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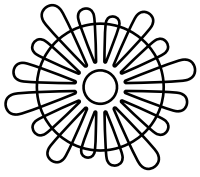

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WILDFIRES AS INCIDENCES OF ECOLOGICAL CRIME: A COMPREHENSIVE EXAMINATION OF THE WILDFIRES IN İZMIR CITY-REGION BETWEEN 25 JUNE AND 5 JULY 2025

ŠUMSKI POŽARI KAO OBLIK EKOLOŠKOG KRIMINALA: SVEOBUHVATNA ANALIZA ŠUMSKIH POŽARA U GRADSKOJ REGIJI IZMIRA U RAZDOBLJU OD 25. LIPNJA DO 5. SRPNJA 2025.

BURAK BEYHAN

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The wildfires that occurred in İzmir city-region between 25 June and 5 July, 2025, are particularly noteworthy due to their media coverage. The aim of this paper is to contextualize these wildfires by adopting a socio-ecological perspective that categorizes the role of humans at different levels. It also develops a framework to present the damage they cause, together with their ignition points, while considering the crime dimension of each wildfire. For this purpose, each wildfire is contextualized with the support of not only remote sensing (RS) data providing the probable ignition points and exposing the damage caused by the wildfires in terms of total area burned, but also the news revealed in the media facilitating the elucidation of crime dimension of the wildfires. In terms of RS data, while Sentinel 2 data is used for the delineation of wildfire zones via ΔNBR, MODIS and VIIRS data is used for the specification of ignition points and the delimitation of fire isochrones. The delimitation of the wildfire zones exposed that a total of 29,612.73 ha was burned in İzmir city-region during the period studied. The majority of the wildfires whose causes are known stem from urban activities and the problems with the electricity transmission infrastructure are particularly responsible for 25% of all wildfire incidences. Overall, the paper reveals that co-employment of RS data with the news exposed in the media, on the one hand, provides stronger evidence about the ignition location and causes of the wildfires to unveil the suspects, and on the other hand, makes it possible to track the spread direction of each wildfire so that some precautions can be taken in both management of forest areas and spatial planning for prevention of similar kinds of incidences in the future. What is particularly evident from this inquiry into the contextualization of wildfire incidences and their crime dimension is that without a shift to a biophilic ontology it is not possible to tame the Anthropocene.

Keywords: ecological crime; climate change; wildfires; fire news; Sentinel 2; FIRMS

Šumski požari u gradskoj regiji Izmira između 25. lipnja i 5. srpnja 2025. značajni su zbog medijske pokrivenosti. Cilj ovoga rada je kontekstualizacija tih šumskih požara iz socioekološke perspektive određivanjem uloge ljudi na različitim razinama i razvijanjem okvira za izlaganje štete koju su prouzročili zajedno s njihovim točkama paljenja u odnosu na dimenziju kriminala svakoga šumskog požara. Šumski požari kontekstualizirani su uz pomoć ne samo podataka daljinskog istraživanja (DI) koji pružaju vjerojatne točke paljenja i otkrivaju štetu uzrokovanu šumskim požarima u smislu ukupne spaljene površine, već i vijesti objavljenih u medijima koje olakšavaju razjašnjavanje dimenzije kriminala šumskih požara. U kontekstu podataka daljinskog istraživanja, podaci Sentinel 2 upotrebljavaju se za razgraničenje zona šumskih požara putem ΔNBR-a, a podaci MODIS i VIIRS za specifikaciju točaka paljenja i razgraničenje izokrona požara. Razgraničenje zona šumskih požara otkrilo je da je u gradskoj regiji Izmir tijekom proučavanog razdoblja izgorjelo 29 612,73 ha. Većina šumskih požara prouzrokovana je urbanim aktivnostima, a problemi s infrastrukturom za prijenos električne energije odgovorni su za 25 % svih šumskih požara. Rad otkriva da istodobna upotreba RS podataka s vijestima izloženim u medijima s jedne strane pruža jače dokaze o mjestu paljenja i uzrocima šumskih požara kako bi se otkrili sumnjivci, a s druge strane omogućuje praćenje smjera širenja svakoga šumskog požara kako bi se mogle poduzeti neke mjere opreza u upravljanju šumskim područjima i prostornom planiranju radi sprječavanja sličnih vrsta incidenata u budućnosti. Ovo istraživanje kontekstualizacije slučajeva šumskih požara i njihove kriminalne dimenzije posebno ističe da se bez prelaska na biofilnu ontologiju ne može ukrotiti antropocen.

Ključne riječi: ekološki kriminal; klimatske promjene; šumski požari; vijesti o požarima; Sentinel 2; FIRMS

INTRODUCTION

İzmir city-region has climate characteristics consistent with the tectonic characteristics of the Aegean coast dominated by a Mediterranean climate. Accordingly, summers are hot and dry, winters mild and rainy, and springs are transitional, which combined with the soil structure, depending on rainfall and sunshine duration, makes the climate suitable for agriculture (Birdal et al., 2018). However, İzmir is the second-fastest rising city in the Europe–Mediterranean region in terms of climate risks including extreme heat, heavy rainfall, and drought (Kelebek et al., 2021). Although climate change is undeniable, the crime dimension involved in this process requires a closer inquiry into the particular stories of each destructive event. In this context, the wildfires occurring between 25 June and 5 July, 2025 in İzmir city-region especially deserve attention owing to the causes revealed in the media. Although the previous wildfires occurring in Antalya (Ohrili et al., 2022) and Muğla (Beyhan & Koca, 2022) during the summer of 2021 attracted public attention particularly due to the destruction of vast forest areas, their causes didn't receive as vivid media coverage as the recent wildfires in İzmir. There is no doubt that the long-term effect of climate change in the anthropocentric era is the chief factor leading to these disasters. However, such argumentation shouldn't obscure the role of any particular triggering cause in a given wildfire event. Thus, elaboration of the causes for each wildfire incidence as a case of crime is as important as the exposition of climate change's general trend. In this respect, recent wildfires experienced in İzmir city-region serve as a perfect laboratory to contextualize and expose the extent of ecological crime as regards human dimension involved in the process.

The temporal coverage of the study is delimited according to the pattern of news on the media. In Türkiye, particularly in summer times, the amount of news about wildfires peaks for a specific time period. In this context, although the study is based on a limited temporal scope of approximately two weeks, its spatial scope is more inclusive. Instead of designation of the case study region according to normative boundaries (such as province boundaries), in this study it is assumed that a better understanding of the causes of the wildfires can be achieved via a socio-ecological approach confirming the inevitable role of humans in the ecological system. If ecological crime can be considered as a result of human activities, the extent of crime considered can be properly analysed in terms of the regions revealed by the self-containment of the pattern of human activities. Thus, as the first step of this consideration, in this study the wildfires are contextualized with reference to the functional region exposed by the pattern of human mobility. It is for this reason that the study area is mainly designated with reference to greater İzmir city-region revealed in Beyhan (2019). This region covers not only the proper İzmir province, but also Aydın, ten districts of Manisa and one district of Balıkesir.

Formative effect of human factor on the ecological system can be considered at three different but interlinked levels. The first one is the long-term disturbance of ecological system by the activities of humans, which is now encapsulated within the concept of Anthropocene. Path-dependent nature of institutions created by humans and ecological system form the basis for the second level. For an examination of this level with reference to wildfires, Kirschner's study (Kirschner et al., 2023) is instructive. The concept of path-dependence actually has similarities with the concept of fire regimes (FR). In its broadest sense, FR refers to everything related to burning events in a given region and period characterized by a uniform and regular pattern of fires (Krebs et al., 2010). Since a given pattern of wildfire can be considered as part of the socio-ecological system sustaining a specific habitat, the stringent protection of an area from fire can have as devastating an impact on the existing habitat as over burning (Talbot, 1964). In this context, regarding the socio-ecological path dependency, a better understanding of FR can be achieved with the help of the concept of panarchy.

In fact, the concept of panarchy is not new

for understanding wildfire events and taking precautions for them (e.g., Higgins & Duane, 2008; Winkler et al., 2022). It is based on the 'theory of adaptive change' whose basic principle is the system's ability to adapt to various changes (such as a wildfire) via four sequential phases; (1) 'exploitation' characterized by a quick populating of the area by numerous species (such as grasses), (2) 'conservation' characterized by the domination of the area by certain species (such as shrubs and woody plants) leading the system to become over-connected, rigid and ripe, (3) 'release' referring to a new disruption (such as a new wildfire because of increasing interconnection between the vegetation growing across forest floors and tree canopies), and (4) 'reorganization' setting the conditions for the subsequent phase of 'exploitation' with reference to innovation and restructuring of the system after the new 'creative destruction' (Higgins & Duane, 2008; Winkler et al., 2022).

As people live very close to the forests and traditional ecological knowledge (such as prescribed/cultural burning) is not properly used, reorganization function is interrupted in such a way that conservation phase tends to result in the extra fuel loads in forest areas close to settlements (Eisenberg et al., 2019; Winkler et al., 2022), which increases the fragility of forests nearby urban areas. In fact, this helps us understand the third level of human factor which refers to the direct involvement of any individual as a triggering factor in huge ecological disturbances such as the ignition of a wildfire that can be considered as a case of ecological crime. Although the rise of Anthropocene is inevitable due to the cumulative causation started by the overall pattern of human activities, the cases of individual ecological crime can be prevented by taking necessary precautions which, in turn, in the medium term, may alter the dynamics of the second level having impact on the first level. In this context, the third level exposing the apparent crime dimension of wildfires is particularly important in terms of the precautions that can be taken for sustaining the ecosystem's resilience. Due to the decreasing capacity of ecological system to adapt to the disturbance, if the system's resilience is exceeded, even a minor disturbance can lead to widespread collapse resulting in a regime shift (Sundstrom et al., 2023).

Although without a regime shift, forests have the capacity to regrow following the wildfire, associated with the climate change the post-fire changes in soil and moisture increase the likelihood of forests' conversion to grassland-bushes or different forest types particularly after the big wildfires characterized by an increase in fire intensity inhibiting the forests' recovery speed (Jiang et al., 2013). Indeed, while intense crown fires result in severe ecosystem damage and retardation of natural regeneration because of the destruction of a remarkable portion of the forest canopy and changes in microclimatic conditions, fire zones influenced by moderate-intensity surface fires preserve an important portion of tree regeneration and exhibit a faster recovery rate thanks to the preservation of the parent trees providing a seed bank and minimal soil disturbance (Zhanguzhina et al., 2025). That's why in an undisturbed regime, more frequent and regular collapses at smaller spatio-temporal scales can prevent culmination of the disturbances to huge scales (Sundstrom & Allen, 2019). However, recent large-scale wildfire events all over the world leave little room for such an outlook, which increases the importance of all possible forms of interventions to buy some time for taking precautions required to prevent these events from cascading up to giant-scale collapses. The systematization of the exposition and prevention of the crime dimension of the wildfire incidences is particularly important for this reason.

Parallel to the involvement of human factor in the ecological system, the crime dimension of the wildfires can also be studied at different scales or levels. A detailed typology for criminological theories from a place-oriented perspective reveals the relevance of ecological scales of macro, meso, and micro (Erdoğan & Erkan, 2021). While in terms of objects studied, macro level refers to a spatial hierarchy ranging from the inter-cities to international scope and a temporal hierarchy ranging from the decades

to centuries in terms of structures of society as groups, classes or community; the micro level refers to a spatial hierarchy of individual addresses to street blocks and a temporal hierarchy ranging from the hours to minutes and seconds (Erdoğan & Erkan, 2021). On the base of their overview of sociological/criminological theories imprinted with an urban bias, for Erdoğan and Erkan (2021), the meso level is characterized by intra-city areas and neighbourhoods for a temporal scale ranging from years to days. Overall, the ecological scales of macro, meso, and micro are actually spatio-temporal scales and one can identify overlapping areas between these scales, which is also valid in this study considering the global scale as the macro scale and focusing on the overlapping areas of macro, meso and micro levels.

At the global scale, ecological crime is usually regarded as a result of the harmful actions of powerful elites driven by the politics and priorities of fiscal imperatives (Walters, 2023). This is also true for sub-global scale in terms of forest degradation caused by fires due to a motivation factor imprinted with excessive extraction of forest resources and the conversion of forests into profit-oriented landscapes by the political elites and oligarchs (e.g. Southeast Asia (Ansori, 2021)). Biodiversity loss, climate change, pollution or resource degradation representing the bio-physical and socio-economic consequences of various sources of threat and damage to the environment can be regarded as part of this crime at the global level (Brisman & South, 2020). At the level corresponding to macro scale, ecological crime can actually be defined as 'climate crime' and it can be seen as a result of actions of economically powerful transnational corporations and the political leaders denying climate change and favouring extractivist policies that increase greenhouse emissions and create environmental harm for the sake of power and profit (Bedford et al., 2020; Kramer & Bradshaw, 2020).

Pearson's (2025) inquiry into the role of mafia in the ignition of wildfires in Italy is very instructive in terms of understanding the organized ecological crime dimension of the wildfire incidences at a second level of agents corresponding to an interplay of macro and meso scales. Although organization of mafia is historically characterized by a struggle of dominance for intra-city areas between different illegal groups, it also gains a regional character by extending these relations to a space of inter-cities. By using Lefebvre's theory on the production of space, Pearson's (2025) geographical research elaborates the social reproduction of mafia groups deliberately setting fires, which exposes the fact that the arson in Sicily is part of a longer and deeper series of processes illustrating the transformations of the mafia in the past and present. According to Pearson (2025), in parallel to the transformation of the Cosa Nostra characterized by 'the spatial production of the mafia,' it is impossible to consider wildland arson as a singular crime. The Sicilian Mafia is operationalizing the landscape in new ways exposing not only the evolution in its organizational structure but also its changing relationship with the land.

Compared with the harmful actions of powerful elites and mafia, the roles of local corporate entities and individuals deliberately or unconsciously triggering wildfires form the third level of agents. The analysis thereof corresponds to an interplay of meso and micro scales that receive less attention when elaborating the wildfires as incidences of ecological crime. Nevertheless, this does not mean that they are less responsible for the disturbance of ecological system. At this level, micro scale overlaps with the meso scale in terms of agents involved in the process. On the one hand, there are individuals triggering a wildfire intentionally or accidentally, and on the other hand, it is also observed that some wildfires in certain neighbourhoods in a city or villages in a region can be attributed to the lack of care for which local corporate entities are responsible. Overall, the individual wildland arson, as a negative externality stemming from urban development, can be linked to high levels of carbon dioxide emissions, devastation of threatened vegetation ecosystems, reduced bio-diversity and disruption of water basins (Cozens & Christensen, 2011).

As a response to the ecological crime resulting from the activities of economically powerful transnational corporations, there are suggestions that they should be recognized as entities committing ecocide and be tried by the International Criminal Court (Whyte, 2020). This call can be extended to the second level of actors responsible for ecological crime via a series of organized actions. At the third level, for the wildfire incidents/arson caused/committed by individuals or local corporate entities as a singular crime, some actions are already being taken by each country in accordance with their particular legal system. However, the effectiveness of these measures is questionable. For example, with reference to forest fire-setting in Spain, Salvador (2016) remarks that the lack of accurate information about the causes of forest arson crimes have created a sense of impunity among potential fire starters, which is further compounded by the fact that very few forest fires were started by corporate entities (e.g., local electricity companies).

Since only lower-ranking employees were found guilty and no criminal convictions were issued against company executives or senior business personnel, the sense of invisibility of forest arson committed by state and corporate perpetrators is further stressed (Salvador, 2016). Thus, first of all, it is important to recognize each wildfire incidence as a possible case of crime and to address it with reference not only to the third, but also, if possible, to the second level of agents involved in the process. Once a wildfire incident is considered a crime, evidence is needed to charge suspects. Thanks to the media drawing on the public and private monitoring systems employed for security purposes, it is possible to trace the triggering events behind some wildfires. The video records created by these systems facilitate not only finding the suspects of wildfires, but also fixing the location of ignition points. Combined with the remote sensing (RS) data available from different satellites for observation of active fires (AF) and delimitation of wildfire zones via certain indexes, in turn, the location of ignition points unveiled in the media can be employed to ascertain and confirm the suspects. Another important contribution of availability of sub-daily AF data in particular, is the possibility of tracing the spread of wildfires from the ignition points to other parts of the wildfire zone, which can be used for taking precautions to prevent the spread of the periodical wildfires occurring at the same or nearby locations.

In this study, first the news that appeared on media are reviewed to expose the basic causes and location of the recent wildfires in İzmir city-region. This effort is integrated into not only RS methods mentioned above but also, if necessary, geo-referencing techniques making it possible to use drone photos shared in the news for the fixation of the fires' ignition points. In a similar fashion, Corine Land Cover (CLC) data helped us localize the approximate starting location of wildfires as exposed in the media in terms of description provided for the fires' origin and spread. Combined with the availability of DEM data that can also be used for the calculation of real surface area damaged during the wildfires, the spread of each wildfire can be visualized via fire isochrones for better understanding and contextualizing the events concerned, which also provides the critical place sensitive information that can be used for the prediction of fire risk potential of the areas exhibiting similar characteristics observed in the wildfire zones delimited in this study. In turn, these studies can be used in urban and regional planning process to take precautions for prevention of the wildfire disasters, and if necessary, to revise the existing spatial plans.

Within the framework drawn above, the next section outlines the method of analysis used in the delimitation of wildfire zones and tracking the spread of the fires from the point of ignition to the other parts of zones. In this section, initial findings are also presented for characterization of the zones exposed via the conducted analysis. The third section is devoted to the contextualization and elaboration of the causes of wildfires as reported in the media and confirmation of this news with the AF data compiled from FIRMS together with the particular story of each wildfire in terms of ignition and spread

of the fire via creation of fire isochrones. The discussion section of the paper links the findings emerging out of third section to the conceptual framework drawn for the level of human agency involvement in wildfire incidents together with a set of implications of the conducted analysis for the required interventions and future research. The last section presents some concluding remarks with particular reference to the contextualization of wildfire incidences and their crime dimension in relation to the possibility of taming the Anthropocene via biophilic ontology.

THE DATA AND METHOD FOR DELIMITATION OF WILDFIRE ZONES AND FIRE ISOCHRONES

Two important issues in the delimitation of wildfire zones are the database used in the analysis and the method of delimitation of the wildfire zones. There are multiple options for the database available for the delimitation of wildfire zones such as Landsat 8 and Sentinel 2 data. Although Landsat 8 Operational Land Imager (OLI) bands have a resolution of 30 meters, Sentinel 2 bands have a resolution of 10 to 20 meters. Thus, Sentinel 2 images technically provide us with a relative higher resolution for the analysis of burned areas compared with Landsat 8 images. Sentinel 2 has also practical advantages in terms of the timely availability of the images related to atmospheric correction which is required to remove the effects of the Earth's atmosphere from the imagery before the calculation of burned areas. Hence, in this study for both technical and practical reasons, Sentinel 2 data are used. For Sentinel-2 data, the raw data obtained from the satellites are first used to prepare Level-1C (L1C) products which are radiometrically and geometrically corrected data with information on the satellite and sun angles. Subsequently, L1C products are processed to create Level-2A (L2A) products with atmospheric correction. Once L2A products are downloaded as described as the first step in Figure 1, the next step in the delimitation of wildfire zones is the employment of an analysis method for the delimitation of wildfire zones. One of the most widely used method for the delimitation of wildfire zones is the calculation of Normalized Burn Ratio (NBR) whose overall accuracy is higher than the other practical indices such as Normalized Difference Vegetation Index (NDVI). For the calculation of NBR, Near Infrared (NIR) and Short-Wave Infrared (SWIR) bands are required. It is known that although in NIR band healthy vegetation has a high reflectance, the burnt areas have a very low reflectance. In the case of SWIR band, the situation is exactly the opposite. These observations reveal that in NIR and SWIR parts of the spectrum the difference between the spectral responses of healthy vegetation and burnt areas peaks, which forms the basis of NBR formula as given below (Equation 1).

$$NBR = \frac{NIR - SWIR}{NIR + SWIR} \quad (1)$$

From the formula it follows that NBR ranges from -1 to 1. A high NBR value shows healthy vegetation, while a low value signifies recently burned areas. NBR values calculated for the post-fire are subtracted from NBR values calculated for the pre-fire (Equation 2) for calculation of ΔNBR exposing the burnt areas and providing a quantitative measure of the change (Nasery & Kalkan, 2020; Saulino et al., 2020). As Beyhan and Koca (2022) remark, although there are two well-known classification schemes for ΔNBR (the one proposed by the United States Geological Survey (USGS) and the other one proposed by the European Forest Fire Information Service (EFFIS)), there is no vital difference between them. In this study, USGS' scheme is used for the classification of ΔNBR as remarked in the workflow presented in Figure 1. It is known that while burnt areas have positive ΔNBR values, unburnt areas have negative ΔNBR values or a value close to zero. A ΔNBR threshold value of +0.1 is found by Rahman et al. (2018) as appropriate for differentiation of burnt areas from unburnt areas if Sentinel-2 data is used.

$$\Delta NBR = NBR_{prefire} - NBR_{postfire} \quad (2)$$

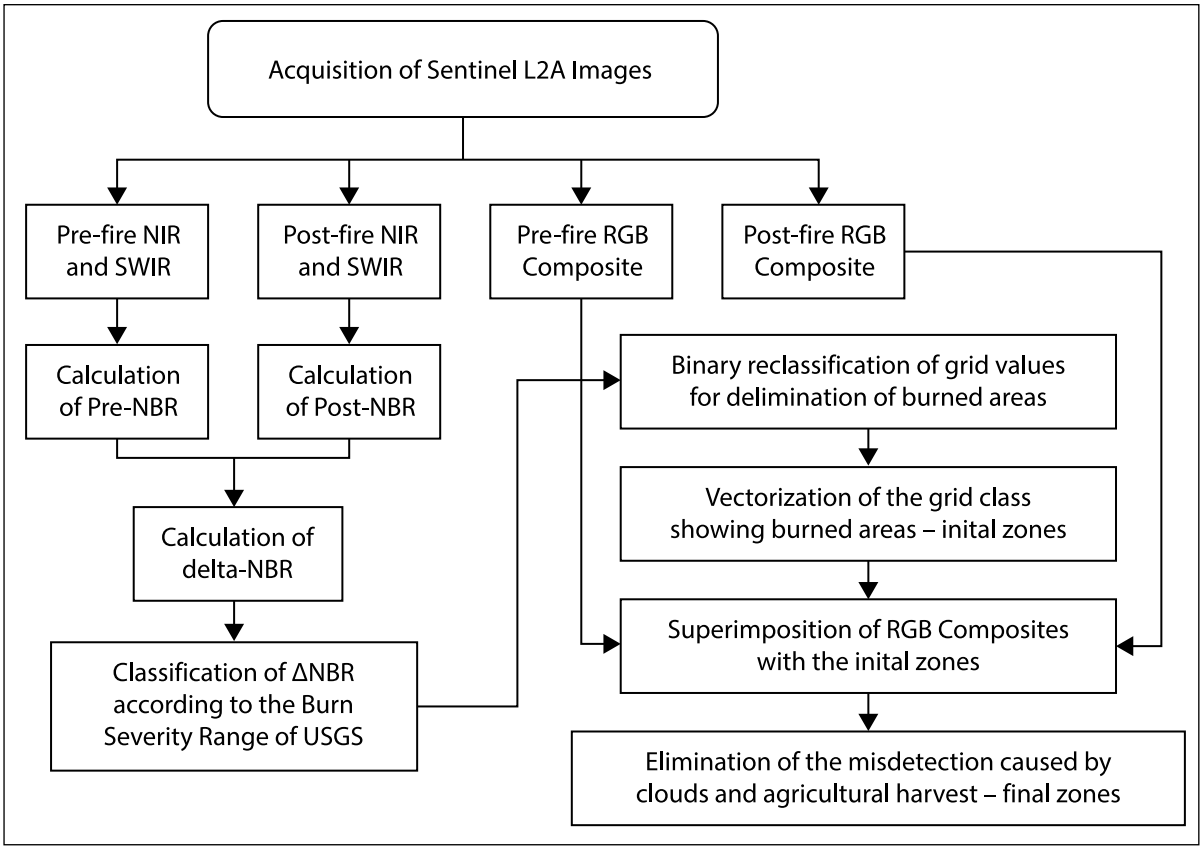

Figure 1 *Workflow used for the delimitation of wildfire zones*

After calculating ΔNBR, in the next stage of workflow the resulting raster grid file is also reclassified with reference to a binary classification (above (1) or below (0) +0.1) for exposition of the burned areas which are subsequently vectorized for initial screening. Before the final stage of the workflow, the resulting vector file is superimposed with RGB composites for the elimination of false classification caused by the clouds and agricultural harvest. For this purpose, a manual inspection is used as the size of study region allows for such an inspection. Following the delimitation of wildfire zones, a series of polygon overlay analyses is also conducted by overlaying the wildfire zones with the layers showing land-cover types and administrative boundaries (Figure 2), which provides us with valuable inputs for not only the amount of burned areas for different types of land cover but also the fixation of ignition points of the wildfires. For example, it is known that some of the wildfires have started in agricultural areas or urban areas and quickly spread to the nearby forest areas. As an intermediate step of post-delimitation workflow, the real surface area of each feature in the resulting overlay layer is calculated by using DEM data, which exposes the actual damage in terms of burned areas in different zones.

