two necropolises, Crnač and Krupac, were chosen because of their significance and level of protection, as they have been proclaimed national monuments of Bosnia and Herzegovina. The third necropolis, the Pavlovac necropolis, was selected due to its specific characteristics: it contains one of the largest stećci in Bosnia and Herzegovina (believed to be the grave of Pavle Radenović) and represents a notable example of the vulnerability and destruction of cultural heritage caused by human activity.

For collecting data on the location and position of the stećak necropolises and mapping the access infrastructure, a GPS device was used. Fieldwork included processes of inventorying, photographing, and assessing the level of vulnerability of the cultural heritage—the stećak necropolises—to anthropogenic impacts.

Table 1. Indicators and scoring scale used for assessing the vulnerability of stećak necropolises to anthropogenic impacts

Indicators / Score	0	0.25	0.5	0.75	1
Authenticity	Very low authenticity	Low authenticity	Moderate authenticity	High authenticity	Fully preserved authenticity
Level of protection	No protection	Local level	Regional level	National level	International level
Threat from roads/traffic infrastructure	Very high threat	High threat	Moderate threat	Low threat	No threat
Urban-construction pressure¹⁵	Very high pressure	High pressure	Moderate pressure	Low pressure	No pressure
Threat from landfills	Very high threat	High threat	Moderate threat	Low threat	No threat
Threat from economic and development activities¹⁶	Very high threat	High threat	Moderate threat	Low threat	No threat
Tourism pressure	Very high pressure	High pressure	Moderate pressure	Low pressure	No pressure
Neglect and lack of maintenance	Very high neglect	High neglect	Moderate neglect	Low neglect	Maintained
Impact of social factors: vandalismtheft	Very high impact	High impact	Moderate impact	Low impact	No impact
Level of awareness of the local community	No awareness	Low awareness	Moderate awareness	High awareness	Very high awareness

¹⁵ Unplanned and excessive construction, infrastructure projects, land-use change, and visual degradation of the cultural landscape

¹⁶ Industrial activities in the vicinity, exploitation of natural resources, and agricultural activities

By analyzing the literature related to the vulnerability of cultural heritage [11], [12], [13], [14], the authors proposed ten indicators (Table 1) representing the most common anthropogenic threats to cultural heritage. The vulnerability assessment was carried out by experts (two social geographers, a physical geographer, a GIS analyst, an environmental geographer, a historian, and an archaeologist) who evaluated the listed indicators of anthropogenic impact on the stećak necropolises. Furthermore, following the example of the GAM model [15], [16] specifically one of its segments (VPr – protection level), the above-mentioned indicators were further elaborated and a scoring scale was proposed in which each indicator was evaluated using a normalized scale from 0 to 1, where lower values indicate higher vulnerability and stronger anthropogenic impact, while higher values represent more favorable conditions and lower levels of threat. The overall score of the site was obtained as the arithmetic mean of the listed indicators. Based on the total score, the sites can be classified as: Very high vulnerability (0.0–0.25), High vulnerability (0.25–0.50), Moderate vulnerability (0.50–0.75), Low vulnerability (0.75–1.0), and No vulnerability (1.00).

Data regarding the locations of medieval necropolises, as well as registered illegal landfills, were collected through field research using the All-In-One Offline Maps 3.18 application to determine their latitude and longitude. Furthermore, Geographic Information Systems (QGIS Desktop 3.40.15) were applied to gather data on built structures and the road network within the study area; these data were extracted from Open Street Map using the QuickOSM plugin. GIS was also utilized for creating buffer zones around the necropolises and for cartographic visualization. For the purpose of displaying terrain relief characteristics, a Digital Elevation Model (DEM) (with a spatial resolution of 5 m was employed).

RESULTS AND DISCUSSION

The settlement of Krupac in the municipality of East Ilidža is located in the southeastern part of the Sarajevsko polje, at the point where the Željeznica River emerges from a canyon. The necropolis of stećci is situated next to the Sarajevo–Trnovo main road (Figure 2). The present-day site is not the original location of the necropolis, as it was relocated from its initial site, Kovačevina, due to the opening of a quarry. The original necropolis in Krupac was mentioned by Đuro Basler in 1951, when he recorded 37 stećci [17]. Bešliagić mentions a necropolis with 33 stećci at the Kovačevina site in Krupac; these were undecorated and located next to a modern Orthodox cemetery [18]. In the immediate vicinity of the necropolis there was also an old Muslim cemetery. Until 1977, the entire complex of stećci was located on the western side of the Sarajevo–Trnovo road. This cultural and historical site was threatened by quarrying activities, which continuously expanded toward the necropolis, so that by 1976 the necropolis was located at the edge of a precipice 10–15 m deep [17]. In 1977, the necropolis consisting of 23 stećci and 14 nišans was relocated to a new site on the eastern side of the Sarajevo–Trnovo road, where it remains today. The relocation was carried out by experts from the City Institute for the Protection of Cultural Monuments in Sarajevo.



Figure 2. The Krupac necropolis (photo LukićTanović M.)

This necropolis, under the name “Historic Area – Necropolis with Stećci and Nišans in Krupac”, was proclaimed a National Monument of Bosnia and Herzegovina in 2007. The national monument consists of 21 stećci and 12 nišans. A site inspection conducted in 2007 established that the site was not being maintained, that some monuments had cracked due to natural factors, and that traces of repairs were visible on several nišans [17].

The Crnač necropolis is located in the settlement of Donji Kotorac in the municipality of East Ilidža, at a site approximately 100 m from the Sarajevo–Trnovo road. A local road cuts through this necropolis (Figure 3). According to Bešlagić, a necropolis with 59 stećci is situated at the Crnač site, in the immediate vicinity of the former airport on the Butmirsko polje [18]. The monuments are mostly of large dimensions, well carved, but damaged and partly sunken into the ground. [18].

This necropolis, under the name “Historic Area – Necropolis with Stećci at the Crnač Site in Donji Kotorac,” was proclaimed a National Monument of Bosnia and Herzegovina in 2012 [19]. According to this decision, 54 graves with stećci were recorded at the Crnač necropolis, of which 51 are chest-shaped and 3 gabled. The graves are arranged in three groups, oriented along the west–east and southwest–northeast axes. The stećci are undecorated but bear inscriptions.



Figure 3. The Crnač-Donji Kotorac necropolis (photo Golijanin J.)

A site inspection conducted in 2012 established that the necropolis area was overgrown with low vegetation, thorny bushes, and grass, and that some of the stećci were partially or completely sunken into the ground. Based on the configuration of the terrain, it can be assumed that their number may be greater. The stećci are exposed to accelerated deterioration due to the lack of regular maintenance. Plant organisms (lichens and moss) are present on the monuments and contribute to the deterioration of the stone structure, while the sunken stećci could not be technically documented. The decision also identifies specific risks, such as the disintegration of the site due to long-term neglect, adverse atmospheric influences, and the spread of spontaneous vegetation [19].

When it comes to the protection of necropolises that have been proclaimed national monuments of Bosnia and Herzegovina, the Government of Republika Srpska is obliged to ensure legal, scientific, technical, administrative, and financial measures for the research, protection, conservation, and presentation of the national monument [17], [19]. At the same time, the Commission to Preserve National Monuments of Bosnia and Herzegovina is responsible for determining the conditions and providing funds for the preparation and installation of an information board containing the basic information about the monument and the decision proclaiming the property a national monument [17], [19].

For the purpose of the permanent protection of the national monument, Level I and Level II protection regimes have been established. Within the Level I protection regime, the prescribed measures include: the prohibition of any construction activities; the enclosure of the national monument with a hedge; the clearing of the parcel of self-grown vegetation; the undertaking of archaeological investigations of the graves; and the implementation of conservation works on any human remains that may be discovered. Furthermore, it is necessary to ensure the preparation and implementation of a programme for the presentation of the national monument. The monument area should remain open and accessible to the public and may be used for educational and cultural purposes. The Level II protection regime applies to the area within a radius of 50 m around the necropolis. Within this zone, it is prohibited to carry out activities that could alter the area or change its ambient character, and the disposal of waste is not permitted [17].

The Pavlovac necropolis is located in the municipality of East Ilidža, on Pavlovac Hill in Kasindo, and represents an example of an urban necropolis that has been almost completely destroyed due to human negligence (Figure 4). The site once contained a necropolis with 28 stećci (22 chest-shaped and 6 gabled monuments) and the monuments were very well carved, although they were damaged, partially sunken into the ground, and overgrown with forest. [18].

The necropolis itself has considerable historical significance because it is associated with the noble Pavlović family, from which the name Pavlovac is derived. Its importance is further emphasized by the assumption that the largest stećak belongs to the nobleman Pavle Radenović, a prince from the Pavlović noble family [18]. It is also important to note that the necropolis is located near a medieval caravan route that led from the Sarajevsko polje along the valley of the Prača River and further through the Drina region toward Dubrovnik, which was the main trading centre of the time.