For the calculation of real surface areas and also exposition of spread of the wildfires, the Terra Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM) Version 3 satellite images providing a DEM of land areas on Earth at a spatial resolution of 1 arc second (approximately 30 meters horizontal posting at the equator) are used. The ASTER GDEM data products are developed as a collaborative effort between National Aeronautics and Space Administration (NASA) and Japan's Ministry of Economy, Trade, and Industry (METI). For the specification of the pre-fire land cover types for different parts of each wildfire zone, CORINE Land Cover (CLC) 2018 vector files are also used. CLC product used by a multitude of users for various purposes including environmental monitoring, land use planning, climate change assessments, and emergency management provides a pan-European land cover in-

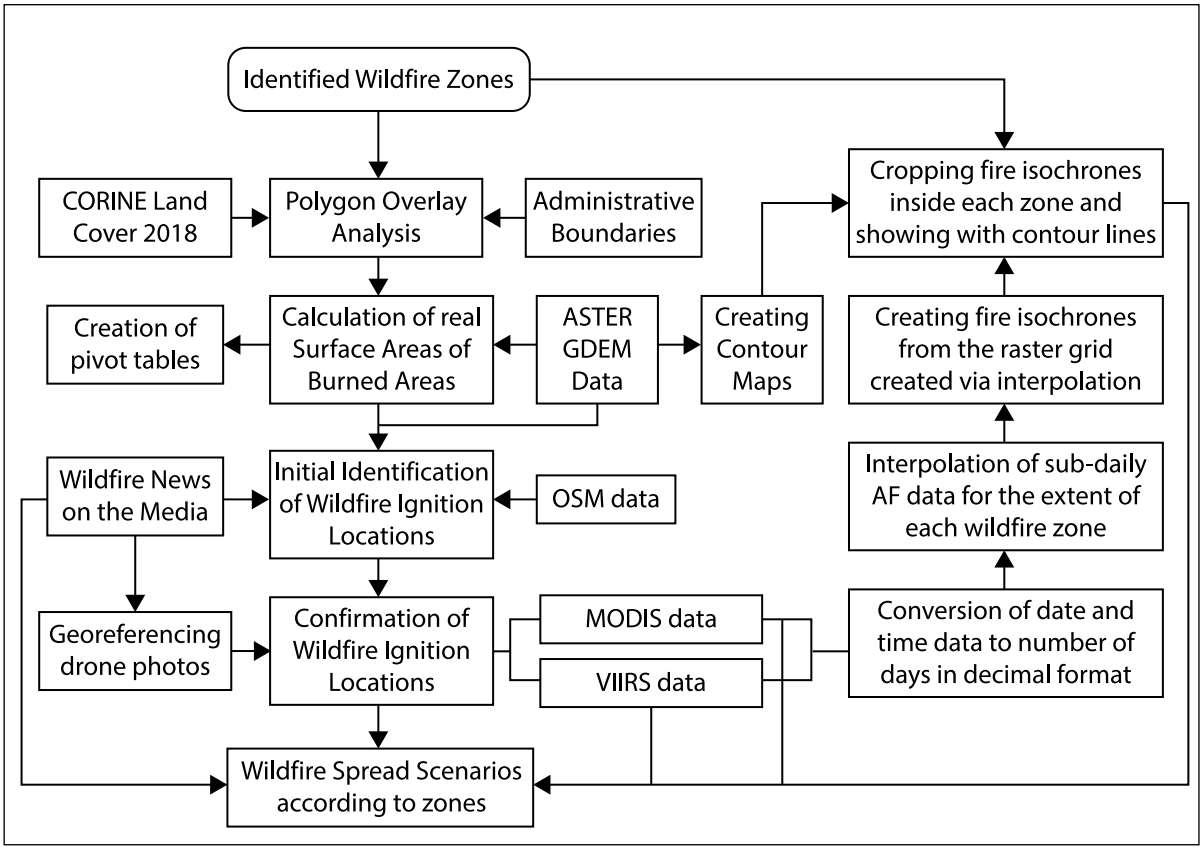

Figure 2 *Workflow used in the characterization of wildfire zones with news and RS data*

Table 1 *Wildfire zones identified within İzmir city-region according to ignition date and area (ha)*

WZ*	Wildfire ignition location according to descriptions provided in the news published in the media via internet	Ignition date	Plane Area	Surface Area	Rank Size
1	Beyazevler neighbourhood of Gaziemir	2025-06-29	90.86	92.21	15
2	Menemen Asarlık Village	2025-06-27	112.92	118.50	12
3	Yakaköy neighbourhood of Bornova	2025-06-27	187.03	189.10	10
4	From Manisa Çepnidere to Kemalpaşa Halilbeyli Village	2025-07-02	273.57	278.47	9
5	Dereköy neighbourhood of Manisa's Ahmetli District	2025-06-30	767.86	802.35	8
6	Horozgediği neighbourhood	2025-06-25	890.30	913.47	7
	Bozköy neighbourhood	2025-06-26			
7	Zafer neighbourhood's Olduruk area in Buca	2025-07-03	1,537.69	1,553.56	6
8	Tosunlar neighbourhood of Ödemiş District	2025-07-02	2,200.04	2,386.16	5
9	Between Kuyucak and Orhanlı neighbourhoods	2025-06-29	4,688.44	4,930.11	3
10	The fire spread to the Doğankent Site (Seferihisar's coastal zone)	2025-06-29	4,850.85	5,002.24	2
11	Çeşme wildfire zone: an agricultural area in the Ildır neighbourhood	2025-07-02	9,616.47	9,763.34	1
12	From Düzce Village (Seferihisar) to TOKI	2025-07-01	109.00	110.44	13
13	Gözsüzler area of the Camikebir neighbourhood (Seferihisar)	2025-06-29	22.94	22.58	18
14	Alacalı neighbourhood of Tire	2025-06-29	165.53	169.78	11
15	Kızılçukur neighbourhood of Dikili District	2025-06-25	29.53	29.78	17
16	Karaköy neighbourhood of Manisa's Akhisar District	2025-06-28	2,924.84	3,080.66	4
17	Kızılçakır area of Yazıkent neighbourhood in Aydın	2025-06-28	94.487	101.57	14
18	An agricultural field in the upper Eskihisar neighbourhood in Aydın	2025-06-29	43.04	47.60	16
19	An agricultural-scrub area near Kırksakallar neighbourhood in Aydın	2025-07-02	19.92	20.76	19
Sum	Total of all wildfire zones	-	2,8625.31	2,9612.73	-

* Wildfire zone

Source: the author; based on the wildfire news in the media

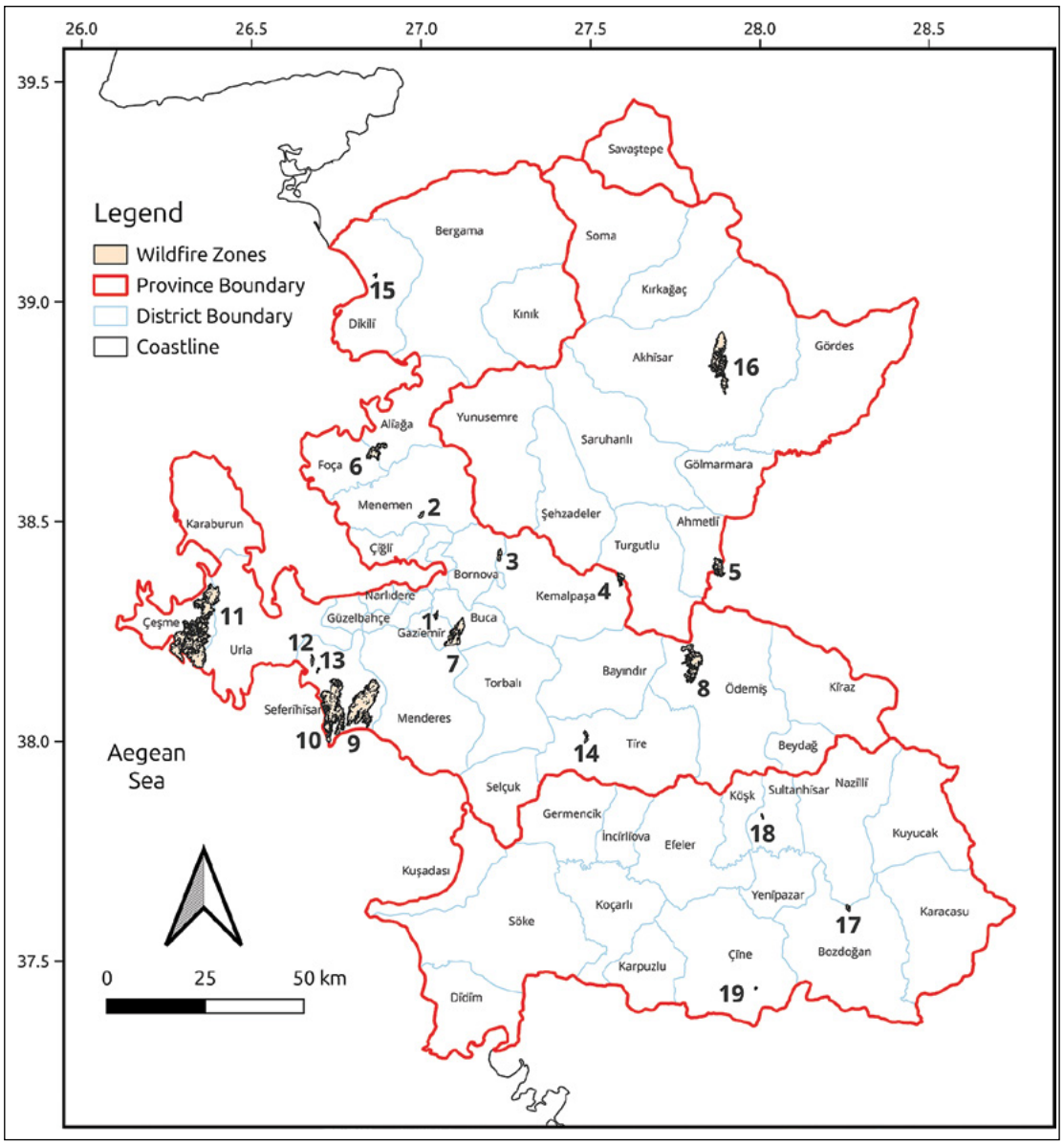

Figure 3 *Wildfire zones identified within İzmir city-region*

Source: the author; based on the analysis conducted in this study by using Sentinel 2 data together with the district & province boundaries obtained from Türkiye's General Directorate

cluding Türkiye and land use inventory for 44 thematic classes that range from broad forested areas to individual vineyards and agricultural areas.

Delimitation of wildfire zones reveals that a total of 29,612.73 ha was burned in İzmir city-region between 25 June and 5 July, 2025 in terms of real surface area (see Table 1 and Figure 3). The largest continuous wildfire zone (zone 11) is Çeşme zone with an area of 9,763.37 ha. Although the respective zone occupies areas (23.28%) also from Urla, the large part of the wildfire (76.72%) is within the boundaries of Çeşme. It is followed by the zone characterized by coastal area of Seferihisar (10th zone) with an area of 5,002.24 ha. Actually, in Seferihisar very close to the zone 10, there is another big wildfire zone (Orhanlı neighborhood of Seferihisar – zone 9) having an area of 4,930.11 ha. Thus, a total of 9,932.35 ha was burned in two very close big wildfire zones mainly covered by Seferihisar, which actually places them together as the biggest recent wildfire region. Although zone 9 also partly occupies areas from Menderes covering 11.54% of the zone, 88.46% of the zone is located within Seferihisar. The fourth biggest wildfire zone (zone 16) is outside İzmir provincial boundaries. It is mainly located in Karaköy Neighborhood of Manisa's Akhisar District with an area of 3,080.66

ha. Following these wildfire zones, there are two other wildfire zones exceeding an area of 1000 ha; the wildfire started (zone 8) at Tosunlar neighbourhood of Ödemiş with an area of 2,386.16 ha and the wildfire (zone 7) ignited at Olduruk area of Zafer neighbourhood in Buca with an area of 1,553.56 ha. Zone 7 occupies areas from not only Buca (49.53%), but also from Gaziemir (41.73%) and Menderes (8.74). As shown in Table 1, each of the other wildfire zones occupies an area less than 1000 ha. Overall, in terms of total burned area, the greatest damage during the period analysed in this study was experienced in Seferihisar district with a total of 9,438.02 ha (32.31% of the burned areas). It is followed by Çeşme (25.59%), Akhisar (10.46%), Ödemiş (8.08%) and Urla (7.75%).

In the next stage, ignition points of wildfires are exposed by locating the information available in media for each wildfire on the map with the help of administrative boundaries and OpenStreetMap (OSM). For the confirmation and detection of wildfires' ignition locations and direction of spread, the data processed and provided by NASA's Land, Atmosphere Near real-time Capability for Earth observation (LANCE) / Fire Information for Resource Management System (FIRMS) were actively used in the study. FIRMS distributes NRT (Near Real-Time) AF data collected from the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard Aqua and Terra satellites, and the Visible Infrared Imaging Radiometer Suite (VIIRS) aboard S-NPP, NOAA-20 and NOAA-21 satellites. These data are normally updated 6 times daily and usually available within 2-3 hours of satellite observation and reflect a growing tendency for the use of 'analysis ready data,' which reduces the Earth Observation System data pre-processing burden on users by enabling easier and faster analyses (EFFIS, 2018). AFs are calculated according to the thermal anomalies produced by them. If the temperature of the land cover surrounding a potential fire is above a given threshold, the fire is confirmed as an AF. While the MODIS AF and Thermal Anomalies product has a resolution of 1 km, the VIIRS AF and Thermal Anomalies product has a resolution of 375 m.

MODIS product is available from the NASA EOS Terra satellite launched in late 1999 and Aqua satellite launched in early 2002. While Terra has a morning (10:30) overpass, Aqua has an afternoon (13:30) overpass. MODIS AF data has two versions: (1) MCD14DL NRT products that may be subject to geo-location errors or reprocessing but available daily, and (2) standard MCD14ML products becoming available usually after 2 months for replacement of the NRT fire data (NASA MODIS Science Data Support Team, 2025; NASA FIRMS, 2025a). VIIRS product is available from the NASA NOAA Suomi National Polar-Orbiting Partnership (S-NPP) satellite launched in 2011, NOAA-20 (formerly JPSS-1) launched in 2017 and NOAA-21 (formerly JPSS-2) launched in 2022. The temporal resolution of VIIRS products is twice daily. While the nominal (equator-crossing) observation times for VIIRS S-NPP (VNP14IMGTDL) are 1:30 and 13:30, the orbit of NOAA-21 (VJ214IMGTDL) (1:05 and 13:05) is about 50 minutes ahead of NOAA-20 (VJ114IMGTDL) (1:55 and 13:55) with S-NPP orbiting between them, which make it possible for researchers to make observations within approximately 1 hour of one another particularly for mid-latitudes (NASA FIRMS, 2025b; EFFIS, 2018). Although S-NPP AF data has again two versions (1-daily available VNP14IMGTDL NRT products and 2-standard data VNP14IMGTML which is available with a 3-month lag), NOAA-20 and NOAA-21 AF have only NRT versions without the standard quality data: VJ114IMGTDL NRT products for the former and VJ214IMGTDL NRT products for the latter (NASA FIRMS, 2025a).

Even though MODIS instruments were designed with a nominal five-year life, they are still in operation. Availability of VIIRS product provides a continuity of data products relying on Aqua. However, data continuity for the products provided by Terra cannot be achieved if it is taken out of service. When interpreting

MODIS and VIIRS data, it should be kept in mind that the accuracy of AF locations shown on the map depends on the sensor's spatial accuracy (EFFIS, 2018). In this context, actually, as elaborated in the next section with reference to each individual zone, in some zones hotspots correspond to neither the wildfire zone delimited by using Sentinel 2 data nor the ignition points identified according to news compiled for this study from the web. Although a knowledge-based algorithm is applied for determination of AF by considering surrounding land cover categories' extent, hotspot's confidence level and distance to urban areas and artificial surfaces to prevent false detections, some fires may be undetected due to the smoke or cloud and if their size are too small (EFFIS, 2018), which is also confirmed by superimposing wildfire zones with MODIS and VIIRS data in this study. Indeed, for some zones there is no ignition point in MODIS and/or VIIRS. Lastly, some of the hotspots aren't fires as other heat sources are also detected by satellites (EFFIS, 2018). That's why, it possible to encounter many individual hotspots outside the identified wildfire zones, which is also experienced in this study.

AF data compiled from FIRMS contains latitude, longitude, the active fire pixel's brightness temperatures measured in Kelvin, FRP (Fire Radiative Power) usually expressed in MW (MegaWatts), confidence, satellite (A=Aqua, T=Terra, N=Suomi NPP, N20=NOAA-20, N21=NOAA-21), acquisition date and time, and acquisition type (D=Daytime fire, N=Nighttime fire) information (NASA Earthdata, 2025). Among these attributes, confidence level expressed either in % or intervals showing the confidence of existence of a fire within a pixel is particularly important for this study. Although it is available in percentages ranging between 0 and 100 for MODIS data, it is available as intervals ($0\%\leq C<30\%$ for low, $30\%\leq C<80\%$ for nominal, and $80\%\leq C\leq 100\%$ for high) for VIIRS data (Giglio et al., 2016; Giglio et al., 2020). Confidence is intended to help users estimate the quality of individual fire pixels (Giglio et al., 2020). While low confidence pixels are daytime fire pixels characterizing areas of Sun glint and lower relative temperature anomaly, nominal confidence pixels are either daytime or nighttime data that are free of potential Sun glint contamination during the day and marked by strong (>15K) temperature anomaly, and high confidence pixels reflect daytime or nighttime pixels greatly exceeding the saturation temperature (Schroeder & Giglio, 2018). In this study, all hotspots with a confidence level equal to or above nominal level of confidence are used for both identification of ignition points and exposition of each wildfire's spread via isochrones.

Employment of MODIS and/or VIIRS AF data for mapping the daily and/or sub-daily progression of wildfires is widespread (Barber et al., 2024; Frantz et al., 2016; McClure et al., 2023; Scaduto et al., 2020; Veraverbeke et al., 2014). Various geospatial interpolation techniques such as kriging, inverse distance weighting (IDW) and natural neighbour can be used for creation of continuous fire progression maps (FPM) (Scaduto et al., 2020; Veraverbeke et al., 2014). Although IDW is a less complex interpolation model compared with kriging, Veraverbeke et al. (2014) remark that it has a performance similar to that of kriging. For a given number of data values (n) and the number of nodes requiring interpolation (m), while the computational and algorithmic complexity of IDW ranges from $O(mn)$ to $O(mn^2)$ thanks to its numerical simplicity and straightforward implementation, kriging's computational and algorithmic complexity ranges from $O(nm+n^3)$ to $O(mn^3)$ as it necessitates the addition of the step of finding and fitting a suitable covariance model prior to the construction of the covariance matrix C (Braham et al., 2014; Henneböhl et al., 2011; Reed et al., 2000). Overall, kriging encompasses three additional operations; (1) the construction of the covariance matrix C, (2) the solution of an n x n linear system and (3) the summation of the weighted data values (Henneböhl et al., 2011). In this study, owing to its simplicity, IDW is designated as the spatial interpolation model for the creation of continuous FPMs for

the wildfire zones having adequate AF data. Prior to the availability of sub-daily and abundant AF data from satellites, isochrones were produced through temporal georeferencing of aerial fire photographs (Manzano-Agugliaro et al., 2014).

Thanks to the availability of RS data at appropriate spatial and temporal resolutions, FPMs showing fire isochrones can be easily produced. In many case studies, FPMs created by using interpolation techniques closely matched the actual observations made in the field (Veraverbeke et al., 2014), which proves their usability in mapping fire progression by employing AF data. Although in some studies only one of the AF products (MODIS or VIIRS) distributed by FIRMS is used (e.g., Veraverbeke et al., 2014), some of the studies draw on both products by pooling VIIRS and MODIS (e.g., Barber et al., 2024). The potential of aggregating MODIS and VIIRS AF data is particularly important for sub-daily fire mapping, which was also performed in this study. Interpolation of AF data provides us with a raster grid showing the fire arrival times that can be used to produce vector files showing the fire isochrones (spread zones) according to the sub-daily intervals (calculated in hours or minutes).

For the production of FPMs in this study, first a model script that can be used to merge downloaded .shp files representing VIIRS and MODIS data was produced in QGIS, a Free and Open-Source Software (FOSS) for GIS. Subsequently, another model script was produced for the creation of a raster grid showing the arrival time of fire in each pixel for each wildfire zone. For this purpose, date data was converted into a decimal number representing the date concerned in terms of number of days. The resulting number is multiplied by 100 before the calculation of IDW interpolation. After the production of raster grid created via IDW interpolation, the contour lines actually representing isochrones are produced for a specific interval value defined for the zone concerned. In the last stage of the model, the numerical values representing these contours are converted back to date format in terms of hours and minutes for the visualization of FPMs.

In addition to AF data from satellites, fire news are also used for identification of active fires (EFFIS, 2018). One such example is fire news section of European Forest Fire Information System (EFFIS). Unfortunately, it is observed that only one piece of fire news is available at the respective website (Firenews Viewer, 2025) in relation to a fire occurring before the period studied in this study for Türkiye. One of the important limitations of this system seems to be identification of fire locations from the news. In this study, this difficulty was overcome by the employment of various sources including not only fire news but also OSM and CLC data for geo-locating the fires' ignition points. The next section addresses this process for each wildfire delimited in this section in order to expose the match between the fire ignition locations revealed in the media and the AF locations compiled from FIRMS, which provides us with critical information not only for confirmation of fire narratives, but also if applicable, for resolving and contextualizing the crime dimension of each wildfire.

THE NARRATIVES AND CAUSES OF WILDFIRES AS REPORTED IN THE MEDIA AND THEIR CONFIRMATION WITH REMOTE SENSING DATA

While overviewing news published on the web, the first ignition location of each wildfire is ascertained by benefiting from both wildfire zone map delimited in the previous section and descriptions provided for each wildfire in the media. In this process, not only OSM and administrative boundaries but also CLC data and geo-referencing tools are used if necessary. After geo-locating the fire, the date of occurrence and cause of the wildfire are compiled from the news. The resulting information are given in Table 2. In this section, individual story of each wildfire is elucidated for the contextualization and confirmation of fire progression via AF

Table 2 *Date of occurrence and causes of wildfires according to the news*

WZ*	Date	Description of the cause and/or starting point of fire according to the news	News source
1	06.29	The fire broke out in a garbage dump in Beyazevler neighbourhood of Gaziemir.	İzmir'deki yangın galericiler sitesinde onlarca aracı küle döndürdü (2025) İzmir'de yangın Otokent Galericiler Sitesi'ne sıçradı (2025)
2	06.27	The fire started at night in Menemen Asarlık.	İzmir Hakkında (2025) Menemen Havadis (2025)
3	06.27	The fire broke out in Yakaköy neighbourhood during renovations on the roof of a house, when sparks, driven by the wind, it first spread to the house's grounds and then to the forest.	40 derecede kaynak yaptı, yangın çıktı! (2025)
4	07.02	The fire started in an electrical transformer in a field near the rural Çepnidere neighbourhood of Turgutlu, Manisa. It quickly spread over a wide area including Halilbeyli neighbourhood in İzmir.	Son dakika! Turgutlu'da başlayan yangın İzmir'in mahallesine ulaştı (2025) Manisa'da çıkan (2025)
5	06.30	The fire started in a garbage dump in the Dereköy neighbourhood of Manisa's Ahmetli district and spread to a forested area.	Ahmetli orman yangını (2025) Ahmetli'deki orman yangını (2025)
6	06.25	The forest fire broke out in the Horozgediği neighbourhood of Aliağa due to a power line. It was intensified by strong winds and spread across a wide area, crossing the border into Foça.	İzmir'in Aliağa ilçesinde (2025) İzmir'de ateş çemberi (2025)
	06.26	The fire originated from garbage burned without permission by an individual near the industrial facilities in the Bozköy neighbourhood and quickly spread to the surrounding forest area.	Aliağa'da yangınla (2025) Aliağa'da alevler (2025) Alevlerle 11 saatlik mücadele (2025)
7	07.03	The sparks from an unlicensed construction site that cut and welded iron in Olduruk area (Kaynaklar area) of Zafer neighbourhood caused the fire.	Buca'da yanan ormanlık alan (2025) İzmir Buca'daki orman yangını (2025) Buca'da orman yangını (2025)
8	07.02	The forest fire broke out in Suçıktı and Tosunlar neighbourhoods because of electrical wires.	Ödemiş yangınında (2025) Ödemiş'te yangının nedeni (2025) Rapor çıktı (2025)
9	06.29	The forest fire broke out in a forested area between Kuyucak and Orhanlı neighbourhoods. The fire was believed to have been caused by an electrical wire.	İzmir'de yangın kabusu (2025) İzmir'deki Yangının Boyutu (2025)
10	06.29	The fire broke out probably as a result of unextinguished cigarette butts thrown or accidentally dropped by a person near a residential area in the Tepecik neighbourhood of Seferihisar and spread to a part of the factory at the Ozer Turer Farm in the area.	İzmir'de Son Dakika (2025) Oluşum Haber (2025a)
11	07.02	The fire started in an agricultural area in the Ildır neighbourhood and spread to the forest. Governor Elban stated, 'We believe the fire started on a power line.'	İzmir Çeşme'de korkutan yangın! (2025) İzmir Çeşme'de orman yangını (2025) İtfaiye Raporladı (2025)
12	07.01	The fire began in Düzce Village and quickly spread due to strong winds. The cause of the fire has not yet been determined.	Düzce'de yangın (2025) Seferihisar'da alevler durmuyor (2025)
13	06.29	The fire broke out in the Gözsüz-ler area of the Camikebir neighbourhood in Seferihisar.	Oluşum Haber (2025b)
14	06.29	The fire broke out in a scrub area near the Alacalı neighbourhood for an as yet unknown reason. Driven by strong winds, the flames quickly reached the centre of the neighbourhood.	Tire'deki yangın yerleşim alanına sıçradı (2025) Yerel Güç Haber (2025)
15	06.25	Kızılçukur neighborhood of Dikili District	Egeli Duysun (2025)
16	06.28	The fire started in a forest area near the Karaköy neighbourhood of Manisa's Akhisar district because a beekeeper in the area used smoke to calm the bees.	Akhisar'daki orman yangınına müdahale (2025) Akhisar'da yangın sürüyor (2025)
17	06.28	The fire broke out in the Kızılçakır area of Yazıkent neighbourhood in Bozdoğan.	Aydın'da saatlerdir süren orman yangını (2025) Manisa ve Balıkesir'de yangın sürüyor (2025)

WZ*	Date	Description of the cause and/or starting point of fire according to the news	News source
18	06.29	The fire ignited in an agricultural field in the upper Eskihisar neighbourhood for an as yet unknown reason. Although it was brought under control, it restarted in the same area.	Aydın'da ziraat alanında çıkan yangın (2025)
19	07.02	The fire broke started in an agricultural & scrub area near the Kırksakallar neighbourhood of Aydın's Çine district for an as yet unknown reason.	Aydın Çine'de ziraat ve makilik alanda yangın! (2025) Aydın'da yangın (2025)

* Wildfire zone

Source: the author; based on the wildfire news in the media

hotspots and particularly crime dimension involved in each fire, which reveals the potential of co-employment of news and RS techniques together with GIS.

The biggest wildfire zone as exposed in the previous section is wildfire zone 11. According to the news it was reported that the fire started in an agricultural area in the Ildır neighbourhood of Çeşme and spread to forest and shrubland (İzmir Buca'daki orman yangını, 2025; Muğla Metropolitian Municipality, 2025). İzmir Governor Süleyman Elban, regarding Çeşme fire, stated that they believe the fire started from a power line on the base of the initial assessment made by technical teams and the statements of eyewitnesses (İzmir Çeşme'de orman yangını, 2025; Sağol, 2025). The ignition location was also confirmed by the İzmir Fire Department in a fire report stating that the fire was caused by a short circuit in the power lines located in some of the plots in the area (İtfaiye Raporladı, 2025). The fire that spread to Alaçatı neighbourhood was brought under control on 4 July. Based on these descriptions and information, as the ignition point of fire, agricultural areas within Ildır neighbourhood and wildfire zone concerned are searched on the map and a big red node with yellow boundaries is placed on the map for the starting point of fire according to news (Figure 4).

Subsequently, a continuous FPM is produced by using IDW and AF data compiled from both MODIS and VIIRS products having a confidence level equal to or above nominal level of confidence. Figure 4, which also shows the earliest ignition points (First Points according to AF data) with a 20-meter contour interval in the wildfire zone, confirms the statements reflected in the news as for the origin of the wildfire concerned. Indeed, AF data confirms the ignition of the fire in agricultural land (complex cultivation patterns) and its quick

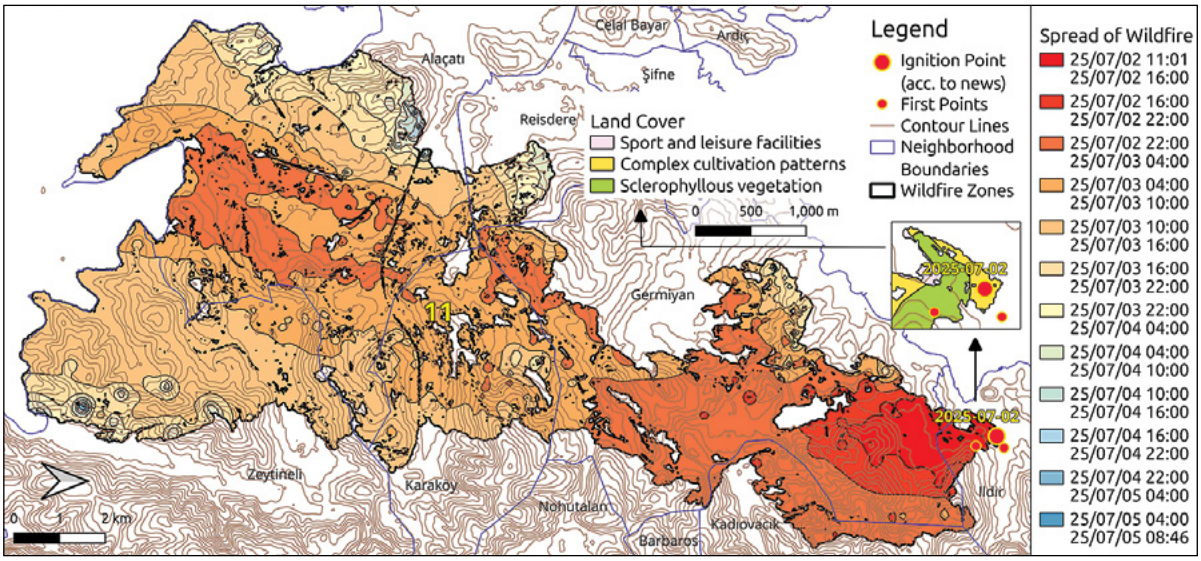

Figure 4 *FPM produced for wildfire zone 11 in combination with ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

spread to nearby forest area. The spread of the fire from north (Ildır) to further south (Alaçatı) and its control on 4 July is also successfully exposed via the interpolation of AF data within the boundaries of wildfire zone. Sağol (2025) remarks that parallel to Çeşme wildfire, namely Foça fire and Seferihisar wildfire were also allegedly been caused by a power line. However, according to both news and AF data, there are multiple sources of fire ignition for the wildfire zone 6, also covering fire named by Sağol (2025) as Foça, and in the case of Seferihisar, there are multiple wildfire zones (two big zones (9 and 10) and two small zones (12 and 13)) isolated from each other.

Indeed, in some zones there are multiple ignitions points whose spread areas merge with each other. One such zone is the wildfire zone 6 (Figure 5). The wildfire first broke out in a forest area in the Horozgediği neighbourhood of Aliağa and it was intensified by strong winds spreading across a wide area crossing the border into Foça (İzmir'in Aliağa ilçesinde, 2025; İzmir'de ateş çemberi, 2025). The first ignition point's location is fixed, according to news, administrative boundaries and CLC data. Parallel to Çeşme wildfire, by assessing the initial findings for the cause of first ignition point Governor Elban stated that they believe the fire started again from a power line (İzmir'de ateş çemberi, 2025).

Following a 22-hour firefight in Aliağa, flames began to rise again in Aliağa. This time fire broke out near industrial facilities in the Bozköy neighbourhood and spread into the forest (Aliağa'da yangınla, 2025; Aliağa'da alevler, 2025). This second fire in the zone originated from garbage burned without permission by an individual near the industrial facilities in the Bozköy neighbourhood and the suspect who allegedly caused the fire was detained by gendarmerie officers (Aliağa'da alevler, 2025; Alevlerle 11 saatlik mücadele, 2025). The location of the fire can also be confirmed by CLC data.

Wildfire zones mostly covered by Seferihisar also deserve attention owing to their proximity to each other. As elaborated in the previous section, wildfires zones 9 and 10 follow-

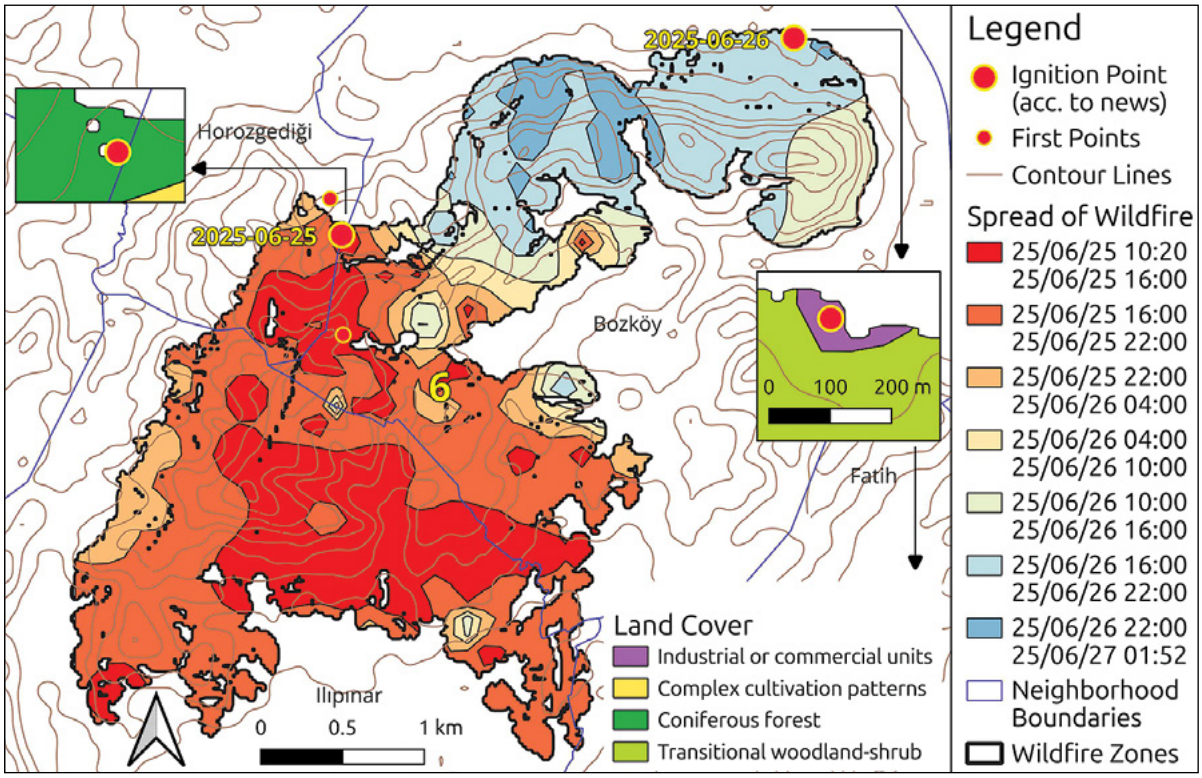

Figure 5 *FPM produced for wildfire zone 6 in combination with ignition points, according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

ing the wildfire zone 11 (Çeşme) in terms of their size are very close to each other, which led to their joint analysis in this study (Figure 6). Ignition point for wildfire zone 9 is in a forest between Kuyucak and Orhanlı neighbourhoods (İzmir'de yangın kabusu, 2025; İzmir'deki Yangının Boyutu, 2025). In this study, a small area covered by a coniferous forest at the northern part of the zone 9 just between Kuyucak and Orhanlı is considered to be ignition point of the fire. This location overlaps with the earlier ignition points (First Points) of the fire according to AF data. According to the fire narratives, due to stormy wind whose speed ranges from 70 to 117 kilometres per hour, the fire leaps into Doğankent Complex of summer houses in a relatively remote area covered by the wildfire zone 10 (İzmir'de yangın kabusu, 2025; İzmir'deki Yangının Boyutu, 2025).

Although the fire narratives lead us to think that the ignition point of zones 9 and 10 are the same, FPM produced for the zones on the base of AF data exposes that there is another ignition point for the zone 10 towards the north of the zone concerned between the boundaries of Tepecik and Turabiye neighbourhoods. The topography of the region also makes it difficult to directly connect these ignition points. When the dominant wind direction which is from north to south for İzmir is considered, it follows that the fire in the zones 9 and 10 started at the northern parts of the zones in First Points as suggested by the FPM. Indeed, it is possible to find two other pieces of news for the starting point of the wildfire zone 10; one at the Instagram account of İzmir'de Son Dakika (2025) stating that a fire broke out near a residential area in Tepecik neighbourhood of

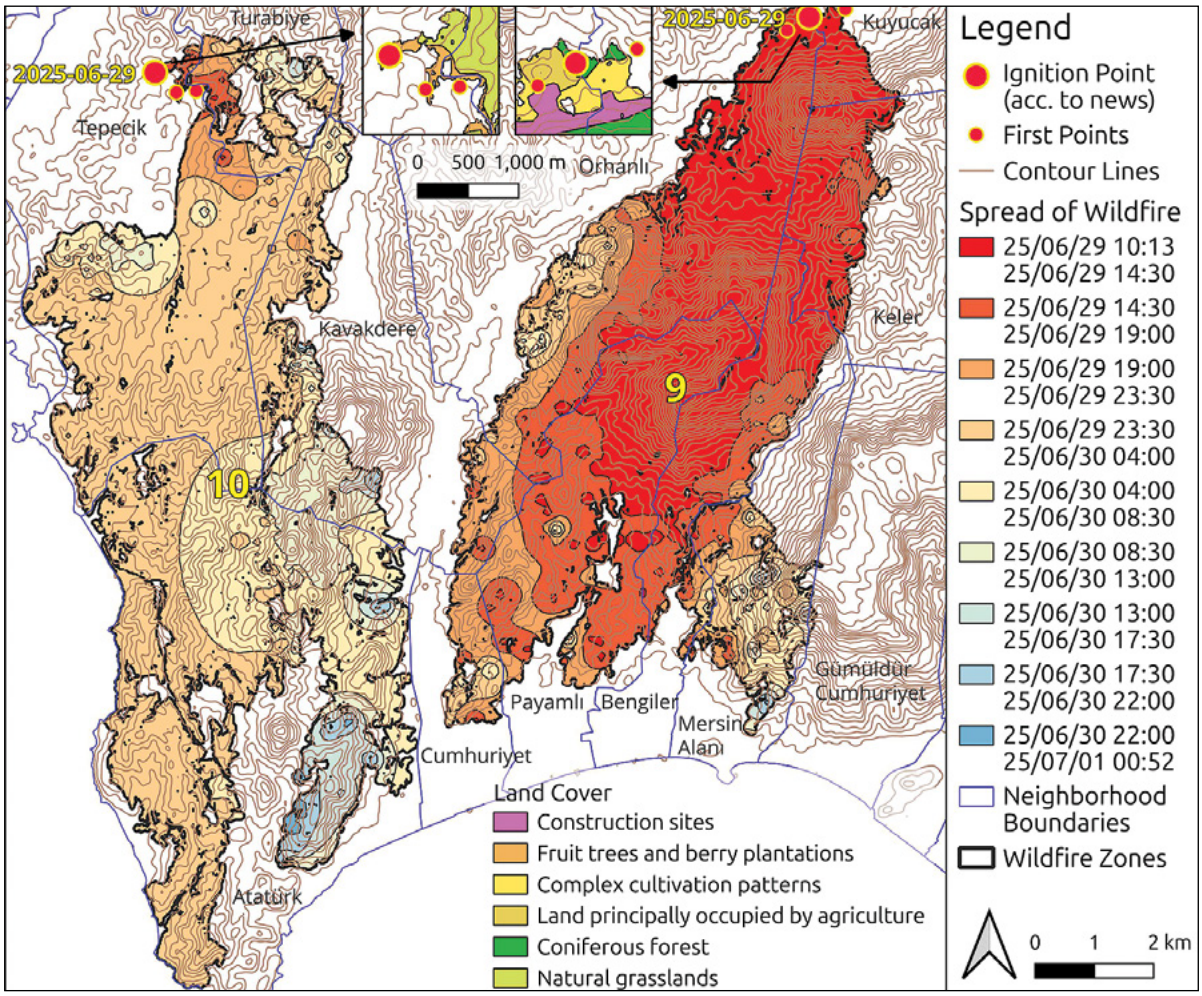

Figure 6 *FPM produced for the wildfire zones 9 and 10 in combination with ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

Seferihisar, and the other one at the Instagram account of Oluşum Haber (2025a) describing that the fire spread to a factory at the Ozer Turer Farm located in Tepecik. At the northern part of the zone concerned, there is only one such location covered by fruit trees and berry plantations close to a residential area and Turer Farm. According to the fire report published on 8 August, 2025, the fire may have started as a result of unextinguished cigarette butts thrown or accidentally dropped by an unidentified person or persons igniting flammable grass (Yangın raporu, 2025). As for the wildfire zone 9, İzmir Governor Elban stated that the fire was believed to have been caused by an electrical wire (İzmir'de yangın kabusu, 2025; İzmir'deki yangınlar elektrik, 2025).

Meaningful sub-daily FPM can be produced only if there are adequate number of points in AF data. If the number of points is very limited, it would be better to present the data as it is. Two other fires (wildfires 12 and 13 close to each other) in Seferihisar exemplify this case (Figure 7) together with one (wildfire 15 in Kızılçukur) in Dikili. According to the narratives, wildfire 12 started in a maquis shrubland for an unknown reason around noon on 1 July, 2025 in Tepecik area of Düzce Village and it quickly spread due to strong winds approaching only 500 meters from TOKİ residences in the area (Düzce'de yangın, 2025; Seferihisar'da alevler durmuyor, 2025). Compared with the zone 12, news for the wildfire zone 13 are limited. There are some news on the Instagram account of Oluşum Haber (2025b) informing us about the fact the fire broke out in the Gözsüzler area of the Camikebir neighbourhood in Seferihisar and that it was rapidly advancing towards the village Sığacık residential complex.

When the AF data is mapped on land-cover, the ignition point of wildfire 12 is marked as shown in sclerophyllous vegetation area in the northern direction close to Düzce village. Although AF data available from MODIS and VIIRS confirm the direction of the ignition point, they belong to a time 3 days after the incidence. For the wildfire zone 13, there are more consistent AF data from both MODIS and VIIRS. The colour inside the circles representing AF data shows the brightness temperatures of the active fire pixel measured in Kelvin. Compared with the other zones, there is only one piece of news for the fire in the wildfire zone 15 on the Instagram account of Egeli Duysun stating that forestry teams are fighting forest fires in Dikili, Çandarlı, Yeni Foça, Kızılçukur and Kozak (Egeli Duysun, 2025), which is confirmed by two AF points available for the zone from VIIRS.

In spite of limited number of AF data, sub-daily FPMs can also be produced for similar kinds of wildfires. In this context, the maps produced for two small fires occurring in Aydın can be seen in Figure 8. In the wildfire zone 17, the

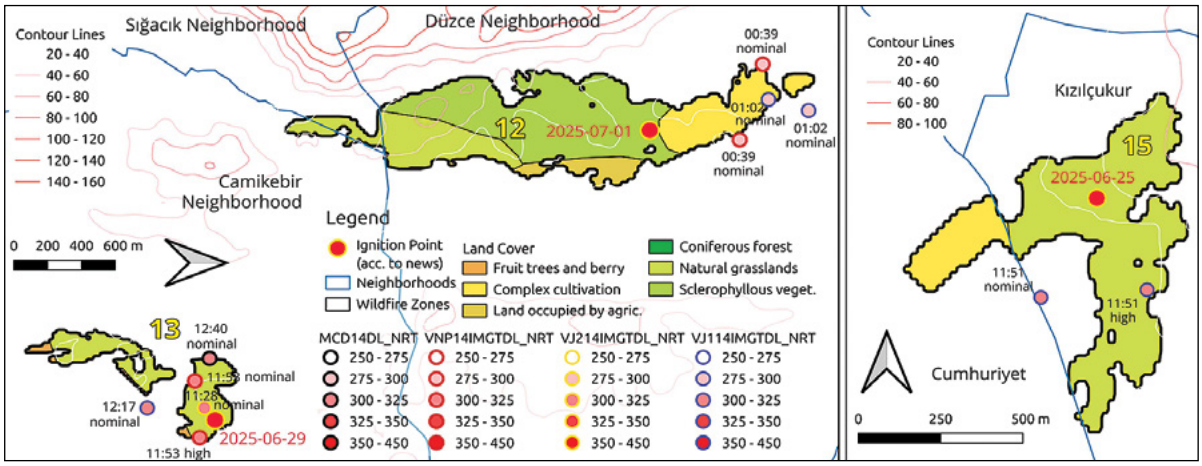

Figure 7 *AF data for wildfire zones 12 and 13 together with wildfire zone 15 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

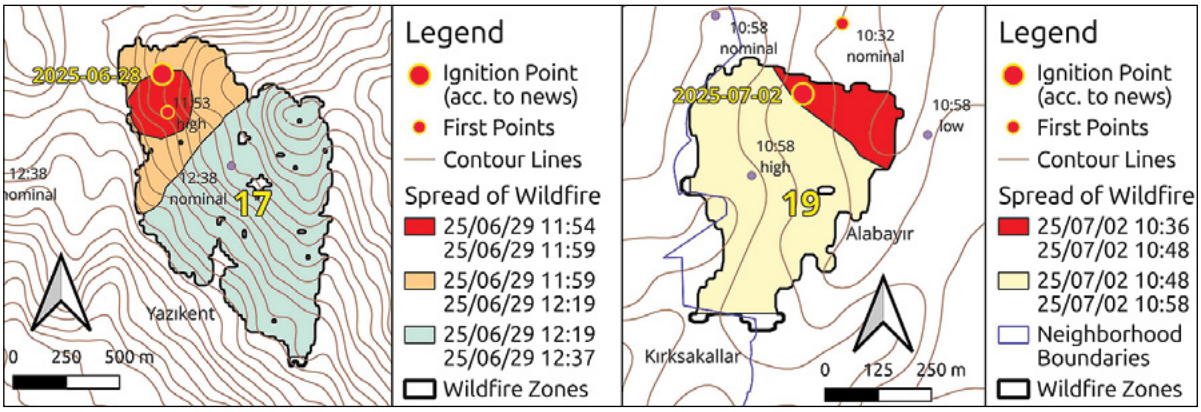

Figure 8 *FPM produced and AF data for the wildfire zones 17 and 19 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

blaze began in the Kızılçakır area (upper part – northern direction) of the Yazıkent neighbourhood in Aydın's Bozdoğan District and it was brought under control after nine hours of fighting (Aydın'da saatlerdir süren orman yangını, 2025; Manisa ve Balıkesir'de yangın sürüyor, 2025). Besides, the fire in the wildfire zone 19 broke out in an agricultural field and scrub area in the upper part of the Kırksakallar neighbourhood of Aydın's Çine District for an as yet unknown reason (Aydın Çine'de ziraat ve makilik alanda yangın!, 2025; Aydın'da yangın, 2025). In the case of the wildfire zone 17, three AF points are available as presented in Figure 8 with small dots in association with the observation time and level of confidence. Two of these points fall inside the wildfire zone delimited according to Sentinel 2 data. For the wildfire zone 19, although there are 4 AF points compiled from FIRMS, only one of them falls inside the zone. Nevertheless, other points are very close to the zone concerned.

As elucidated in the previous section, in some wildfire zones there is no AF data from FIRMS. Two such zones exist in this study; 4th and 14th wildfire zones. In the case of 4th wildfire zone, although there are AF data towards the north of wildfire zone within a distance 2-3 km to the zone for the start day of fire and the subsequent day, there is no AF data inside the zone. Nevertheless, existence of fire can be confirmed by the news and Sentinel 2 data. Actually, the fire ignited in the rural Çepnidere neighborhood of Turgutlu, Manisa, driven by the wind, it spread to the Halilbeyli neighborhood of Kemalpaşa in İzmir damaging many cattle farms in the area (Son dakika! Turgutlu'da başlayan yangın İzmir'in mahallesine ulaştı, 2025; Manisa'da çıkan, 2025). The damage caused by the fire can be confirmed in the map showing the land-cover types inside the zone (Figure 9). Progression of the fire from Manisa's rural area covering

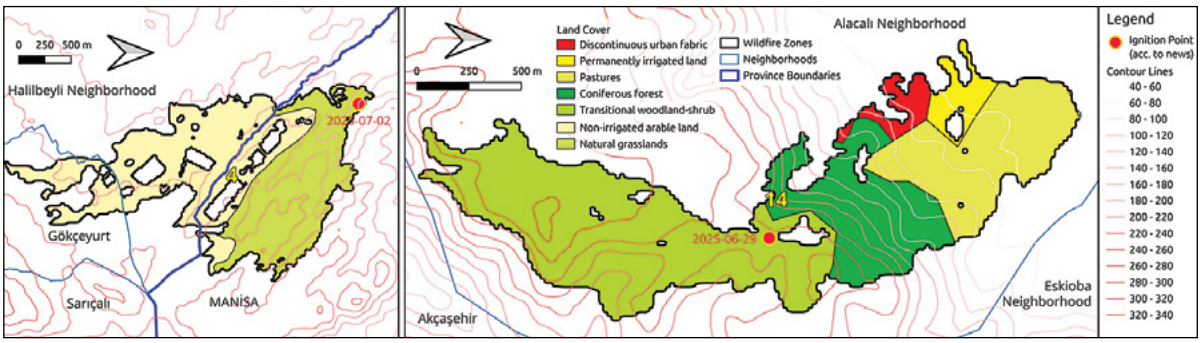

Figure 9 *The wildfire zones 4 and 14 in combination with probable ignition points according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

natural grasslands to arable land in Halilbeyli exposes the damage caused in the farms. In the news it was reported that the fire started in an electrical transformer in a field near the rural Çepnidere, which unveils the probable location of ignition point (Son dakika! Turgutlu'da başlayan yangın İzmir'in mahallesine ulaştı, 2025).