Figure 4. The Pavlovac necropolis (photo Lukić Tanović M.)

The destruction of the necropolis began in 1980, when it was relocated by the Yugoslav People's Army for the purpose of constructing a military training ground. One part of the stećci was moved to the site of Donje Mladice, while another part was relocated to Krupac. Only the largest stećak, believed to belong to Pavle Radenović, remained at the original site, most likely because its weight made relocation impossible. This stećak has a volume of 11.40 m³ and a weight of 31,920 kg, making it the largest known stećak [18]. The relocation of the stećci was carried out under professional supervision, specifically under the supervision of the then City Institute for the Protection and Use of Cultural-Historical and Natural Heritage. However, the irresponsible attitude toward the relocated stećci, both by the local population and by municipal and city authorities, led to their almost complete destruction. The stećci that had been placed at the secondary site of Donje Mladice were further damaged during the construction of a hotel at that location, after which they were returned to the original site, where they remain today in very poor condition. The results of the analysis of anthropogenic impacts on the three aforementioned necropolises are presented in Table 2.

Table 2. Indicator scores for the assessment of anthropogenic vulnerability of the Pavlovac, Krupac, and Crnač–Donji Kotorac necropolises

Indicator/Site	Pavlovac	Krupac	Crnač – Donji Kotorac
Authenticity	0.25	0.5	0.5
Level of protection	0	0.75	0.75
Threat from roads/traffic infrastructure	0.75	0.25	0.25
Urban-construction pressure	0.5	0.5	0.25
Threat from landfills	0.5	0.5	0.5
Threat from economic and development activities	0.75	0.25	0.25
Tourism pressure	1	1	1
Neglect and lack of maintenance	0	0.5	0
Impact of social factors: vandalism, theft	0.25	1	1
Level of awareness of the local community	0	0.5	0.25
TOTAL SCORE	0.40	0.58	0.48

Based on the overall indicator scores, the Pavlovac and Crnač necropolises are classified as sites with high vulnerability, while the Krupac necropolis falls within the category of moderate vulnerability. Among the analyzed sites, Pavlovac represents the most vulnerable necropolis, with a score of 0.40, whereas Krupac shows the lowest level of vulnerability (0.58), indicating that it is the least affected by anthropogenic impacts. The high vulnerability of the Pavlovac necropolis can be attributed to the fact that the site is unprotected, completely neglected, and poorly maintained. Awareness of the significance of this cultural site among the local community is entirely absent, as the site is frequently used for waste dumping. In addition, the authenticity of the necropolis has been severely compromised due to dislocation, and a high level of vandalism has been recorded. On the positive side, the Pavlovac necropolis is exposed to a low level of threat from economic and development activities, as well as from roads and traffic, due to its location on the outskirts of the city, at the transition to a rural area.