In parallel to zone 4, although there is an AF data towards the north of the wildfire zone 14 within 3-4 km distance to the zone concerned for the previous day of start of fire, there is no AF data again inside the zone. However, the existence of fire can be confirmed again by the news and Sentinel 2 data. According to news, the fire broke out in a scrub area near the Alacalı neighbourhood for an as yet unknown reason, and driven by strong winds, the flames quickly reached the neighbourhood centre where evacuations were initiated as the fire threatened homes and livestock barns (Tire'deki yangın yerleşim alanına sıçradı, 2025; Yerel Güç Haber, 2025). Based on this description, a probable ignition point can be placed for the fire in transitional woodland-shrub near the Alacalı (Figure 9).

In some zones, although there are many AF points or an adequate number of them, they do not properly overlap with the wildfire zone. Two such zones are the wildfire zones 1 and 7. In spite of these limitations, FPMs are also produced for these zones to get a sense of spread of the wildfires in the respective zones. It is reported that the wildfire in the zone 7 (Figure 10) is caused by sparks from an unlicensed construction site that cut and welded iron in the Olduruk area of Zafer neighbourhood of Buca (Buca yangını havadan görüntülendi, 2025; Buca'da orman yangını, 2025; Buca'da yanan orman-

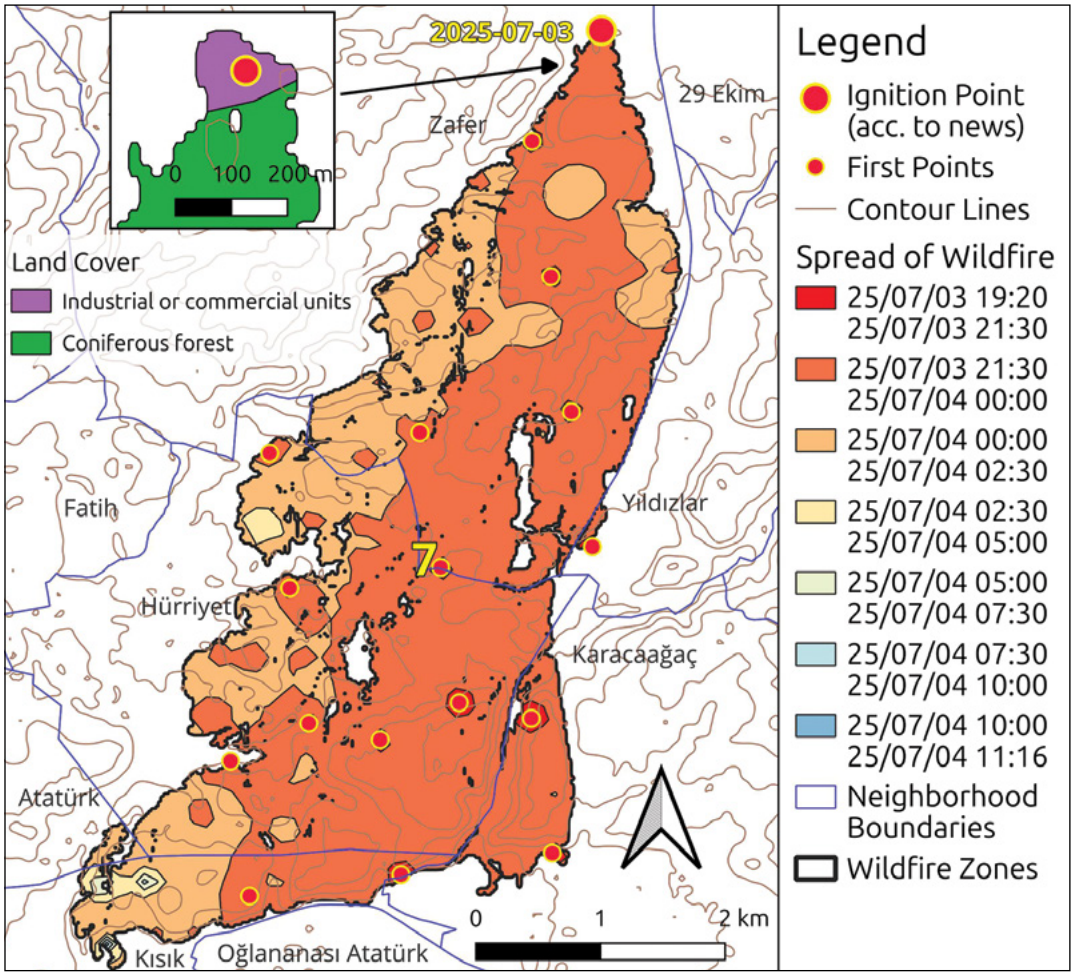

Figure 10 *TFPM produced for the wildfire zone 7 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

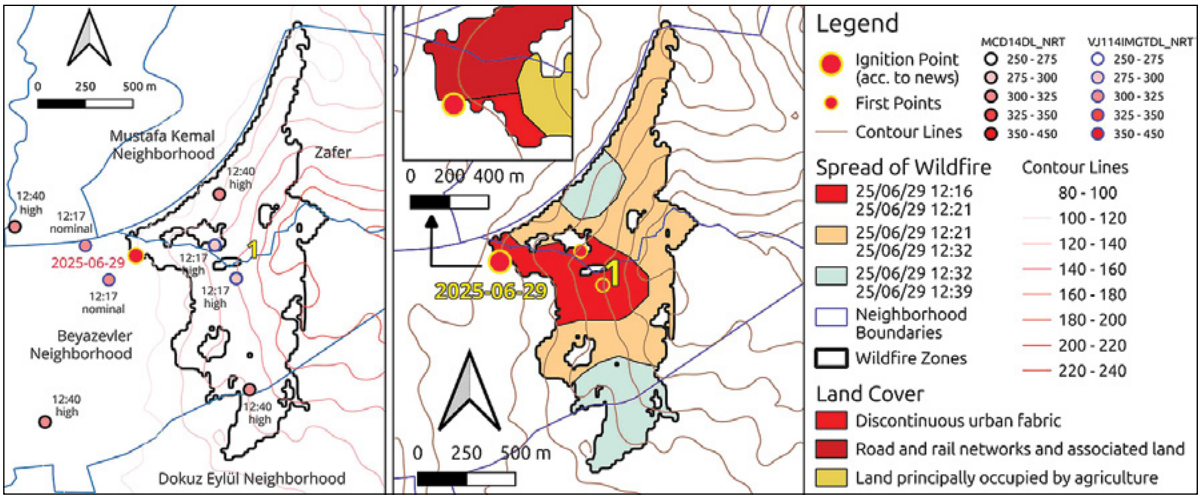

Figure 11 *AF data and FPM produced for the wildfire zone 1 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

lık alan, 2025; İzmir Buca'daki orman yangını, 2025). As part of an investigation, two suspects were taken into custody for allegedly causing the fire while working with a spiral windmill in the area (Buca'da orman yangını, 2025; İzmir Buca'daki orman yangını, 2025).

Unfortunately, due to strong wind, the fire quickly grew by spreading to a nearby grassy-trash area and then to the red pine forest advancing toward İzmir-Aydın highway and Kısık industrial site covering a wide area (Buca'da yanan ormanlık alan, 2025; İzmir Buca'daki orman yangını, 2025). Among the other wildfire zones occupying an area over 1000 ha, the wildfire in the zone 7 is characterized by quick spread of the fire and multiple locations of sub-sequent ignition points which are seemed to be caused by the strong winds. This is also evident in the map from the isochrones showing the sub-daily progress of the fire according to intervals calculated in hours and minutes. The fire's first ignition point can also be confirmed with land cover data. As described in the news, the fire's ignition point is placed at the northern part of the zone in land-cover category corresponding to industrial or commercial units.

Compared with the wildfire zone 7, the wildfire zone 1 is small (Figure 11). The fire broke out in a garbage dump in the Beyazevler neighbourhood of Gaziemir, and driven by the wind, the flames quickly spread to the forested area and then to the nearby Otokent dealership complex, where numerous vehicles were burned to ashes (İzmir'deki yangın galericiler sitesinde onlarca aracı küle döndürdü, 2025; İzmir'de yangın Otokent Galericiler Sitesi'ne

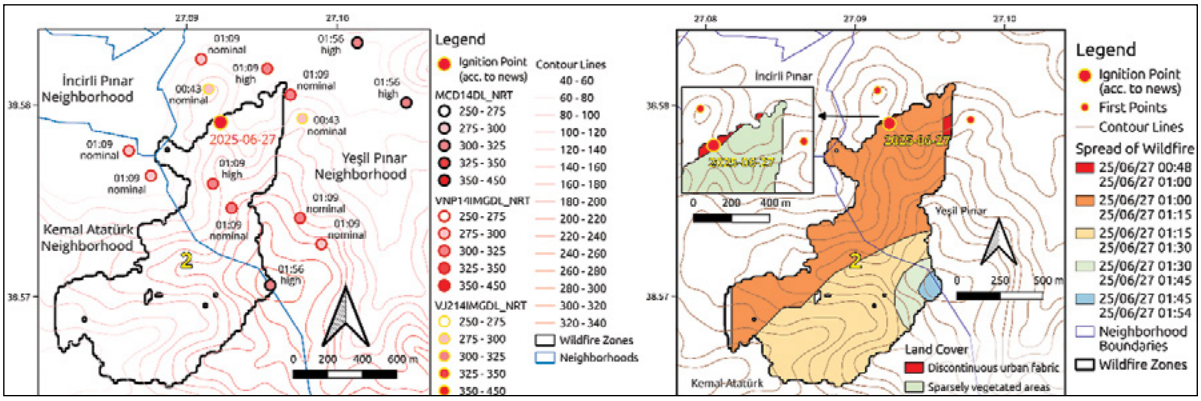

Figure 12 *TAF data and FPM produced for the wildfire zone 2 in combination with ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

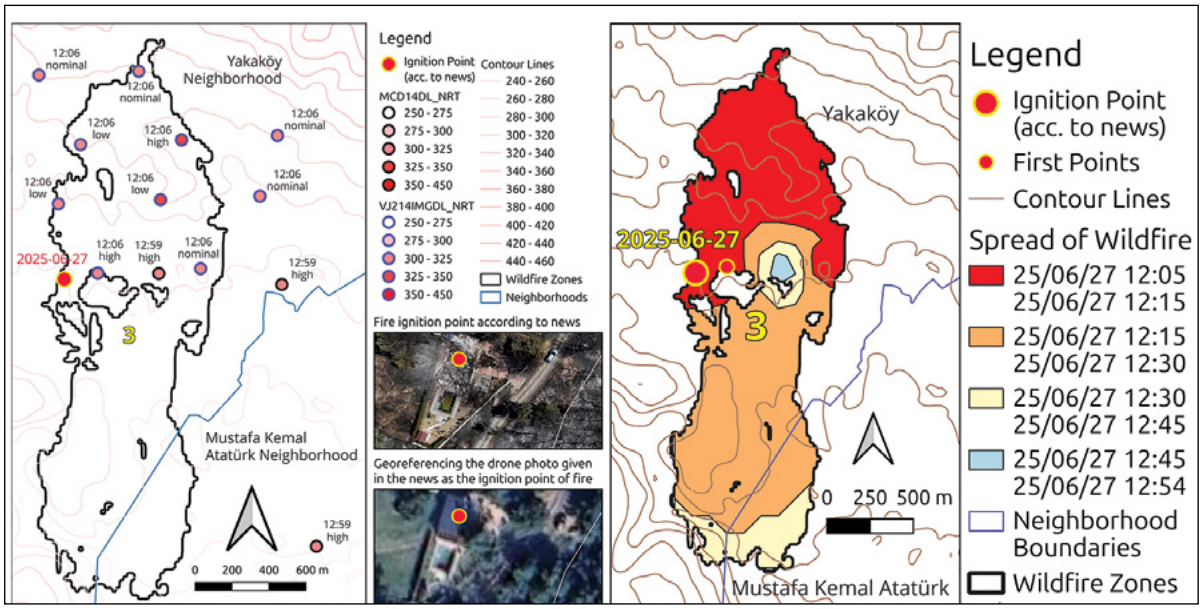

Figure 13 *AF data and FPM produced for the wildfire zone 3 in combination with the ignition point according to news confirmed with a drone photo and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

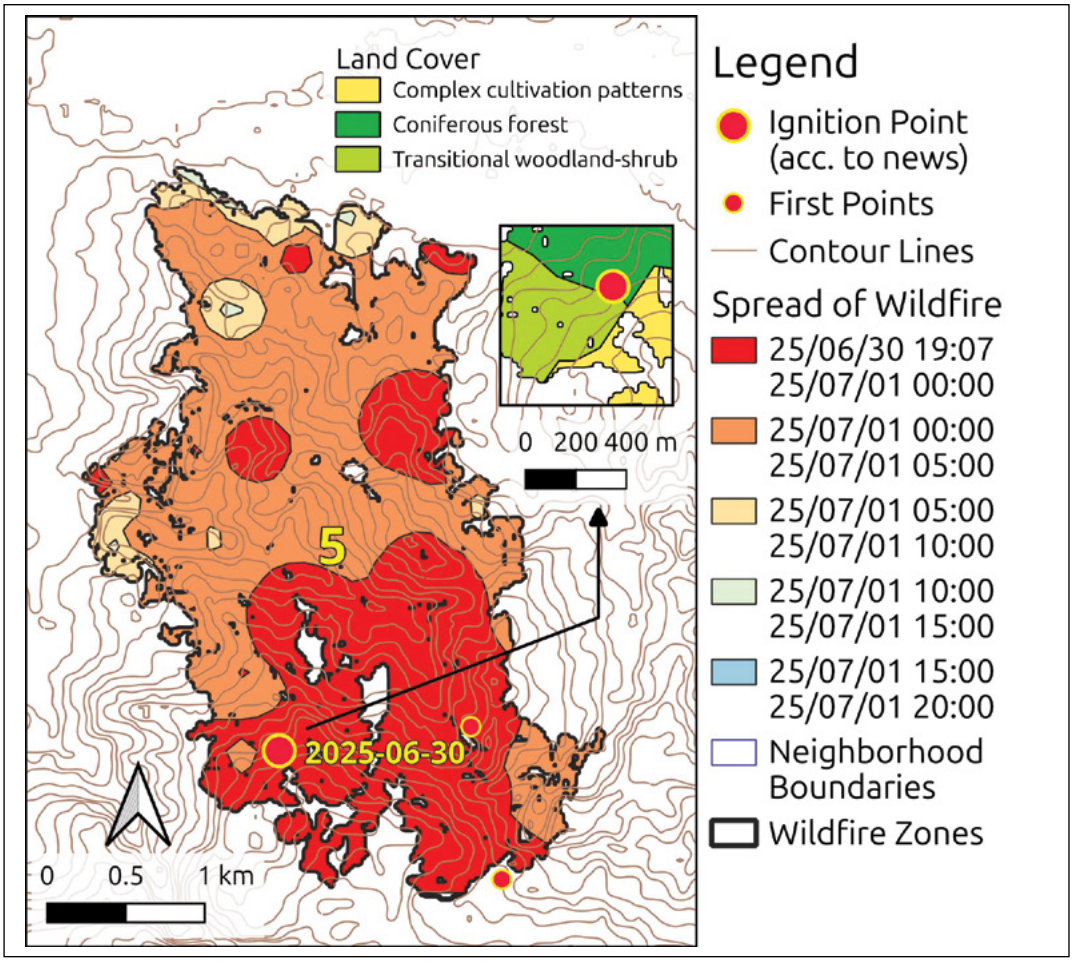

Figure 14 *FPM produced for the wildfire zone 5 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

sıçradı, 2025). One person was detained as part of an investigation launched into the fire by the Chief Public Prosecutor's Office (İzmir'deki yangın galericiler sitesinde onlarca aracı küle döndürdü, 2025).

The starting point of the wildfire zone 1 is very close to urban area, which can be confirmed by land cover data covering the ignition point determined according to the news and distribution of AF points falling outside the zone, but inside urban area. Figure 11 is also illustrative for the limitation of inadequate number of AF points partly overlapping with the wildfire zone boundaries in the creation of FPM for the zone concerned. Nevertheless, it gives us a sense of progression of the fire.

Some other small wildfire zones are also characterized by agglomeration of AF data in a certain part of the zone. Two illustrative examples are the wildfire zones 2 and 3. According to news, in the wildfire zone 2, the fire started at night (on 27 June, 2025) in Menemen Asarlık (İzmir Hakkında, 2025; Menemen Havadis, 2025). On the base of AF data agglomerated at the northern part of the zone, an FPM with an interval of 15 minutes is produced (Figure 12).

The third wildfire broke out in Yakaköy neighborhood of Bornova during roof renovations under welding at 40 degrees Celsius which caused the sparks to spread first to the property and then to the forest, which created devastating effects for those losing their homes and vehicles (40 derecede kaynak yaptı, yangın çıktı!, 2025). The drone photo of the property causing fire during renovations is used for fixation of the fire's ignition point in the zone 3 via geo-referencing the respective photo (Figure 13). It is observed that AF data are again agglomerated in the northern part of the zone.

In contrast to these cases, wildfires occupying relative larger areas at the eastern part of İzmir city-region such as the wildfire zones 5, 8 or 16 are characterized by availability of relatively abundant and homogeneous distribution of AF data parallel to the big wildfire zones at the western part of the city-region (as exemplified by wildfire zones 9, 10 and 11). Although smaller than these wildfires, the wildfire zone 18 in Aydın has also a homogeneous distribution of AF data. In the wildfire zone 5 (Figure 14), the fire broke out in a garbage dump in the Dereköy neighbourhood of Manisa's Ahmetli District and spread to a forested area (Ahmetli orman yangını, 2025; Ahmetli'deki orman yangını, 2025).

The fire in the wildfire zone 8 (Figure 15) started in the Suçıktı and Tosunlar neighbourhoods of Ödemiş because of electrical wires, and spread over a wide area, first covering the villages of Tosunlar and Suçıktı, and then Üzüm-

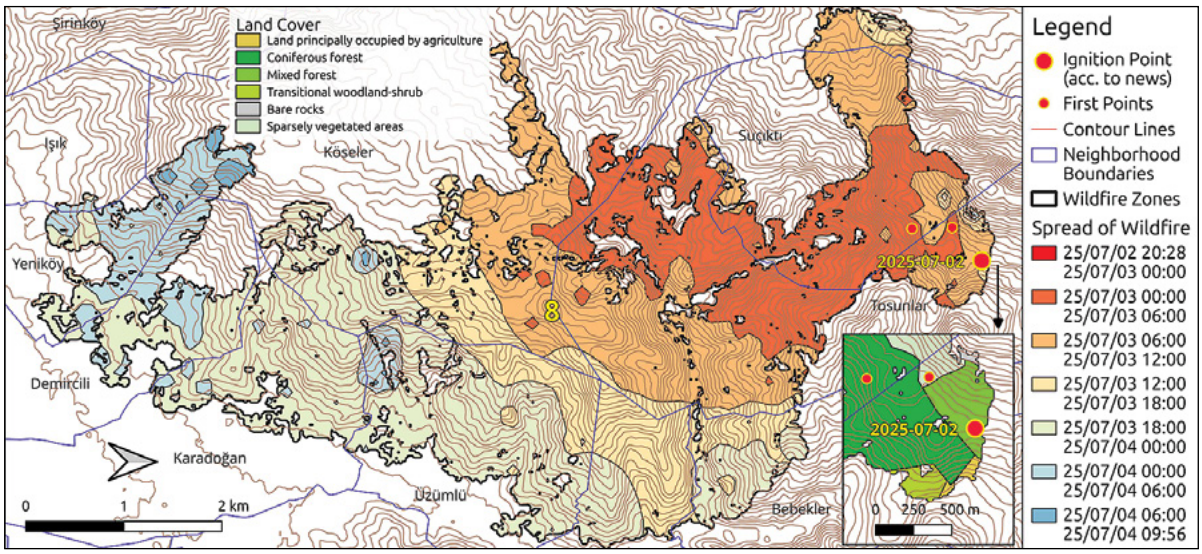

Figure 15 *FPM produced for the wildfire zone 8 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

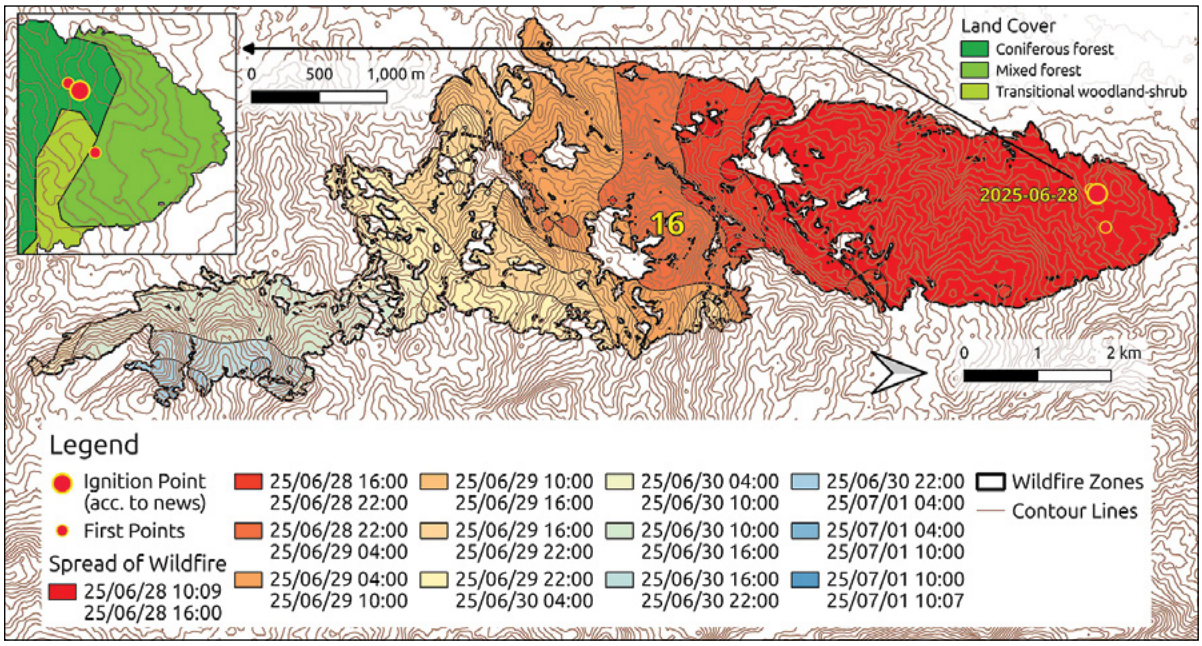

Figure 16 *FPM produced for the wildfire zone 8 in combination with ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

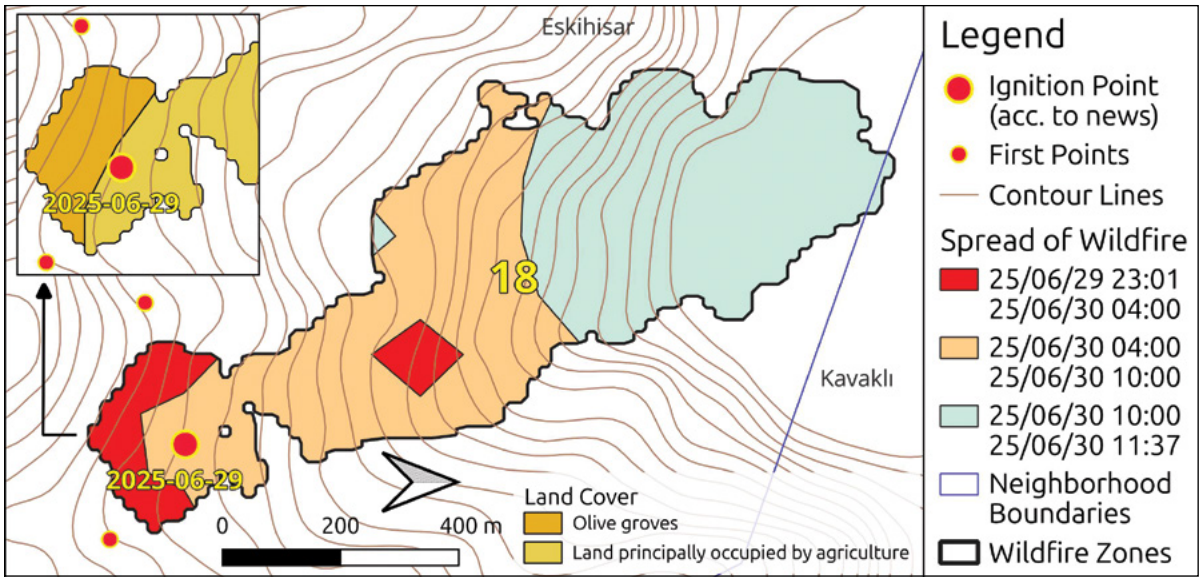

Figure 17 *FPM produced for the wildfire zone 18 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

lü and Köseler, due to strong winds (Ödemiş yangınında, 2025; Ödemiş'te yangının nedeni, 2025; Rapor çıktı, 2025). Description of the progression of the wildfire in the news exactly corresponds to the FPM produced for the wildfire 8 zone associated with administrative boundaries in Figure 15.