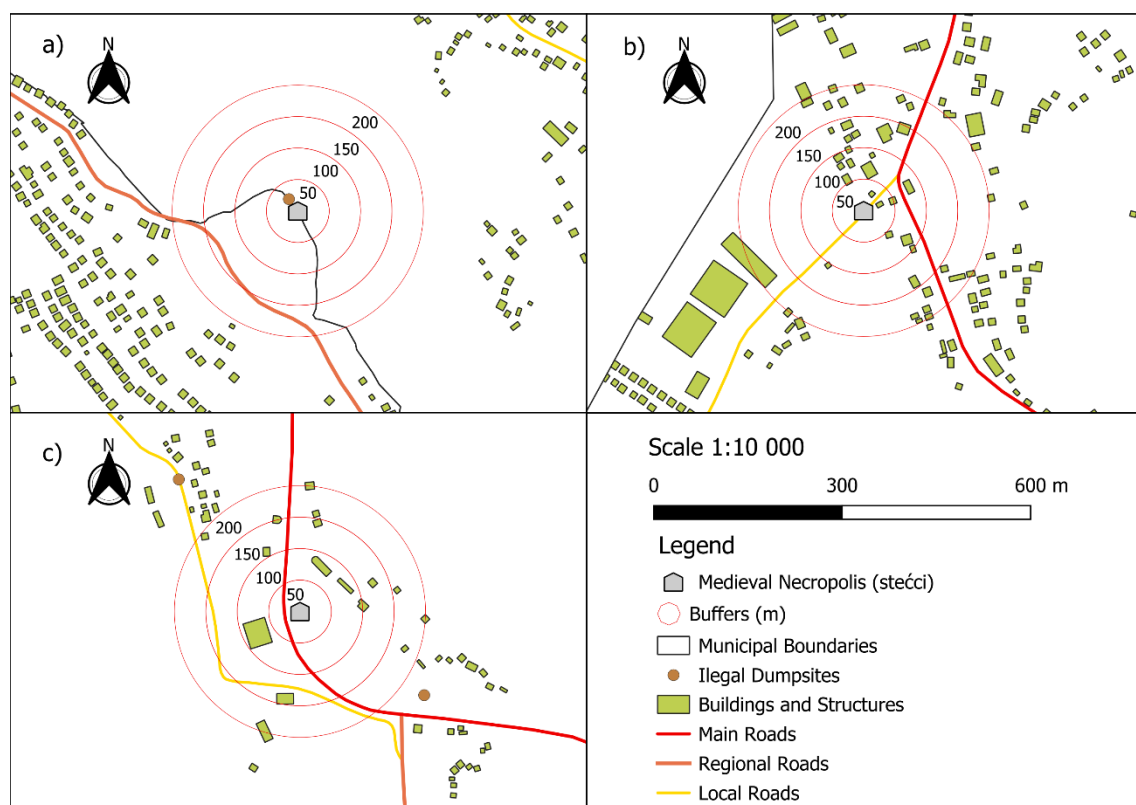


Figure 5. Buffer zones and surrounding anthropogenic features of the stećak necropolises: a) Pavlovac; b) Crnač; c) Krupac.

The Crnač necropolis, classified as high vulnerability, benefits from a high level of protection but is primarily threatened by urbanization. The site is particularly affected by roads, as a local road cuts through the necropolis. In addition, there is substantial urban and construction pressure, and the site is exposed to a high level of threat from economic and development activities. Although the Crnač necropolis is a national monument of Bosnia and Herzegovina, it is completely neglected and poorly maintained, and local community awareness of the significance of this cultural and historical monument is low. The least vulnerable necropolis is Krupac, which, according to the vulnerability indicator scores, falls into the category of moderate vulnerability. Its relatively higher overall score is since the necropolis is better maintained, is not exposed to vandalism or theft,

experiences no tourist pressure, and benefits from a high level of protection as a national monument of Bosnia and Herzegovina. The main threats to this site, however, are its proximity to roads and exposure to economic and development activities.

It is also important to note that none of the three analyzed necropolises have fully preserved their authenticity, primarily due to the dislocations mentioned earlier. Finally, all three necropolises received a score of 1 for the tourist pressure indicator, indicating that they experience no tourist pressure and are therefore not threatened in this regard. This can be seen as a drawback rather than an advantage, since, as part of the cultural heritage, these sites should be incorporated into the tourism offerings of the City of East Sarajevo.

CONCLUSIONS

As indigenous medieval monuments, stećci hold great cultural and historical significance. However, insufficient efforts have been made in Bosnia and Herzegovina to protect and promote stećci for tourism. These cultural monuments are exposed to various natural and anthropogenic impacts. Anthropogenic pressures, such as urbanization, unplanned construction, pollution and waste disposal, road infrastructure development, and economic activities, can negatively affect cultural heritage.

The analysis of the vulnerability of three stećak necropolises in the area of the City of East Sarajevo—Crnač in Donji Kotorac, Krupac, and Pavlovac—revealed a significant degree of vulnerability. According to the research results, the Pavlovac and Crnač necropolises are classified as sites with high vulnerability, while the Krupac necropolis falls into the category of moderate vulnerability. Based on the analysis of indicators measuring anthropogenic impacts—such as exposure to roads, urban and construction pressures, and threat from economic and development activities—the Crnač and Pavlovac necropolises are particularly threatened.

Although formally protected as national cultural monuments, the Crnač necropolis shows clear signs of neglect and poor maintenance. The most vulnerable site is the Pavlovac necropolis, which lacks protection, is almost entirely neglected, and largely devastated. The regular disposal of waste at this location reflects a complete lack of awareness among the local community.

The analysis also showed that all three sites experience no tourist pressure, indicating that they are not utilized as tourist attractions for the development of cultural tourism. In this regard, measures should be undertaken to protect and preserve these necropolises, as they represent significant cultural heritage with considerable tourism potential.

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