According to the news, in the wildfire zone 16, the fire allegedly started in a forest area near the Karaköy neighbourhood of Manisa's Akhisar District because of a negligent beekeeper trying to create smoke to calm the bees in the area, and it spread rapidly due to the strong winds resulting in the evacuation of many villages, as a precaution (Akhisar'daki orman yangınına müdahale, 2025; Akhisar'da yangın sürüyor, 2025). The suspected beekeeper was arrested on charges of causing the fire by negligence (Akhisar'daki orman yangınına müdahale, 2025, Akhisar'da yangın sürüyor, 2025). As it is evi-

dent from Figure 16, the ignition point of the fire corresponds to a forest area in CLC data.

The description provided for the progression of the fire in the news is also completely in line with the FPM produced on the base of AF data. The fire in the wildfire zone 18 (Figure 17) broke out in an agricultural field in the upper Eskihisar neighborhood of Aydın's Sultanhisar District for an as yet unknown reason, and it spread due to the wind (Aydın'da ziraat alanında çıkan yangın, 2025). The ignition point defined according to news in compliance with CLC data and administrative boundaries corresponds to the First Points showing the earlier AF points.

DISCUSSION

The causes of the wildfires analysed in this study are imprinted with some dominant reasons as evident from the previous sections (Table 3). Although for 40% (8) of the wildfires analysed no cause is given in the news, it is reported that five incidences (25%) are related to electricity transmission infrastructure. The next remarkable cause is the uncontrolled activities in garbage dumps (15%). In two cases (10%), it is reported that the wildfires ignited because of sparks from the renovations on the roof of a house and an unlicensed construction site. There is no doubt that the role of urban activities constitutes the reason for the majority of cases (more than 50% of all cases and more than 90% of the cases whose causes are known). Among the incidences there is only one case that seems to stem from a rural activity as exemplified in the case of the wildfire zone 16 where the fire was ignited because of a beekeeper using smoke to calm the bees. Wildfires caused by accident, negligence, or intentionally constitute 88% of forest fires in Türkiye and the remaining portion is caused by lightning, one of the most important natural causes of the wildfires (Türkeş & Tolunay, 2023).

Table 3 *Wildfire zones (WZ), the generalized cause of the fires and the statistics for AF points*

WZ	Date	Cause of the fire	AF used	AF inside zone	AF used per ha
1	06.29	garbage dump	8	5	11.53
2	06.27	unknown reason	14	7	8.46
3	06.27	sparks from the renovations on the roof of a house	16	8	11.82
4	07.02	electrical transformer	-	-	-
5	06.30	garbage dump	80	73	10.03
6	06.25	power line in forest	164	133	5.57
	06.26	garbage burned by an individual near the industrial facilities			
7	07.03	sparks from an unlicensed construction site cutting iron	332	258	4.68
8	07.02	electrical wires	499	447	4.78
9	06.29	power line - electrical wire in forest	660	597	7.47
10	06.29	as a result of unextinguished cigarette butts thrown	361	326	13.86
11	07.02	power line in an agricultural area	1239	1143	7.88
12	07.01	unknown reason	-	-	-
13	06.29	unknown reason	5	4	4.52
14	06.29	unknown reason	-	-	-
15	06.25	unknown reason	2	1	14.89
16	06.28	because of a beekeeper using smoke to calm the bees	384	341	8.02
17	06.28	unknown reason	3	2	33.86
18	06.29	unknown reason	22	18	2.16
19	07.02	unknown reason	4	2	5.19

Source: the author; based on the wildfire news in the media and the analysis conducted in the study by using Sentinel 2, MODIS and VIIRS data

While the wildfires caused by the lightning is also important in the ignition of fires, for the studied region and era no such reason is reported in the media as the cause of a given wildfire. Nevertheless, according to the official statistics compiled by the General Directorate of Forestry it is known that 5.83% of the wildfires in Türkiye were caused by lightning in 1997 (Orman Genel Müdürlüğü, 2025). Although this ratio increased to 19.12% in 2024, on average 11.79% of the wildfires in Türkiye between 1997 and 2024 were caused by lightning. The reflection of these statistics on the total area burned is somehow different. Indeed, in 1997 lightning was responsible for the destruction of 37 hectares of forest area corresponding to the only 0.59% of the total area of forests burned in the same year. While this ratio increased to 2.67% in 2024, on average the lightning was responsible for the destruction of only 1.78% of the forest areas burned in Türkiye between 1997 and 2024. It is important to remark that lightning is usually the sole natural cause of wildfires, which again reveals the importance of human factor in the ignition of wildfires.

In parallel to observations revealed in this study in relation to the wildfires caused by the failures in energy transmission lines, the official statistics exposed that the share of power lines system failures as a cause in the total number of wildfire incidences tends to increase over time; it increased from 3.27% in 2012 to 4.44% in 2021 (Atmiş et al., 2023). Compared with the lightning and their share in the total number of wildfire incidences, the ruptures or failures of energy transmission lines have a more devastating impact on the forest areas in terms of total area burned over time. Although in 2012 the forest lost caused by the rupture or malfunction of power transmission lines was 80 ha corresponding to only 1.13% of total forest area lost in the same year, this amount increased to 4,536 ha corresponding to 29.23% of total forest area lost in 2023 (Orman Genel Müdürlüğü, 2025).

In fact, power lines system failures under extreme wind conditions led to multiple ignitions owing to the fact that they cross a broad geographic area, which resulted in explosive wildfire growth as observed in the US state of California in 2007 and the Australian state of Victoria in 2009 (Mitchell, 2013). In parallel to these catastrophic wildfires, in the fire narratives compiled from the news for the case of İzmir, it is observed that the strong wind seems to be part of the story not only in terms of the fire spread but also its ignition. As Mitchell (2013) remarks, ignitions from power lines are the only wildland fire cause that increases with wind speed. Thus, although the sprawl of urban areas and uncontrolled activities in urban fringe areas create a potential threat to forests because of the increasing probability of fire ignition, this study reveals the role of proper maintenance of technical infrastructure of electricity distribution network in the prevention of wildfires. In particular, this is an issue of planning and maintenance of the respective system, and in general, proper implementation of the spatial decisions taken in urban and regional plans prepared for the city-region concerned.

In relation to the declared cause for the wildfire zone 11, BirGün's headline, 'the greed for profit is burning,' by Sağol (2025) is particularly illustrative for the main motive behind the ecological crime dimension of the wildfires stemming from electricity distribution network. Mahir Ulutaş, Chairman of the Board of Directors of the Chamber of Electrical Engineers (EMO), stated that electricity distribution lines, which occasionally cause fires, are now operated by private distribution companies after privatization, and that maintenance and repair work is contracted out to subcontractors with less technical expertise to maximize profits (İzmir'deki yangınlar elektrik, 2025). Ulutaş emphasized that electricity systems require constant maintenance, and before privatization, there were personnel who visited and checked the lines for maintenance purposes, but the personnel were purged after privatization (İzmir'deki yangınlar elektrik, 2025). Nonetheless, in many advanced countries corporate entities such as electricity companies are assumed to handle vegetation and minimize

the risks of the wildfires stemming from their operations.

Yet, neo-liberal economic system relies on profit driven instinct limiting the agents in fulfilling their social responsibilities even though they may be defined in their contracts. In this context, privatization of electricity distribution network and profit driven approach of private sector seems to prevent them from taking necessary precautions for prevention of wildfires caused by power lines or other components of the electricity distribution network. As remarked above, regular cleaning and inspection of the area beneath power lines is extremely necessary. Combustible materials should be monitored along the routes of power lines passing through forests, intersections, and residential areas, ensuring that thin combustible materials are removed from these routes. Environmental protection zones and health protection zones of power lines and other sectors occupying forest areas should also be defined according to universal standards by ensuring that relevant sectors (electricity generation and transmission, mining, etc.) comply with protocols and agreements in forest areas allocated for non-forestry purposes. Spatial adjustments for these sectors should be a topic of research in city and regional planning studies.

Overall, any service left incomplete by distribution companies with diminished technical capacity and competence can lead to fatal accidents and fires. Although, between 2014 and 2023, the rate of fires caused by power lines was at most 5 percent, the rate of area burned in fires ignited by this cause is quite high reaching to 29.2% in 2023. (Güngöroğlu et al., 2025). In parallel to these findings, it was calculated in this study that according to the information compiled from the news for the recent wildfires in İzmir city-region, the electricity distribution network is responsible for more than 60% of the total burnt areas even though the share of wildfire incidence number linked to the respective network is 25% of the incidence total. According to data from the Turkish Foresters Association (TOD), an average of 94 fires broke out annually in the Aegean region over the last decade due to power transmission lines, burning 5,215 hectares. However, the penalties imposed by the General Directorate of Forestry on energy companies haven't been made public (Sağol, 2025).

As suggested at the beginning of the study, agents involved in the creation of wildfires can be analysed at different levels. Direct involvement of individuals in the ignition of a wildfire is exemplified in the cases of the wildfire zones 3, 6 (the second ignition point), 7, 10, and 16 (25% of all cases). In some of these cases, the suspects responsible for the fire were immediately identified and detained by the officers. However, in the case of fires reported to be originated from the electricity distribution system, it is observed that the suspects were not individuals but corporate entities (local energy companies) assumed to run and maintain the system concerned. According to Gediz Electricity Distribution Inc. which operates the electricity distribution service in İzmir, there is no concrete evidence that the fires originated from power lines (İzmir'deki yangınlar elektrik, 2025). However, after the official report by the İzmir Metropolitan Municipality Fire Department revealed that the forest fire in the Ildır neighborhood of Çeşme was caused electrically, Çeşme residents, along with the İzmir Bar Association and environmental NGOs, filed a criminal complaint against Gediz Electricity Distribution Inc. (İtfaiye Raporladı, 2025). It is clear that without certain penalties on the part of agents causing fires and compensation for the victims of wildfires, socio-ecological system cannot be sustained.

A special attention should be paid to compensation dimension due to its complexity. Although a careless person who causes a forest fire by lighting a fire in a campsite is definitely guilty, it is unlikely to obtain compensation by suing the perpetrator, as losses can run into millions of US dollars and most people do not have the commensurate resources (Babrauskas, 2024). In a similar fashion, while the victim of a wildfire ignited by a power outage will likely sue the electricity company and receive compensation, the victim of a wildfire triggered

by a lightning strike, on the other hand, has no one to sue. Thus, if fires are started accidentally, the current system does not contain sufficient incentives to minimize the costs of tort litigation, nor does it include appropriate measures to ensure a fair distribution of costs in many countries (Babrauskas, 2024). Furthermore, if it is considered that big wildfires often occur in high wind conditions and sometimes as a result of foreign objects being blown into power lines by the wind, it is unrealistic to expect the entire electrical infrastructure to perform satisfactorily up to its design limits. Thus, the legal system should also be changed to encourage fire safety behaviour and ensure a more equitable distribution of cost burdens.

Fixation of the ignition points of fires has merit not only for the confirmation of the probable causes of the fires in terms of, for example, overlapping between power lines and ignition area, but also exposition of the role of topography and land cover in the spread of the fires concerned. For example, in some of wildfire narratives the actual source of the fire in a zone is confused with a nearby zone (for example, it is epitomized as if the source of fire in the zone 10 is the same with the one in the zone 9). Production of FPMs and subsequently fire isochrones together with the land cover data provides us with a more accurate description of actual dynamics and ignition points, which in turn, provides us with a more consistent and concrete story for the spread of each fire. In this context, outcomes of this study have also potential implementations in several areas such as modelling the fire spread for different locations in İzmir city-region, planning of forest road network and forest watchtowers, and also residential roads that should be reevaluated to ensure their adequacy in ensuring access for evacuation and firefighting vehicles in the event of a fire hazard.

In many studies conducted for assessment of the wildfire risk susceptibility and potential of certain regions, a spectrum of parameters including the role of topography and climatic conditions in the ignition and spread of the wildfire is used. In the majority of the studies, it is recognized that the higher the surface's steepness, the higher the fire spread rate, and subsequently, the greater the vulnerability of the forest to fire (Boboulos & Purvis, 2009; Çetin et al., 2022; Dupuy, 1995; Viegas, 2004). Indeed, all big wildfires occupying an area over 2000 ha and exposed in this study are characterized by steep terrain. Although the slope can both reduce and increase the influence of the wind, it is also known that the wildfire spreads faster upslope than downslope, which stems from the fact that flames are tilted closer to the surface and warm air rising up the slope results in drying out of the combustible materials because of preheating (Durlević et al., 2025; Vujović et al., 2024). In this context, the analysis of the rate of spread (ROS) of fire constitutes another domain of research for the prediction of fire behaviour. The isochrones produced in this study can be used for the calculation of ROS in future studies focusing on the fire risk assessment of particular areas in İzmir city-region. As Boboulos & Purvis (2009) remark, the statistical models built for ROS can be used to assess the risk for spreading of the fire by considering specific terrain features and climatic data in a particular geographic area.

In these models and forest fire risk analysis, the aspect indicating the compass orientation of the slope is also actively used (Djabri et al., 2023; Durlević et al., 2025; Vujović et al., 2024). Again, it is no accident that the majority of the wildfires analysed in this study is characterized by the southern direction exposed to more solar radiation compared with the other directions. Combined with the predominant wind direction which is from north to south in the study region, a detailed examination of topography and climatic conditions including precipitation, temperature, wind speed and concentration of sunlight, the subsequent studies may benefit from the outcome of this study instead of assigning a fixed weight to the role of topographic (slope and aspect) and climatic factors in the respective models. It is within this context that the results of this study are also valuable in terms of conduction of similar type of future studies for İzmir city-region.

In this context, as a rough measure of the resolution of FPMs produced in this study, the total number of AF points used in the production of fire isochrones can also be seen in Table 3. It is observed that for huge wildfire zones on average one AF point is available per 5-15 ha area of burnt land. It increases to 34 ha for small wildfire zones. This also implies the usability of AF data for big wildfires in combination with other technological instruments in the monitoring and prevention of wildfires. The impact of global warming on fires as a result of climate change is undeniable. However, with today's technology, such as drones or artificial intelligence applications, remote control of, for example, power lines can easily be done for the prevention of big wildfire disasters. In this respect, AF data in fact can be used in combination with drones so that the fires can be identified and intervened timely.

At this point, spatially continuous FPMs at a daily or sub-daily interval provide us not only with important insights about the role of availability and distribution of fuel, local topography and weather (such as moisture content) in fire spread as they directly influence the capacity of landscape to carry fire, but also combined with other basic maps such as land cover, they help us estimate fire arrival time for finding missing hotspots. Timely and accurately produced FPMs also help us establish a fire monitoring and management system in NRT that can provide us with critical decision support for on-field firefighting efforts (Scaduto et al., 2020). In this regard, the aggregation of AF data is particularly important for rapid initial fire perimeter delineation, and thanks to the availability of NRT FPM from satellite observations, continuous aerial observations by aircraft are not required any more.

CONCLUSION

Although, in our anthropocentric era, the long-term impact of climate change is the primary factor leading to disastrous wildfires, this should not obscure the role of a specific trigger in any given wildfire incidence. In this study, the wildfires occurring in İzmir city-region between 25 June and 5 July, 2025 are used as a laboratory to examine the damage caused by them and to contextualize the crime dimension for each wildfire incidence. When all these incidences are considered within the framework of panarchy, it becomes evident that global climate change makes the ecological system more vulnerable to the small individual disturbances whose effects are amplified due to the current state of the change characterized by a cumulative process of causation. What is evident from the discussion section is that the exposition of suspects of wildfires may not automatically result in the compensation to the fire victims, be it humans or other living organisms.

In this respect, two issues gain importance; (1) establishment of a more equitable distribution of cost burden and (2) promoting a behaviour valuing all living organisms. For the former characterized by practical concerns, the insurance system can be improved to absorb the costs associated with wildfire liability. However, the latter seems to require a shift in the ontological conceptions that may trigger changes in the third level cascading up to a 'wonderful world' in the first level. In this context, it is argued that if the current wildfire prone world is a result of the Anthropocene placing the 'Anthropos' at the centre of geological narratives, it can only be reversed by a transition to a more biophilic world. For such a transformation, as Carvalho & Riquito (2022) remark, a shift is required from existing ontologies favouring a world model characterized by extractivism, dualism and human exceptionalism to the ontologies characterized by pluriverses recognizing the heterogeneous clamour of human and non-human agency via recognition of intimate entanglement of politics, aesthetics and affect. That's why, in this paper, as a concluding remark a new ontology is proposed; biophilic ontology.

It is within this context that the panarchic conception of the role of individual actions of humans exposes the importance of the third level human factors in terms of initiation of

a reverse cycle. Circular effect making the world wildfire-prone can only be interrupted with the strategic decisions favouring a biophilic intervention into and conception of the socio-ecological system in which we live. The change at the first level of human factor on ecological system depends upon the change at the second level characterized by the path-dependency of socio-ecological system as illustrated in the case of concept of fire regime. Once the fire regime is restored with biophilic interventions parallel to the other socio-ecological cycles, we may have some hope to tame the Anthropocene.

Supplementary Materials: Models developed in QGIS for the delimitation of isochrones will be available together with other models developed for calculation of NBR and polygon overlay.

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EXPLORING PATTERNS OF RIPARIAN VEGETATION ASSEMBLAGES TO REVEAL HUMAN-INDUCED LANDSCAPE CHANGE ALONG SOUTHERN SEMI-ARID MEDITERRANEAN STREAMS

ISTRAŽIVANJE OBRAZACA PRIOBALNIH VEGETACIJSKIH ZAJEDNICA RADI OTKRIVANJA PROMJENA KRAJOLIKA UZROKOVANIH LJUDSKIM DJELOVANJEM DUŽ JUŽNIH POLUSUŠNIH MEDITERANSKIH TOKOVA

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This study investigates the composition and ecological structure of riparian vegetation in southern Mediterranean semi-arid streams (north-eastern Algeria) to test how environmental filtering and anthropogenic pressures shape community assemblages. Vegetation relevé plots and a combination of landscape metrics have been used to quantify the spatial configuration and express the ecological condition of these riparian areas. Multivariate statistical process including Jaccard's distances matrix, hierarchical clustering procedures, Distance-based Linear Models (DistLM), and Generalized Linear Models (GLMs) were used to unveil the ecological status of these areas. We have identified a total of 25 woody plants (trees and shrubs) distributed in two dissimilar assemblages (SIMPROF test) promoted mainly by topographical variables, proximity to human activities, damming and aridity intensity, which explained 44.4% of total variance in woody composition according to DistLM ordination. Group 1, undisturbed landscape dominated (IndVal > 0.7, $p < 0.001$) by natural riparian plants such as Populus alba (stat = 0.874), Cytisus purgans (0.788), Juniperus oxycedrus (0.788), and Rubus ulmifolius (0.766), mainly align with sites located at mid to high altitudes, further from human settlements, and in undammed streams. Group 2, a human induced landscape dominated by Rhus tripartita, and associated with lower altitudes, close proximity to human development, and the presence of dams. Our best-support-

ed GLM showed that woody species richness increased at sites with permanent stream flow (β = 0.33, p = 0.01) and higher elevation (β = 0.25, p = 0.009), but declined in riparian zones affected by damming structures. The significant effect of proximity to human habitation on species composition, but not on species richness (not retained in the best model), indicating that the complementary use of diversity metrics (species richness and composition) is crucial to properly capture the effects of human disturbance.

Keywords: riparian biota; multivariate analysis; environmental gradient; land use; disturbance

Ova studija istražuje sastav i ekološku strukturu priobalne (riparijske) vegetacije u južnim mediteranskim polusušnim vodotocima (sjeveroistočni Alžir) da bi se ispitalo kako okolišni filtri i antropogeni pritisci oblikuju sastav biljnih zajednica. Vegetacijske plohe (relevéi) i kombinacija krajobraznih metrika primijenjene su za kvantifikaciju prostorne konfiguracije i procjenu ekološkog stanja tih riparijskih područja. Multivarijatni statistički postupci, uključujući Jaccardovu matricu udaljenosti, hijerarhijsko klasteriranje, Distance-based Linear Models (DistLM) i generalizirane linearne modele (GLM), korišteni su za otkrivanje ekološkog statusa tih područja. Identificirano je 25 drvenastih biljaka (stabala i grmlja) raspoređenih u dvije međusobno različite zajednice (SIMPROF test), koje su uglavnom određene topografskim varijablama, blizinom ljudskih aktivnosti, prisutnošću brana i intenzitetom aridnosti. Ti čimbenici, prema DistLM ordinaciji, objašnjavaju 44,4 % ukupne varijance u sastavu drvenastih vrsta. Skupina 1, koju obilježava slabo poremećen krajobraz i dominacija prirodnih riparijskih biljaka (IndVal > 0,7, p < 0,001) kao što su Populus alba (stat = 0,874), Cytisus purgans (0,788), Juniperus oxycedrus (0,788) i Rubus ulmifolius (0,766), uglavnom se povezuje s lokalitetima na srednjim do većim nadmorskim visinama, udaljenijima od ljudskih naselja i u vodotocima bez brana. Skupina 2 predstavlja krajobraz pod snažnim ljudskim utjecajem, dominantna je vrsta Rhus tripartita povezana s nižim nadmorskim visinama, blizinom ljudskih aktivnosti i prisutnošću brana. Najbolji GLM model pokazao je da se bogatstvo drvenastih vrsta povećava na lokalitetima sa stalnim protokom vode (β = 0,33, p = 0,01) i većom nadmorskom visinom (β = 0,25, p = 0,009), ali se smanjuje u riparijskim zonama zahvaćenima izgradnjom brana. Značajan utjecaj blizine ljudskih naselja na sastav vrsta, ali ne i na bogatstvo vrsta (nije zadržan u najboljem modelu), pokazuje da je komplementarna uporaba pokazatelja raznolikosti (bogatstvo vrsta i sastav zajednice) ključna za ispravno bilježenje učinaka ljudskih poremećaja.

Ključne riječi: riparijska biota; multivarijatna analiza; okolišni gradijent; korištenje zemljišta; poremećaj

INTRODUCTION

There is an increasing need to provide localized information about the status and characteristics of vulnerable ecosystems, as the impact of some local factors (e.g., local land use) may counteract or amplify the effects of broader-scale drivers (e.g., climate change) (Bendix & Stella, 2013). Global datasets and broad-scale analyses often fail to capture the fine-scale environmental and ecological dynamics that are critical to understanding how ecosystems function and respond to change. Vulnerable ecosystems, such as riparian zones, which are among the richest landscapes on Earth, play a vital role in maintaining biodiversity, regulating water quality, and supporting a wide range of ecosystem services (Naiman et al., 1993; Singh et al., 2021). These ecosystems are facing growing threats from climate change, habitat destruction, and human activities (Allan, 2004), making it essential to understand their unique local conditions. Categorized as one of the fifteen globally recognized terrestrial biomes (Maraseni & Mitchell, 2016), riparian zones refer to biotic communities living on the shores of streams and lakes (Naiman et al., 2000). As ecotones, they encompass sharp gradients of environmental factors, ecological processes, and plant communities (Gregory et al., 1991). Among the various plant communities found in riparian zones, the primary focus is on woody plant communities such as trees and shrubs due to the critical roles they play in in shaping these ecosystems. The ecological functions and services provided by riparian vegetation such as the provision of physical habitat, water filtration, and erosion control are well recognized globally (Burton et al., 2005; Stella et al., 2013). However, it is impossible to list all their contributions here, particularly since this study focuses more on revealing patterns of woody riparian assemblages rather than emphasizing their benefits.

Changes in riparian plant assemblages are driven by a combination of natural and anthropogenic disturbances. Fluvial geomorphology and hydrology (González et al., 2010; Mollot et al., 2008) along with climate features (Ferreira et al., 2005) are the primary natural determinants of the shape and structure of riparian woodland. Besides, anthropogenic disturbances including land-use changes (Allan, 2004), agricultural expansion, urban development (Burton et al., 2009; Ferreira et al., 2005), and water regulation (e.g., damming or channelization) (Aguiar et al., 2018) exert significant pressures on riparian ecosystems. While shifts in the structure of woody plant communities, under multiple environmental changes have been extensively studied in the northern part of the Mediterranean ecoregion (eg: Aguiar et al., 2018; Angiolini et al., 2017; Corbacho et al., 2003; Ferreira et al., 2005; Leo et al., 2019; Zaimes, 2020), the situation in the southern Mediterranean remains largely unexplored. The southern side of this ecoregion, which includes parts of North Africa, faces unique environmental pressures such as increased aridity, higher temperatures, and growing human activity, all of which could significantly alter the structure and composition of riparian ecosystems. Thus, Mediterranean riparian habitats exhibit a more pronounced 'island character' compared to those in more humid regions, due to the steep microclimatic contrast between the riparian environment and the surrounding uplands showing clear floristic dissimilarities (Moore et al., 2005; Sabo et al., 2005). Human activities, water shortage and drought can be more important explaining woodland patterns than riparian habitat availability in the context of semi-arid Mediterranean basin (Bruno et al., 2014; Zaimes, 2020). The common riparian landforms observed often consist of naturally narrow galleries composed mainly of resilient species adapted to flash floods, low precipitation and seasonal droughts (Aguiar & Ferreira, 2005; Lite et al., 2005; Salinas & Casas, 2007). However, this resilient pattern is compromised by the increasing human alterations that make these environmental regimes in these areas more unpredictable (Bruno et al., 2014). Given these pressures, the status of Mediterranean riparian vegetation, especially in these extreme zones, requires continuous monitoring and updates. Regular assessment of its ecological health is crucial to detect changes in species composition, habitat quality, and the ability of these ecosystems to continue providing essential services. Effective management strategies must be based on real-time data to mitigate the impacts of human activities and

ensure the resilience of riparian woodlands in the face of ongoing environmental challenges. At the best of our knowledge the most relevant investigation of the woody riparian in the southern part of the Mediterranean basin such as Algeria the largest country of north Africa dates back to 1999 and was conducted by Bensettiti and Lacoste (1999). Thus, there is an urgent need for focused research in this area to fill these gaps, assess the current state of riparian vegetation, and provide insights into the drivers of ecological change. This will support better-informed conservation initiatives that consider the unique characteristics of the southern Mediterranean riparian ecosystems.

The aim of the current study is to analyse how natural riparian woodlands (with the exception of cultivated species) respond to environmental gradients (e.g., altitude, slope, aridity), and to reveal human-induced landscape change in the Southern Mediterranean Basin. This study addresses the following two questions: (1) Which factors shape the richness of species, abundance and composition of riparian vegetation? and (2) What are the key plant species of indicator environmental changes?

MATERIALS AND METHODS

Study area

Standing as the first barrier against the vast Sahara, the Aures Mountain chain, covering a total area of 12,428 km², is the largest forested physical boundary between northern and

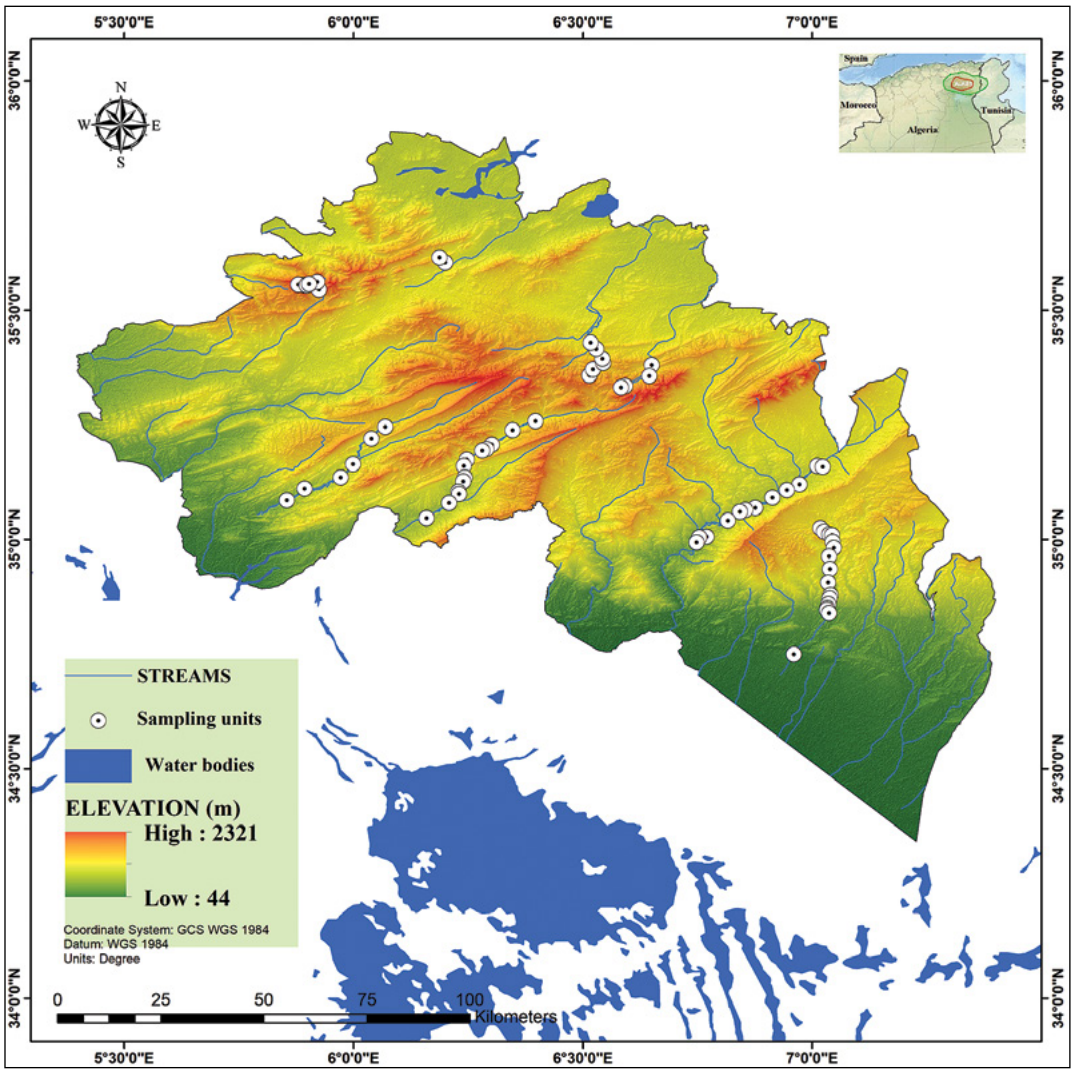

Figure 1 *Location of the Aures massif in northeastern Algeria showing the 61 survey units and the altitudinal gradient*

Source: DEM data were obtained from the Copernicus Data Space Ecosystem via Google Earth Engine. The map was produced using ArcGIS

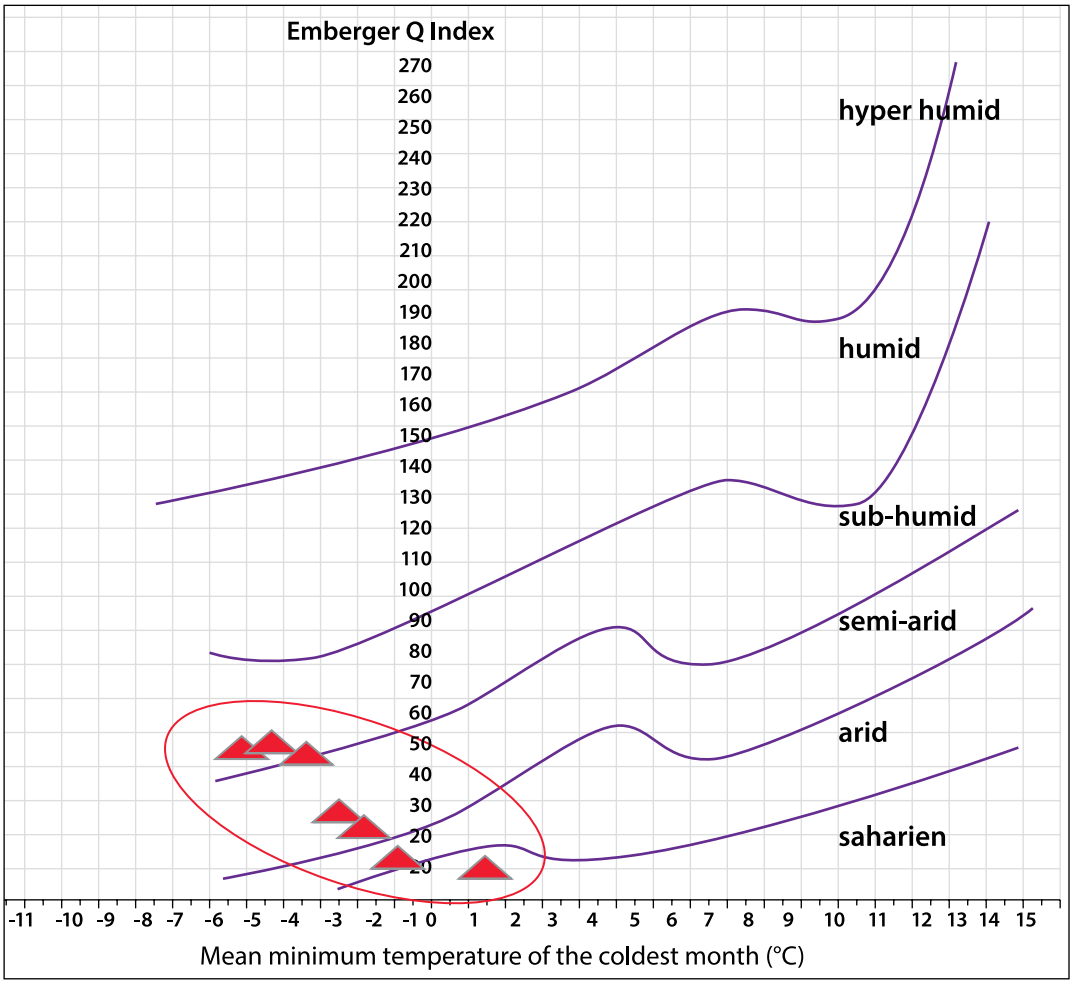

Figure 2 *Climate classification of the seven studied watercourses based on the Emberger Q Index and the mean minimum temperature of the coldest month (Red triangles indicate the locations of the seven watercourses)*

Source: Temperature and precipitation data for the period 1981–2022 were obtained from the NASA POWER Data Access Viewer (approximately 0.5° spatial resolution) and used to calculate the Emberger Q index. Bioclimatic classes follow Emberger's classification

southern Algeria (Fig.1). Lying between 34°90` and 35°60` north latitude, and 5°10` and 7°10` east longitude, the massif of Aurès is located in the Eastern part of the Saharan Atlas (Bezzih et al., 2021). The most notable forest formations are to be found there. The cedar and pine forests form veritable forests combined with several species, particularly the holm oak (*Quercus ilex subsp. ballota* (Desf.) Samp) (Vela & Schäfer, 2013), the only Algerian thuriferous stands (*Juniperus thurifera subsp. Aurasiaca* and a stand of small-leaved Zen oak (*Quercus faginea subsp. faginea*) (Bezzih et al., 2021; Vela & Schäfer, 2013).

Over the period 1981–2022, monthly average temperatures and precipitations showed significant variations, contributing to a wide range of bioclimatic belts, ranging from the subhumid to the semiarid on the Saharan level. According to the most common climatic classification for the Mediterranean region using the Emberger's quotient (Emberger, 1930; Vessella & Schirone, 2022) the studied streams belong to four bioclimatic belts: Saharan, arid, semiarid and subhumid (Fig. 2).

Sampling design

Riparian vegetation was surveyed from the source to the mouth of seven watercourses located in a mountainous region, the Aurès mountain chains of north-eastern Algeria (Fig. 1). The data were collected from 61 sampling riparian units (a 10-hectare circular plot) distributed along a total length of 244.7 km across seven rivers (Table 1).

Table 1 *Summary of the sampled rivers*

Name of the river	Number of sampled plots	Sampling kilometres (km)
Taberdga	16	46.8
Laarab	12	54.7
L'Abiad	13	45.3
Abdi	6	47.4
Chemora	7	30.6
Chelia	4	11.4
Refaa	4	8.5

Source: Google (2024)

Each plot of approximately 180 m radius was supposed to include the river bed, the floodplain and the adjacent upland (Fig 3). We believe that our surveys within this plot limits (ecotones: from a functional standpoint) allow us to cover all plants communities supposed to influence stream habitat and ecosystem processes and, conversely influenced by stream hydrology, microclimate and increased human activities (Decocq, 2002; Goebel et al., 2003). The three geomorphic sub-units (riverbed, floodplain, and upland) were delignated using field-based indicators, including topographic breaks, channel morphology, sediment texture, and flooding evidence (e.g., scour marks and depositional features). For the purposes of this study, we considered the riverbed as the permanently flooded channel, the floodplain as the adjacent area subject to temporary flooding, and the upland as the portion of the riparian zone outside the flood influence. We use vegetation relevé conducted according to Braun-Blanquet Approach 1964 (Ivanova, 2024). Using a stratified random sampling design, we placed six random plots (each 30×30 m) two on the banks, positioned adjacent to the active channel margin (approximately < 20 m from the bank) and four in the buffer zones,

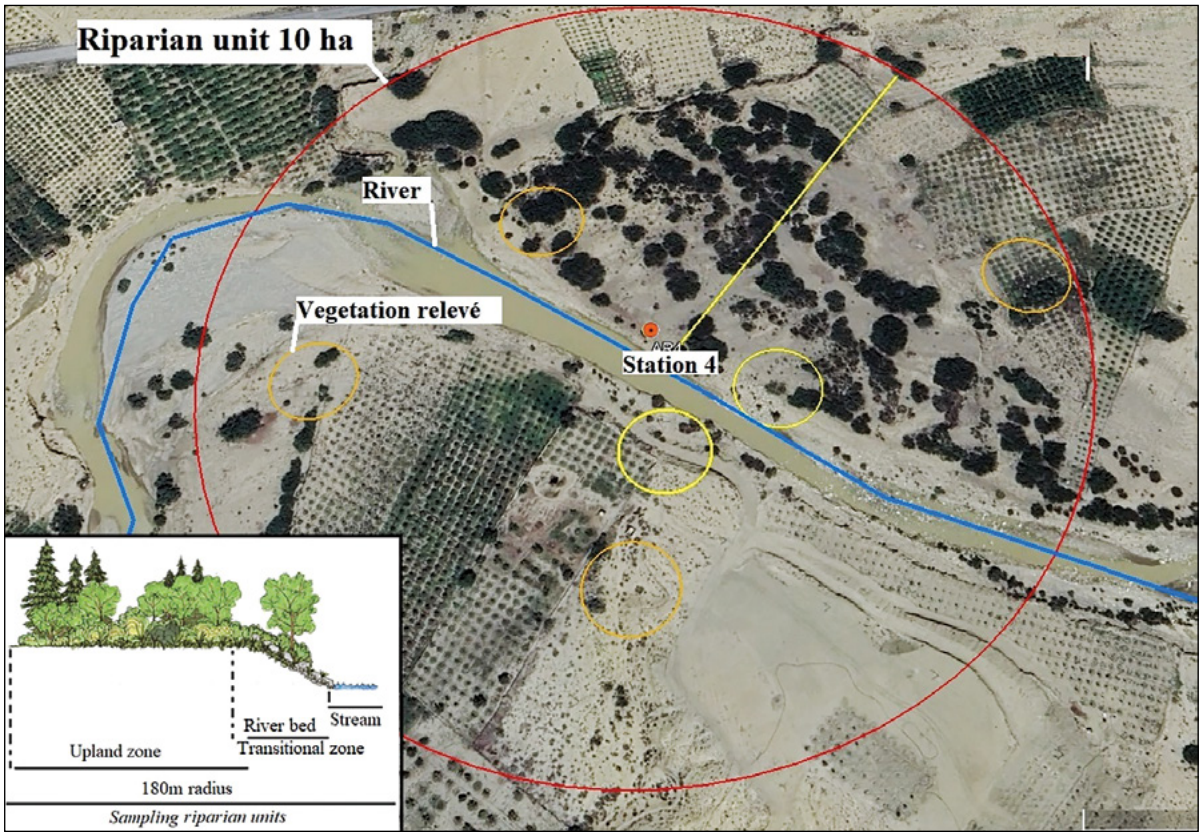

Figure 3 *Scheme illustrating the boundaries of riparian units, with six vegetation relevés conducted within each unit*
Source: Google (2024)

placed outside the near-channel zone (typically 50–150 m from the channel), in each of the 61 riparian units previously delineated, resulting in 366 plots (Fig 3). Our floristic survey was undertaken between the winter-spring high-flood level and the summer low-water level, at approximately 5 km intervals along the studied fluvial corridors, (during May and early June 2023). The riparian units were spaced at ~5 km intervals along the longitudinal course of the river to ensure spatial independence and coverage of regional environmental gradients. All woody species recorded in the field were collected and prepared as herbarium specimens for identification. Species were identified using regional floras (Meddour et al., 2021; Quézel & Santa, 1963) and subsequently confirmed by a taxonomic expert from the National School of Forests, Batna (Algeria). These herbarium specimens were used only for verification and were therefore not deposited as official vouchers. Cultivated species, defined as planted or actively managed individuals associated with agricultural activities, were excluded from the analysis. In particular, all fruit-tree species were excluded, and this was done at the species level.

In order to understand the spatial patterns of riparian vegetation, it is important to consider the influence of environmental factors and topographic features as well as land use and human activities. For this reason, a set of 11 variables expected to influence riparian vegetation variation were selected. To extract the value of each variable, the methodology used is based on satellite data analysis (The processing of all variables was performed in ArcGIS), as well as measurements and observations in the field (Table 2).

Statistical analysis

Environmental variables were transformed when necessary to improve normality and reduce skew. Variables were log-transformed 'x'=log (x+1),' while proportional data were logit-transformed 'x'=log (x+ϵ / 1−x+ϵ)' where ϵ =

Table 2 *Variables used in the multivariate analysis aiming to explain spatial variation in riparian vegetation of the Aurès mountain chains of north-eastern Algeria*

Variables	Description and units	Source
Dependent variable		
Riparian woody (tree and shrub) species	Number of species per 10-hectare plot	Observation in the field
Independent variable		
Altitude	Elevation (m)	**Satellite data:** Copernicus Data Space Ecosystem: https://dataspace.copernicus.eu/ Google Earth Engine: https://earthengine.google.com/ ESA WorldCover: https://esa-worldcover.org/en Resolution 10-20 m, accessed in May and June 2023
Slope	Slope (°)	
Flood prone	Area that is likely to be inundated with water (m)	
Bankfull width	Channel width (m) area that is inundated or saturated by water at frequency duration	
Bank height	Vertical distance (m) from the water of a river to the top of its bank	
Flow	Intermittent vs permanent water flow	
Built-up distance	The distance between the centre of the sampling plot and the nearest urban area (m) (cities and small or rural villages)	
Agricultural distance	The distance between the centre of the sampling plot and the nearest agricultural area (m)	
Agricultural cover per 10-hectare plot	Surface of agricultural area per 10-hectare plot (ha)	
Damming	Presence or absence of dams, damming coded as 0/1	
IDM	De Martonne aridity index = Total yearly precipitation / mean temperature + 10 (computed for a custom climatological period (January 2001 - December 2023)	NASA POWER Data Access Viewer: (~0.5°): https://power.larc.nasa.gov/ (accessed in September 2023)

0.001 was added to accommodate zeros. Due to the varying measurement scales of environmental variables, all variables in the environmental variable matrices were standardized to z-scores, expressed as standard deviations from the mean (Legendre & Gallagher, 2001). Spearman's correlations were then used to identify highly correlated variables. Accordingly, considering the variables showing Spearman correlation coefficients greater than 0.7, those with a greater number of significant correlations were discarded for subsequent analysis to avoid redundant information. The 'corrplot' package in R v3.3.5 was used and annual precipitation and temperature were the highly correlated variable (Spearman coefficient = -0.85). Given the ecological importance of the removal of these two variables, and since one is not a desirable option, we chose to include a composite index that combines both. The most relevant index for the Mediterranean region is the De Martonne aridity index (Pellicone et al., 2019). The final result of Spearman's correlations analysis with the retained variables is presented in the figure 4.

The compositional gradient in woody species per plot matrix was explored by multivar-

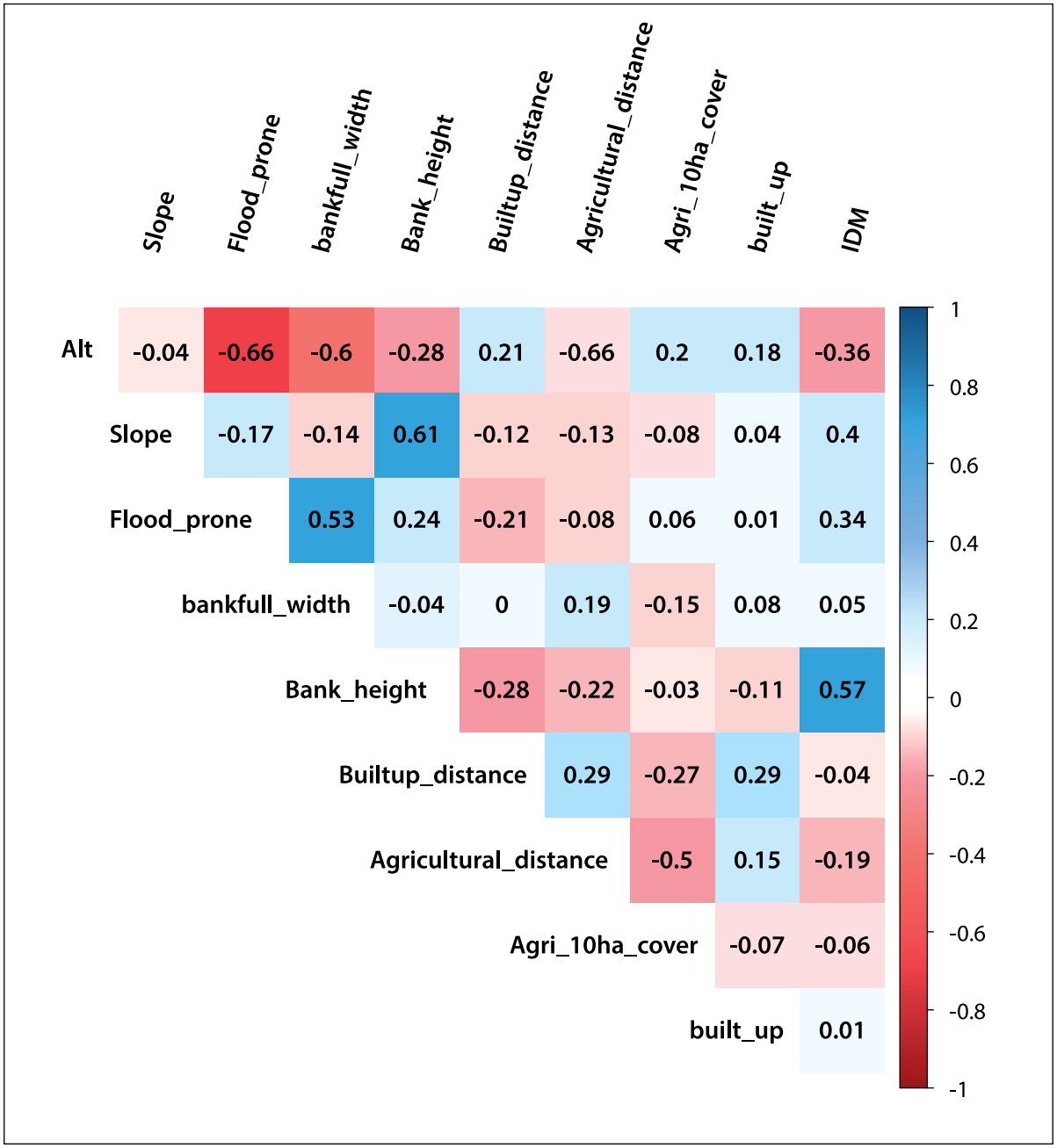

Figure 4 *Correlation matrix of the retained variables (IDM: De Martonne aridity index)*

iate analyses. Community composition was converted to presence–absence and used to compute a Jaccard dissimilarity matrix ('vegan' package in R). To reduce noise caused by extremely infrequent taxa, species occurring in fewer than four riparian units were excluded prior to analysis (Borcard et al., 2011; Bruno et al., 2014). Jaccard's index (Paul, 1901) is one of the most widely used similarity indices in ecology for detecting species assemblages association. Based on the Jaccard's distances matrix, hierarchical clustering procedures using the average-linkage (UPGMA) method was then conducted for woody species to investigate patterns of interspecific spatial associations (Pang et al., 2023). The SIMPROF (Similarity Profile, 'clustsig' package in R) test was used to identify significant clusters from the obtained groups (Clarke et al., 2008) with $\alpha = 0.05$ and 999 permutations. The selected groups were than tested for beta diversity dispersions using ANOVA (i.e., heterogeneity in species composition within groups) using 'betadisper' from the 'vegan' package in R. The significance was assessed with 999 permutations. Such analysis helps to identify groups with higher variability, highlighting thereby patterns of species assemblage heterogeneity induced by a variety of environmental drivers (Bevilacqua et al., 2012). Finally, indVal index (Species Indicator Values) was used to compute indicator values of species within the selected groups of sites using 'indival' function from the R package 'labdsv' (Roberts, 2015). Distance-based Linear Models (DistLM) was used to depict differences in woody riparian composition (dependent variable matrix) in relation to a set of explanatory variables (independent variable matrix) (Borcard et al., 2011; Legendre & Gallagher, 2001). In order to select only the most important factors for the parsimonious model, 'adonis2' function from the R package 'vegan' was used for performing distance-based multivariate analysis of variance (PERMANOVA: unrestricted permutation test with 999 runs): *adonis2(Jaccard_matrix., data=data, permutations=999).* It is designed to test how much variation in a multivariate response matrix (woody species composition) can be explained by one or more explanatory factors (environmental variables) (Borcard et al., 2011). Results were visualized using dbRDA ordination plots with the significant environmental variables influenced clustered assemblages (Oksanen et al., 2016). Differences in riparian vegetation composition (number of plant species) of the clustered assemblages were investigated using a Kruskal–Wallis ANOVA by mean rank tests. Then, in order to evaluate the relationships between plant species richness and environmental predictors (only those selected before), we fitted generalized linear models (GLMs) assuming a Poisson error distribution (number of species: count data). Model selection followed an information-theoretic approach based on AICc (Guthery et al., 2003). A candidate set of 64 a priori models was generated using the dredge function in the MuMIn package. Competing models were ranked by AICc, and only those within $\Delta AICc < 2$ were considered to have substantial support. All models were checked for normally distributed residuals, homogeneity of variance, outliers and over-dispersion (overdispersions ~ 1). Multicollinearity (Variance Inflation Factor) was checked and VIF values estimated using the *performance* package in R for assessment of regression models performance.

RESULTS

Species composition

A total of 25 woody plants were identified to species level, including 8 tree and 17 shrub species (Table 3). By evaluating the dominant taxa (the most frequented species), we found that trees were mostly composed of *Pinus halepensis*, *Cupressus sempervirens, and Populus alba* and shrubs were mainly composed of *Nerium oleander, Tamarix* sp., and *Rhus tripartita* (Table 3) (Supporting Table 1).

Patterns of woody riparian assemblages

The clustering procedures, combined with SIMPROF analysis, identified several significantly distinct woody riparian groups. However,

Table 3 *Woody plants identified at the Aures region, north-eastern Algerian highlands*

Shrub species	Share (%)	Tree species	Share (%)
Nerium oleander	27.68	*Pinus halepensis*	19.92
Tamarix sp.	22.04	*Cupressus sempervirens*	14.78
Rhus tripartita	12.99	*Populus alba*	12.09
Juniperus oxycedrus	8.96	*Quercus ilex*	5.65
Cytisus purgans	7.79	*Eucalyptus globulus*	3.22
Retama raetam	7.79	*Ulmus* sp.	3.22
Fraxinus xanthoxyloides	7.73	*Quercus faginea*	2.15
Rubus ulmifolius	6.98		
Ziziphus lotus	5.91		
Juniperus phoenicea	5.79		
Capparis spinosa	4.97		
Crataegus laciniata	4.03		
Pistacia atlantica	3.86		
Ziziphus jujuba	3.49		
Rosa canina	3.22		
Berberis hispanica	2.15		
Rosa montana	1.07		

Source: Field survey, species frequency was calculated as the number of plots in which a species was observed at the study site (six plots) divided by the total number of plots surveyed (366 plots)

only two groups were selected due to their high level of dissimilarity, exceeding 0.8 (Figure 5). Group 1 comprised most stations characterized by relatively similar woody species composition, whereas Group 2 formed a distinct cluster, indicating marked compositional differences between the two groups. Beta diversity analysis demonstrated a significant difference in disper-

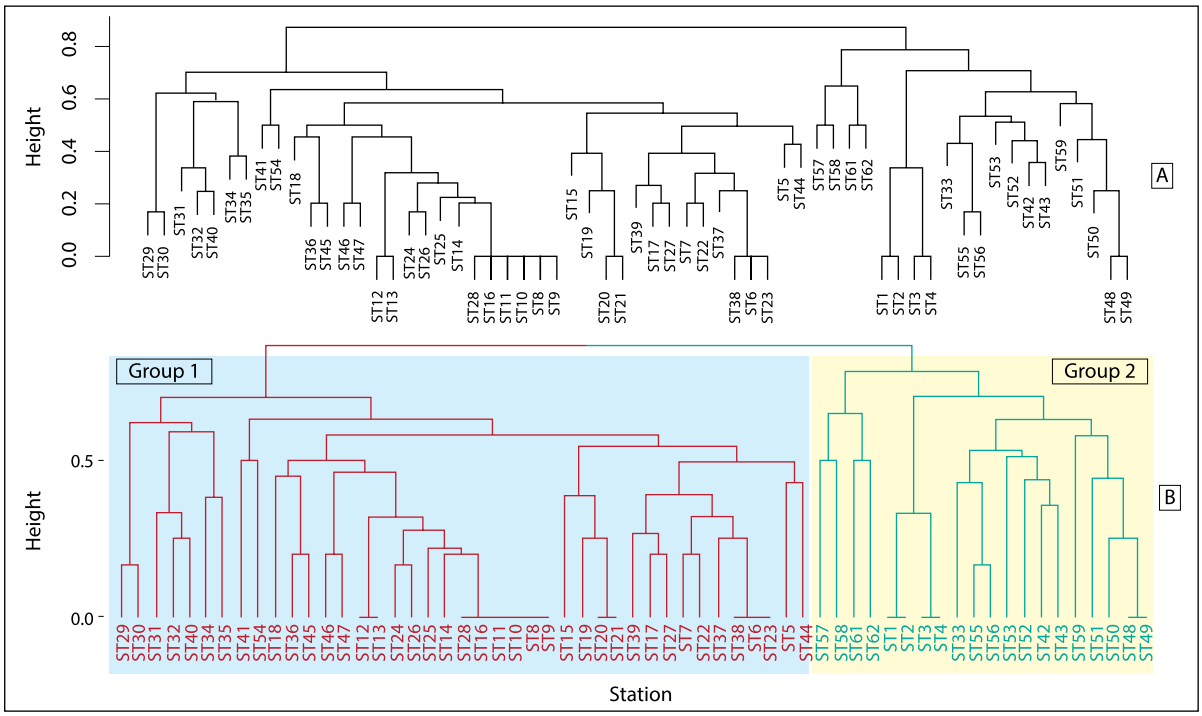

Figure 5 *Hierarchical clustering (Jaccard distance; average linkage, UPGMA) showing: (A) the full dendrogram for all surveyed stations and (B) clusters identified by SIMPROF analysis (α = 0.05), which indicated two significantly distinct groups of riparian units: Group 1 (blue) and Group 2 (yellow). Solid coloured branches denote statistically supported groups; labels correspond to station codes*

Source: Jaccard distance calculated from presence–absence data (Supporting Table 1)

Table 4 *Best DistLM results for woody species composition (999 permutations)*

Variable	Individual explained variance (%)	F-value	P-value
Altitude	25.03	24	0.001
Slope	3.35	3.23	0.005
Dist_HA	6.31	6.06	0.001
Damming	5.02	4.82	0.002
Flow	2.23	2.11	0.045
Altitude*IDM	2.4	2.33	0.021
Residual	54.9		

Source: Environmental variables were extracted using Google Earth Engine and ArcGIS. Statistical analyses were conducted in R

sion between the two groups (ANOVA using 'betadisper': $F = 33.52$, $p < 0.001$) (Figure 6). Group 1 displayed higher dispersion, suggesting greater variability in species composition compared to Group 2. Multilevel pattern analysis using the IndVal method identified 14 species significantly associated with the groups derived from the clustering analysis (alpha = 0.05). Of the 24 species analysed, 13 were significantly associated with Group 1, and 1 species was associated with Group 2 (Supporting Table 2). In Group 1, highly significant indicator species (IndVal > 0.7, $p < 0.001$) included *Populus alba* (stat = 0.874), *Cytisus purgans* (0.788), *Juniperus oxycedrus* (0.788), and *Rubus ulmifolius* (0.766), among others. Additional significant indicators included *Pinus halepensis*, *Rosa canina*, *Ulmus* sp., and *Fraxinus xanthoxyloides*. Less strongly associated, but still significant, were species such as *Quercus ilex*, *Crataegus laciniata*, *Capparis spinosa*, *Berberis hispanica*, and *Quercus faginea* ($p < 0.05$). In Group 2, *Rhus tripartita* was the sole significant indicator species (stat = 0.685, $p = 0.001$).

The significant variables selected during the DistLM analysis including altitude, slope, proximity to human-built areas (cities and small villages), damming, hydrological regime (flow), and an interaction term between altitude and aridity intensity (Table 4).

Among these, altitude explained the largest proportion of variance (25.03%), followed by proximity to human-built areas (6.31%) and a dam construction (5.02%), making them the most influential contributors. Linking these variables to the floristic patterns identified earlier, we found that the high compositional variability and species richness in Group 1 align with sites located at mid to high altitudes, further from human settlements, and in undammed streams (undisturbed group in figure 6). In contrast, the more homogeneous species

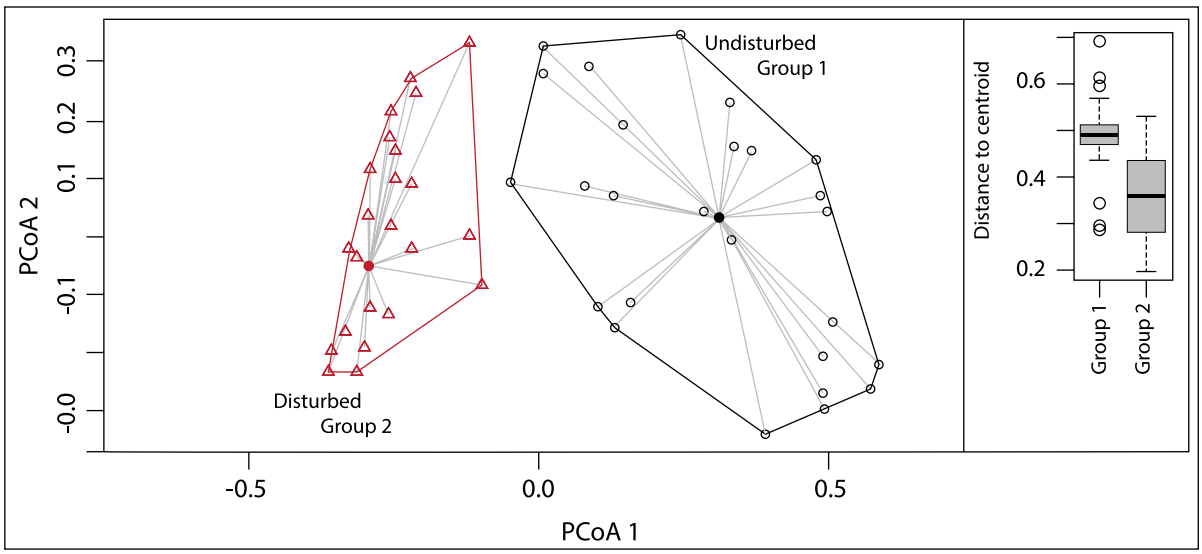

Figure 6 *Beta diversity comparison showing the extent of dispersion of the sites within each group*

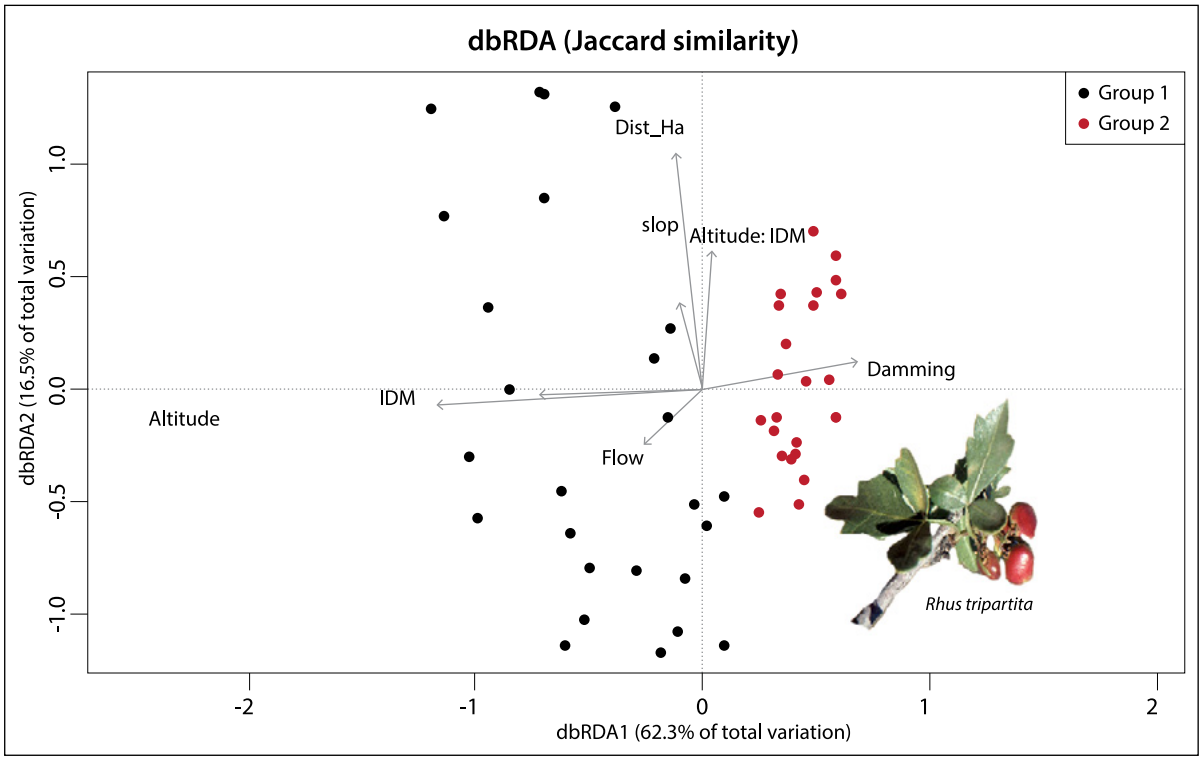

Figure 7 *dbRDA ordination plot relating composition cluster grouping and significant environmental variables from DistLM analysis*

Source: Environmental variables were extracted using Google Earth Engine and ArcGIS. Jaccard similarity calculated from presence–absence data (Supporting Table 1). Statistical analyses were conducted in R

composition of Group 2 (disturbed group in figure 6), dominated by *Rhus tripartita*, is associated with lower altitudes, close proximity to human development, and the presence of dams (Figure 7).

Species richness

The Kruskal–Wallis test revealed significant differences in species richness between woody riparian assemblages, with Group 1 exhibiting higher richness than Group 2 (χ^2 = 34.51, df = 1, p < 0.0017). The best-supported model identified during model selection (the model with the lowest AICc and model weight = 0.38) showed that most variables influencing species composition (as identified in the DistLM analysis) also explained variation in species richness, except proximity to human built-up areas, which was not retained (Table 5).

The best model-estimates showed that woody species richness increased significantly with altitude (β = 0.25, p = 0.009) and at sites with permanent flow (β = 0.33, p = 0.01), but declined with increasing slope (β = -0.18, p = 0.009) and in the riparian zone affected by damming constructions Table (6).

Table 5 *Summary of the best-supported candidate generalized linear models (GLMs) explaining variation in woody species richness across riparian units, ranked by AICc*

Model	df	logLik	AICc	delta	Weighting coefficients
12456	7	-125.09	266.29	0	0.38
1246	6	-126.65	266.85	0.56	0.29
12346	7	-125.85	267.81	1.52	0.18
123456	8	-124.67	268.11	1.82	0.15

1 = Altitude, 2 = Damming, 3 = Distance to habitation, 4 = Flow, 5 = IDM, 6 = Slope

Source: Environmental variables were extracted using Google Earth Engine and ArcGIS. Number of plant species recorded at each site (field survey, Supporting Table 1)

Table 6 *Model-averaged parameter estimates for environmental predictors of woody species richness, derived from the top-ranked GLMs (ΔAICc < 2)*

Term	Estimate	Std.Error	z value	Pr (>|z|)	VIF
Intercept	1.67	0.09	17.89	<0.001	
Altitude	0.25	0.07	3.22	0.001	1.99
Flow (permanent)	0.33	0.12	2.57	0.01	1.59
Slope	-0.19	0.06	-3.08	0.002	1.65
IDM	-0.12	0.07	-1.79	0.07	1.98
Damming (Before)	-0.37	0.15	-2.38	0.01	1.89

Source: Environmental variables were extracted using Google Earth Engine and ArcGIS. Number of plant species recorded at each site (field survey, Supporting Table 1)

DISCUSSION

Species composition

There were 25 woody species excluding cultivated species in all sampled plots recorded in the Aures region, north-eastern Algeria. In general, riparian strips in this study were both narrow and extremely poor in woody species compared to fluvial corridors in the northern part of the Mediterranean basin, namely 39 woody species in the Portuguese part of the Tagus River basin (Aguiar & Ferreira, 2005), 66 species in the north and central mainland of Portugal (Aguiar et al., 2018), 74 species in the Segura River basin, Spain (Bruno et al., 2014), and 67 woody species in the Panaro River, Northern Italy (Gumiero et al., 2015). At regional (North Africa) scales, phytosociological syntheses of riparian vegetation are very scarce, the most relevant attempts date back to 1999 by Bensettiti and Lacoste (1999). The global territory of this study englobes the occidental part of the Mediterranean Sea, where the data on woody riparian vegetation from Algeria were quite limited. Generally, we shared similar observations with this study, where the riparian woodland vegetation along the highland streams was mainly represented by assemblages of *Salici-Populetum alba* infiltered by abundant sub-association of *Nerio-Tamaricetea*. These assemblages are typical for the Maghreb riparian communities, a vegetation taxon to which halophyte and xerophytes species belong (Bensettiti & Lacoste, 1999; Salinas & Casas, 2007). Additionally, due to their location at the edge of the Algerian Sahara, the Aurès riverbeds support the occurrence of Saharo-Mediterranean vegetation species such as *Rhus tripartite* (Benaissa et al., 2019). These woody patches, though limited in height and coverage are notable for their ability to develop in soils deprived of organic matter (Taibaoui et al., 2020) and act as the last forested barrier before the Sahara, playing a critical role in buffering the surrounding ecosystems from further desert encroachment.

Assemblage patterns

In our study of the north-eastern Algerian highland streams, the clustering procedures, combined with SIMPROF analysis, identified two distinct groups: one more homogeneous and the other more heterogeneous in terms of beta diversity. Although the influence of altitude was clearly evident in shaping these groups, explaining 25% of the variance in community composition (Distance-based Linear Model), this pattern suggests a natural successional gradient in riparian vegetation. However, this natural succession appears to be disrupted by high levels of human disturbance. The DistLM further revealed a notable effect of anthropogenic pressures, such as damming and proximity to human habitations, as key drivers of the observed community transition. Landscape alteration caused by human activities such as urbanization, agriculture, and infrastructure development is a globally recognized problem that reduces habitat diversity and threatens local (Pennington et al., 2010; Ruas et al., 2022; Stieger & Mckenzie, 2024). Our findings reflect this trend, showing reduced beta diversity in areas impacted by damming and proximity to human settlements

leading to a high vegetative configuration homogeneity. Man-made riparian complexes are often characterized by high structural and vegetative homogeneity, both horizontally and vertically (Corbacho et al., 2003). In more humid areas of the northern Mediterranean basin, these environments are typically dominated by highly invasive and opportunistic species such as *Typha*, as well as introduced genera such as *Eucalyptus* and *Populus* (Beerling, 1991; Nilsson et al., 1989). In contrast, in more arid regions, such as the one in our study, these environmental conditions favour the proliferation of xerophytic species, particularly *Rhus tripartita*. On this basis, one particularly alarming issue in the study area is the human disturbance of riparian corridors, primarily due to agricultural activities especially apple cultivation. The region has become one of the main apple-producing areas in Algeria, yielding approximately 1.6 million quintals during the agricultural season (Abdessemed et al., 2022; Frah et al., 2009; Khaoula et al., 2025). These orchards are generally established in close proximity to water resources, with the studied streams serving as the main source. It has a double impact: first, the replacement of native vegetation, especially where orchards are planted directly in riverbeds due to reduced water flow (presence of cultivated species are noted in almost all the study sites) and second, the intensive extraction of water through river irrigation, which alters the hydrological regime of the streams. In addition to riparian vegetation landscape changes driven by agricultural activities, damming emerged as a second significant factor influencing the structure of woody riparian vegetation in our study. The DistLM revealed a strong association between dam presence and the homogenization of vegetation structure. It is well established that alterations to the water flow regime caused by damming can disrupt ecosystem equilibrium, affecting both biotic components (such as vegetation and other living organisms) and abiotic components (including sediment transport and nutrient cycling) (Braatne et al., 2008). River damming is a widespread human activity that has been practiced for millennia and represents one of the most significant anthropogenic impacts on freshwater ecosystems (Aguiar et al., 2018). The findings of this study provide further evidence of the detrimental effects of damming on the integrity of freshwater ecosystems, particularly through the homogenization of riparian habitats. As noted by Bejarano et al. (2018), riparian plant guilds tend to become simpler and likely less diverse following flow regulation. According to the Kruskal–Wallis test, the disturbed group exhibited more limited and less varied vegetation compared to the riverbeds in the undisturbed group, which were characterized by mixed vegetation and a more complex riparian structure. The high compositional variability and species richness in this group align with sites located at mid to high altitudes, further from human settlements, and in zones with cooler temperatures and higher precipitation (higher IDM) (DistLM analysis). The undisturbed riverbeds are characterized by mixed vegetation formations, including both tall trees and shrubs, which contribute to a more complex riparian structure. Significant tree species identified (IndVal, $p<0.001$) include *Populus alba*, as well as some specimens of *Quercus ilex* and *Quercus faginea*. *Populus alba* tends to occur spontaneously in riparian zones along entrenched streams, particularly in the high plateaus of northern Algeria (Labiod el al., 2007). These areas typically feature rivers with steep slopes and elevated banks, creating microenvironments well-suited to this species. In contrast, *Quercus ilex* and *Quercus faginea* are often accompanied by a limited number of evergreen shrubs that are not typically characteristic of riparian zones, such as *Juniperus*, *Rosa canina*, *Rosa montana*, *Berberis hispanica*, and *Capparis spinosa*. These species are generally more representative of north-eastern Algerian forests (Djema & Messaoudene, 2009) and are primarily observed in the upper zones of the remaining riparian units, embedded within pre-forest and forest landscapes.

Species richness patterns

The parsimonious GLM indicated that, similar to species assemblage composition, species richness (expressed as the number of woody spe-

cies) was influenced by the same environmental variables selected during the DistLM analysis. However, proximity to human settlements (measured as distance to built-up areas such as cities and villages) did not have a significant effect and was therefore not retained in the final model. These findings align with previous studies that emphasize the role of ecological drivers as key filtering factors shaping riparian taxonomic richness (Fu et al., 2022). More specifically, riparian woody species richness in the Aurès dry region was influenced primarily by water availability and topography (altitude and slope). Water availability is widely recognized as one of the most important determinants of plant species richness, particularly in regions with pronounced precipitation seasonality (Espinosa et al., 2011; López-Angulo et al., 2020; White & Hood, 2004) such as our study area. Similar patterns were also reported in semi-arid regions of the northern Mediterranean. For example, along the Tagliamento River, north-eastern Italy (Karrenberg et al., 2003) and in the Tagus River basin, Portugal (Aguiar & Ferreira, 2005), broad-scale geographical variables, such as altitude and water availability (i.e., flow regime), were identified as the primary drivers of riparian plant richness, followed by reach-scale variables such as riverbank structure. While common patterns in mountainous regions suggest that plant species richness either decreases with altitude or follows a hump-shaped curve, peaking at mid-elevations (Bertuzzo et al., 2016; Namgail et al., 2012; Rahbek, 2005; Vittoz et al., 2010; Wang et al., 2024), these trends were not evident in our data and species richness increased along the altitudinal gradient. There is limited information from the Algerian highland montane systems (Djema & Messaoudene, 2009), which in fact are ideal for studying biodiversity patterns along altitudinal gradients as these montane chains are a transitional zone and stand as a natural barrier to the north African Sahara. Although several mechanisms were proposed to explain altitudinal declines in species richness (Lee et al., 2021), the positive relationship observed in our study may be attributed to the fact that higher-altitude sites of the studied region fall within the habitat range of Algerian cedar, oak and Aleppo pine forests (50% of the cedar forest of Algeria in the Aurès region) (Bentouati & Bariteau, 2006; Lakhdari et al., 2024). In these areas, riparian zones shift from a typical semi-arid Mediterranean configuration, characterized by narrow, species-poor strips along watercourses, to more developed riparian forests that support relatively higher plant richness.

The combination of multivariate analysis (targeting species assemblage composition) and univariate analysis of a diversity metric (species richness) offered complementary aspects to understand riparian plant distribution. It showed that some environmental variables influence both species composition and richness, whereas others affect only composition. For instance, both damming and human proximity significantly shaped community composition; however, only damming had a marked effect on species richness. Human proximity influenced assemblage composition but did not significantly affect richness. While damming is widely recognized as one of the most severe anthropogenic disturbances affecting river ecosystems (Ceschin et al., 2015), strongly altering both riparian plant composition (as discussed above) and species richness, the finding that human proximity influences species composition but not richness deserves further consideration. Urbanization gradients may simultaneously promote the loss of sensitive species (through habitat degradation, pollution, or hydrological alteration) and impose the establishment of new species that are better adapted to the disturbed conditions created by human settlements (Schwoertzig et al., 2016). This turnover in community identity can alter species composition without necessarily reducing overall richness, as species lost from the system may be numerically replaced by newly arriving or tolerant taxa. Another plausible explanation is that the effects of human disturbance may not manifest as a reduction in the number of plant species, but rather through decreases in woody cover, the loss of understory vegetation, or a narrowing of the riparian corridor (Corbacho et al., 2003). Indicating that species richness alone is

insufficient as a proxy for diversity, and should be complemented with multiple structural and ecological indicators to properly capture the effects of human disturbance.

CONCLUSIONS

Due to the absence of a recent national forest inventory and the lack of updated riparian categorization in Algeria as well as in all North African countries, our understanding of the current state of riparian habitats in the region remains limited. Our findings shed light on two critical aspects of riparian vegetation in unexplored and characteristic mountainous regions of North Africa. First, we have unveiled species assemblage associations and identified the environmental drivers that shape their spatial distribution. Second, we have identified trends in species richness, highlighting how woody biodiversity patterns shift across different environmental conditions. Our multivariate analysis identified three primary drivers influencing both the structure of riparian landscapes and woody species richness in this semi-arid area, and more importantly water availability followed by river damming and finally altitude. Additionally, the data confirm that human activities significantly affect the richness of the species and the composition of riparian woody communities. While river damming influences both species composition and richness, it also contributes to the homogenization of riparian landscape configurations, potentially reducing ecological diversity and resilience. The finding that human proximity influences species composition but not richness deserves further consideration. Indicating that species richness alone is insufficient as a proxy for diversity, and should be complemented with multiple structural and ecological indicators to properly capture the effects of human disturbance.

Author Contributions: L.B and A.E: conceptualization, methodology, writing – original draft preparation, writing – review and editing. A.E.: methodology, software, validation, writing – review and editing.

S.T.: literature review, resources, review and editing, supervision.

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PRIMJENA BIHEVIORALNIH ZNANOSTI U TURIZMU: PROSTORNI UVIDI I POLITIČKA RAZMATRANJA IZ HRVATSKIH OBALNIH GRADOVA

APPLICATIONS OF BEHAVIOURAL SCIENCES IN TOURISM: SPATIAL INSIGHTS AND POLICY CONSIDERATIONS FROM CROATIAN COASTAL CITIES

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Turistička industrija, mjerena međunarodnim turističkim dolascima, posljednjih desetljeća bilježi kontinuirani rast. Prema izvješću Svjetske turističke organizacije (UNWTO) pod nazivom „Turizam prema 2030. – Globalni pregled", očekuje se da će se takav trend nastaviti s projekcijama rasta međunarodnih dolazaka od 3,3 % godišnje. Stalni rast zahtijeva sveobuhvatne javne politike koje osiguravaju da turistički sektor može podržati dugoročnu ekonomsku, ekološku i društvenu održivost kako za lokalne zajednice tako i za posjetitelje. Sa sve većim brojem dolazaka stranih turista, izazov seže dalje od razvoja infrastrukture. Učinkovita prilagodba također zahtijeva politike koje usklađuju turističko ponašanje s lokalnim običajima i kulturnim vrijednostima s posebnim naglaskom na očuvanje kulturne baštine i tradicije. U tom kontekstu, ljudsko ponašanje igra ključnu ulogu, posebno u zaštiti kulturnog identiteta. Bihevioralna ekonomija nudi vrijedne uvide u donošenje odluka i preferencije turista, pružajući temelj za osmišljavanje mjera politike koje potiču održivo i poštovano ponašanje posjetitelja. Integriranje bihevioralne znanosti u istraživanje turizma stoga može podržati razvoj učinkovitih, održivih rješenja. Ovaj rad istražuje kako se bihevioralna znanost uključuje u lokalne turističke politike usmjerene na promicanje održivog ponašanja. Konkretno, ispituje provedbu i percipiranu učinkovitost takvih politika te odgovore turista. Analiza se temelji na dubinskim intervjuima (n = 8) s kreatorima politika u četiri obalna hrvatska grada – Zadru, Šibeniku, Splitu i Dubrovniku. Među ispitanicima su pročelnici lokalnih komunalnih odjela i predsjednici lokalnih turističkih zajednica. Rad ističe javne politike koje se trenutačno primjenjuju kako bi se s pomoću njih utjecalo na ponašanje turista da poštuju lokalne običaje i kulturnu baštinu. Nalazi rada pridonose širem razumijevanju kako se bihevioralni uvidi mogu primijeniti za podršku praksama održivog turizma.
Ključne riječi: održivi turizam; bihevioralna ekonomija; zaštita kulturne baštine; ponašanje turista; javna politika u turizmu

The tourism industry, as measured by international tourist arrivals, has experienced continuous growth over recent decades. According to the Tourism Towards

2030 – Global Overview report by the World Tourism Organization (UNWTO), this trend is expected to continue, with international arrivals projected to increase by 3.3% annually. This steady growth calls for comprehensive public policies that ensure the tourism sector can support long-term economic, environmental, and social sustainability, for both local communities and visitors. As countries experience rising numbers of foreign tourist arrivals, the challenge extends beyond infrastructure development. Effective adaptation also requires policies that align tourist behaviour with local customs and cultural values, placing particular emphasis on preserving cultural heritage and traditions. In this context, human behaviour plays a crucial role, especially in the protection of cultural identity. Behavioural economics offers valuable insights into tourist decision-making and preferences, providing a foundation for designing policy measures that promote sustainable and respectful visitor behaviour. Integrating behavioural science into tourism research can thus support the development of effective, sustainable solutions. This paper explores how behavioural science is incorporated into local tourism policies aimed at promoting sustainable behaviour. Specifically, it examines the implementation and perceived effectiveness of such policies, as well as tourist responses. The analysis is based on in-depth interviews (n=8) with policymakers in four coastal Croatian cities: Zadar, Šibenik, Split, and Dubrovnik. Interviewees include heads of local communal departments and presidents of local tourist boards. The study highlights the public policies currently employed to influence tourist behaviour in ways that respect local customs and cultural heritage. Ultimately, the findings contribute to a broader understanding of how behavioural insights can be applied to support sustainable tourism practices.

Keywords: sustainable tourism; behavioural economics; cultural heritage protection; tourist behaviour; public policy in tourism

UVOD

Posljednjih godina hrvatski obalni gradovi poput Dubrovnika, Splita, Zadra i Šibenika suočavaju se s rastućim izazovima u upravljanju porastom masovnog turizma, osobito s porastom neprimjerenog ponašanja turista koje je u suprotnosti s lokalnim kulturnim normama. Jedan od vidljivih izraza tog problema sve je učestalije nošenje oskudne ili neprimjerene odjeće u povijesnim gradskim jezgrama što je potaknulo donošenje javnih politika na lokalnoj razini. Hrvatska je jedno od najposjećenijih turističkih odredišta na Mediteranu s 20,6 milijuna dolazaka i 108 milijuna noćenja ostvarenih 2023. godine (Državni zavod za statistiku, 2024b). Turizam u Hrvatskoj, posebno u promatranim gradovima Dubrovniku, Splitu, Zadru i u manjoj mjeri Šibeniku, posljednjih je godina obilježen pojavama prekomjernog turizma i masovne turistifikacije. Nadalje, prema prognozama Svjetske turističke organizacije (2024), u razdoblju 2024.–2028. očekuje se značajan rast s prosječnom godišnjom stopom rasta od 3,4 %.

Rast turizma osim negativnih okolišnih posljedica, dovodi i do neprimjerenog ponašanja turista. Destinacije moraju biti svjesne tih problema i adekvatno im se suprotstaviti. Turistički sektor mora biti pripremljen te osigurati dugoročnu gospodarsku, okolišnu i društvenu održivost za lokalno stanovništvo i posjetitelje. Zemlje s povećanim rastom dolazaka stranih turista moraju se prilagoditi ne samo infrastrukturno, već i pronalaženjem politika i upravljačkih odluka koje će ponašanje većeg broja posjetitelja uskladiti s lokalnim običajima i kulturom.

Negativne okolišne i društvene posljedice turizma potiču donositelje odluka na prilagodbu politika i transformaciju postojećih praksi. Isto tako, zaštita kulturne baštine i tradicije jedan je od ključnih motiva za izmjene zakona i uvođenje novih politika. Osim zakona i politika, ljudsko ponašanje i utjecaj na njega imaju istaknutu ulogu u zaštiti kulturne baštine. Bihevioralna istraživanja omogućuju praćenje potreba turista i izbora koje donose. Uključivanje bihevioralnih znanosti u istraživanja turizma može doprinijeti učinkovitim i održivim rješenjima usmjerenima na promjenu ponašanja turista. Cilj ovoga rada

INTRODUCTION

In recent years, Croatian coastal cities such as Dubrovnik, Split, Zadar, and Šibenik have faced increasing challenges in managing the surge of mass tourism, particularly the rise of inappropriate tourist behaviour that conflicts with local cultural norms. One visible expression of this issue is the growing problem of tourists wearing revealing or unsuitable clothing in historic city centres, prompting legal and policy responses at the local level. Croatia is one of the most visited tourist destinations in the Mediterranean with 20,6 million arrivals and 108 million overnight stays in 2023 (Državni zavod za statistiku, 2024b). Tourism in Croatia, but more precisely, tourism in observed cities Dubrovnik, Split, Zadar, and in smaller part Šibenik, has been characterized by overtourism and mass touristification in recent years. Furthermore, according to World Tourism Organization (2024) forecasts, there is significant growth in coming years with annual growth of 3,4% in period 2024–2028.

Tourism growth has a negative environmental impact and also brings inappropriate behaviour of tourists. Destinations need to be aware of that problem and face it appropriately. More precisely, the tourism sector needs to be prepared and guarantee long-term economic, environmental, and social sustainability for both local population and tourists. Countries that record the growth of foreign tourist arrivals must adapt to it infrastructurally, but also by finding policies to adapt the behaviour of a larger number of foreigners to local customs and culture.

Negative environmental consequences of tourism encourage decision makers to adopt new policy adaptation and transformation of current practices. Protection of cultural heritage and customs is one of the motives for changing laws and introducing new policies. Besides laws and policies, human behaviour, and influence on it, has a prominent role in cultural heritage protection. Behavioural research enables monitoring of tourists' needs and the choices they make. Involving behavioural science in tourism research can deliver effective and sustainable behaviour solutions. The aim of this paper is to research the public policies that are used

je istražiti javne politike koje se primjenjuju za utjecaj na ponašanje turista u skladu s lokalnim običajima, očuvanje dostojanstva i lokalne baštine te ispitati stavove o mogućnostima primjene poticaja (*nudginga*) i bihevioralne znanosti u promjeni neprimjerenog ponašanja turista (Boranić Živoder i sur., 2024).

Liberalne demokracije, poput Hrvatske, poštuju osobne slobode i pravo na samoizražavanje. Odijevanje oduvijek služi kao način predstavljanja u javnosti, no komunikacija putem odjeće kao oblik samoizražavanja nije predmet ovoga istraživanja. Rasprava o odnosu između društvenih normi i slobode samoizražavanja izlazi iz okvira ovoga rada. Fokus istraživanja usmjeren je na utjecaj bihevioralnih znanosti u poticanju promjena neprimjerenog ponašanja turista, konkretno neprimjerenog odijevanja kao oblika nepoštivanja lokalne kulture, baštine, običaja i načina života, a ne na upravljanje imidžem ili osobno izražavanje odjećom.

Iako odnos između turista i lokalne zajednice zahtijeva određenu razinu međusobnog razumijevanja, postoji jasno moralno shvaćanje o tome što se smatra primjerenim, a što neprimjerenim ponašanjem. Hrvatski gradovi poput Zadra, Šibenika, Splita i Dubrovnika uveli su zabranu neprimjerenog odijevanja u lokalne propise kako bi zaštitili lokalnu baštinu, običaje i način života. Glavna motivacija za ovo istraživanje proizlazi iz lokalnih zakona koji reguliraju zabranu kretanja povijesnim gradskim jezgrama u neodgovarajućoj odjeći u navedenim gradovima. Stoga je cilj rada analizirati lokalne javno-političke mjere usmjerene na utjecaj na ponašanje turista u skladu s lokalnim kulturnim normama u hrvatskim obalnim gradovima, s posebnim naglaskom na regulaciju neprimjerenog odijevanja u povijesnim gradskim jezgrama, te istražiti potencijal bihevioralnih pristupa, uključujući *nudging*, u promicanju pristojnog ponašanja turista radi očuvanja kulturne baštine. Kako bi se ostvario taj cilj, rad nastoji odgovoriti na sljedeće istraživačko pitanje: Kako lokalne javne politike u hrvatskim obalnim gradovima reguliraju neprimjereno odijevanje turista u povijesnim jezgrama te kako bi bihevioralni pristupi mogli poduprijeti napore u zaštiti lokalne kulture?

to influence the behaviour of tourists in accordance with local customs, and to preserve dignity and local heritage, as well as to explore attitudes about the possibilities of using nudging and behavioural science to change the inappropriate behaviour of tourists (Boranić Živoder et al., 2024).

Liberal democracies, such as Croatia, respect personal freedom and the desire for expression of everyone. Clothing has always been used to present oneself to the public, but communication through clothes as one of the aspects of self-expression is not the subject of our research. The discussion between typical social norms and freedom of self-expression is out of scope of our research. Our focus is on impacts of behavioural sciences in encouraging changes in the tourists' inappropriate behaviour - inappropriate clothing as an aspect of disrespect for local culture, heritage and disrespect for local customs and ways of life, not on 'Image Management' and the way of expressing through clothes.

Although the relationship between tourists and hosts requires certain understanding, there is a clear moral understanding about what is appropriate and what is not appropriate. Croatian cities such as Zadar, Šibenik, Split and Dubrovnik put the ban of inappropriate dressing in laws on local level to protect local heritage, customs and way of life. Our main motivation for the research was a law at the local level that deals with banning movement through the historic core without clothing or partly dressed in Zadar, Šibenik, Split and Dubrovnik. Based on this research, the aim of this paper is to examine local public policy measures designed to influence tourist behaviour in accordance with local cultural norms in Croatian coastal cities, with a specific focus on the regulation of inappropriate clothing in historic city centres, and to explore the potential of behavioural science approaches, including nudging, to promote respectful tourist conduct that preserves cultural heritage. To achieve this aim, the paper seeks to answer the following research question: How do local policy measures in Croatian coastal cities regulate inappropriate tourist clothing in historic areas, and how can behavioural science approaches support these efforts to protect local culture?

TEORIJSKI OKVIR

Teorije ponašanja turista

Ponašanje turista sve se više prepoznaje kao ključni izazov u kontekstu prekomjernog turizma i održivog razvoja destinacija. Taj problem obuhvaća više dimenzija održivosti, uključujući okolišnu, gospodarsku i društvenu, te zahtijeva integrirani pristup u oblikovanju odgovarajućih politika i strategija. U tom se kontekstu primjena koncepta *nudginga* (odnosno suptilnog usmjeravanja ponašanja) ističe kao jedno od potencijalno učinkovitih alata koji mogu pomoći turističkim organizacijama u održivijem upravljanju ponašanjem turista.

Razumijevanje i utjecaj na ponašanje turista ključno je za razvoj održivih turističkih politika koje poštuju i štite lokalnu kulturnu baštinu. Teorija planiranog ponašanja (*Theory of Planned Behaviour – TPB*), koju je razvio Ajzen (1991), pruža vrijedan teorijski okvir za analizu determinanti ponašanja turista. Prema TPB-u, ponašanje pojedinca vođeno je namjerama ponašanja oblikovanim stavovima prema ponašanju, percipiranim društvenim normama i percipiranom kontrolom ponašanja. U kontekstu turizma, ti čimbenici mogu pomoći u objašnjavanju kako i zašto se turisti odlučuju na kulturno obzirne i okolišno održive prakse (Lam & Hsu, 2006). Nedavna međukulturna istraživanja dodatno naglašavaju da su namjere ponašanja turista snažno oblikovane njihovom kulturnom pozadinom, vrijednostima i kulturološki ukorijenjenim psihološkim obrascima, što znači da se subjektivne norme mogu različito tumačiti među različitim skupinama turista (Jafarov & Isazada, 2024). Istraživanje Wasaya i sur. (2022) ističe važna ograničenja bihevioralnih intervencija u turizmu: *nudging* i politike temeljene na društvenim normama ne djeluju jednako na multikulturalne skupine turista. Kako bi bile učinkovite, bihevioralne alate potrebno je prilagoditi kulturnoj pozadini turista.

Nadopunjujući TPB, teorija poticaja (*Nudge Theory*), koju su razvili Thaler i Sunstein (2008), nudi pristup bihevioralne ekonomije koji suptilno utječe na donošenje odluka bez ograničavanja slobode izbora. U turističkom kontekstu *nudging* se može primijeniti strateškim intervencijama poput podsjetnika, zadanih opcija ili poruka temeljenih

THEORETICAL BACKGROUND

Tourist behaviour theories

Tourist behaviour is increasingly recognized as a key challenge in the context of overtourism and sustainable destination development. This issue encompasses multiple dimensions of sustainability, such as environmental, economic, and social, and requires an integrated approach in the design of appropriate policies and strategies. In this regard, the application of the nudging concept (i.e., subtle behavioural guidance) emerges as one of the potentially effective tools that can support tourism organizations in managing tourist behaviour in a more sustainable way.

Understanding and influencing tourist behaviour is essential for the development of sustainable tourism policies that respect and preserve local cultural heritage. The Theory of Planned Behaviour (TPB), developed by Ajzen (1991), provides a valuable framework for analysing the determinants of tourist actions. According to TPB, individual behaviour is guided by behavioural intentions, which are shaped by attitudes toward the behaviour, perceived social norms, and perceived behavioural control. In the context of tourism, these factors can help explain how and why tourists choose to engage in culturally respectful and environmentally sustainable practices (Lam & Hsu, 2006). Recent cross-cultural research further emphasizes that tourists' behavioural intentions are strongly shaped by their cultural background, value orientations, and culturally rooted psychological patterns, meaning that subjective norms may be interpreted differently across tourist groups (Jafarov & Isazada, 2024). The study conducted by Wasaya et al. (2022) highlights important limitations of behavioural interventions in tourism: nudges and norm-based polices may not work uniformly across multicultural tourist groups. Behavioural tools must be tailored to the cultural background of tourists to be effective. Complementing TPB, Nudge Theory, pioneered by Thaler and Sunstein (2008), offers a behavioural economics approach to subtly influence decision-making without limiting freedom of choice. Nudges can be applied in tourism settings through strategic interventions such as prompts,

na društvenim normama koje usmjeravaju turiste prosocijalnom i održivom ponašanju (World Tourism Organization, 2019). Kada se primjenjuju zajedno, TPB i teorija poticaja pružaju sveobuhvatnu osnovu za oblikovanje turističkih politika koje ne samo da razumiju, već i aktivno oblikuju ponašanje na način koji podržava dugoročnu kulturnu održivost i dobrobit lokalne zajednice.

Iako su se dosadašnja istraživanja primjene bihevioralne znanosti i *nudginga* u turizmu uglavnom usmjeravala na sektor ugostiteljstva, posljednjih godina bilježi se sve veći akademski interes za odnos između *nudginga* i turističkih destinacija. Smallman i Ryan (2020) ističu da tradicionalni modeli racionalnog donošenja odluka često zakazuju u nestabilnim okruženjima u kojima se turisti ponašaju impulzivno u potrazi za hedonističkim i spontanim iskustvima. Nadalje, uvode koncept „*nudge* plus u turizmu", koji kombinira konvencionalne mehanizme *nudginga* s refleksivnim porukama i dizajnom iskustva. Souza-Neto i sur. (2022) istražuju primjenu strategija *nudging*a usmjerenih na smanjenje negativnih okolišnih utjecaja turizma. Njihovi nalazi upućuju na postojanje trajnog jaza između stavova turista prema održivosti i njihova stvarnog ponašanja, što dodatno opravdava stratešku primjenu bihevioralnih intervencija.

Recentna literatura ističe i koncept digitalnog *nudginga*, koji uključuje primjenu tehnologija poput internetskih zajednica i automatiziranih *chatbotova* za usmjeravanje ponašanja korisnika. Primjerice, Ni i sur. (2025) naglašavaju da rasprave u online zajednicama i automatizirani mehanizmi povratnih informacija mogu značajno doprinijeti usmjeravanju ponašanja turista prema održivijim obrascima, čime se otvara prostor za širu primjenu digitalnog *nudginga* u promicanju održivog turizma.

Empirijski nalazi ovoga istraživanja podudaraju se s teorijskim postavkama teorije planiranog ponašanja i teorije poticaja te ilustriraju njihovu primjenjivost u razumijevanju i oblikovanju ponašanja turista u kulturno osjetljivim urbanim okruženjima. Prema TPB-u (Alonso i sur., 2015), ponašanje je pod utjecajem stavova, subjektivnih normi i percipirane kontrole ponašanja, što se odražava u uvidima prikupljenima intervjuima s donositeljima odluka u Zadru, Šibeniku, Splitu i Dubrovniku. Na primjer, percepcija da je svijest

defaults, or social norm messaging that steer tourists toward pro-social and sustainable behaviour (World Tourism Organization, 2019). When used together, TPB and Nudge Theory provide a comprehensive basis for designing tourism policies that not only understand but also shape behaviour in ways that support long-term cultural sustainability and community well-being.

Although previous research on the application of behavioural science and nudging in tourism has predominantly focused on the hospitality sector, recent years have seen a growing academic interest in the relationship between nudging and tourist destinations. Smallman and Ryan (2020) discuss how traditional rational decision-making models often fail in turbulent environments, where tourists tend to behave impulsively in search of hedonistic and spontaneous experiences. Furthermore, they introduce the concept of 'nudge plus in tourism,' which combines conventional nudging mechanisms with reflective messaging and experiential design. Souza-Neto et al. (2022) explore the application of nudging strategies aimed at minimizing environmental harm in tourism. Their work highlights a persistent gap between tourists' pro-sustainability attitudes and their actual behaviour, offering further justification for the strategic use of behavioural interventions.

Recent literature highlights the concept of digital nudging, which involves the use of technologies such as online communities and automated chatbots to guide user behaviour. For example, Ni et al. (2025) emphasize that discussions in online communities and automated feedback mechanisms can significantly contribute to steering tourist behaviour toward more sustainable patterns, thereby creating space for broader application of digital nudging in the promotion of sustainable tourism.

The empirical findings of this study align with and illustrate the applicability of both the Theory of Planned Behaviour (TPB) and Nudge Theory in understanding and shaping tourist behaviour in culturally sensitive urban environments. According to TPB (Alonso et al., 2015), behaviour is influenced by attitudes, subjective norms, and perceived behavioural control, all of which are reflected in the insights gathered from interviews

turista o očuvanju kulturne baštine niska i ovisna o sezonskim, demografskim i geografskim čimbenicima potvrđuje varijabilnost stavova i subjektivnih normi među turistima. Učestalo prepoznavanje neprimjerenog odijevanja, bacanja otpada i konzumacije alkohola na javnim površinama kao ključnih problema podupire tvrdnju da turisti često ne percipiraju snažne društvene norme ni dovoljnu kontrolu nad takvim ponašanjima.

Teorija poticaja pruža praktičan uvid u uočene odgovore javnih politika. Gradovi poput Splita i Dubrovnika, u kojima su zabilježene pozitivne promjene u ponašanju nakon uvođenja sankcija i mjera podizanja svijesti, nude empirijske dokaze o tome kako strateški poticaji, poput verbalnih upozorenja, signalizacije ili prijetnje sankcijama, mogu utjecati na ponašanje bez oslanjanja isključivo na strogo provođenje pravila. Te intervencije suptilno mijenjaju arhitekturu izbora, čineći pristojno i obzirno ponašanje vidljivijim i očekivanim. Iskustvo Dubrovnika, u kojem su povećana razina informiranosti i poboljšano ponašanje uslijedili nakon primjene „mekog" nadzora i komunikacijskih strategija, odražava temeljno načelo *nudginga:* usmjeravanje odluka malim, ali učinkovitim kontekstualnim promjenama. S druge strane, slabija primjena pravila i oslanjanje na upozorenja u Šibeniku i Zadru upućuju na ograničenja javnih politika kada percipirana kontrola ponašanja nije potkrijepljena dosljednim institucionalnim djelovanjem. U cjelini, nalazi potvrđuju potencijal bihevioralno utemeljenih javnih politika u unaprjeđenju ponašanja turista i doprinosu održivom upravljanju kulturnom baštinom u povijesnim urbanim destinacijama.

Javne politike i ponašanje turista

Sa širenjem turističke industrije, potreba za učinkovitim javnim politikama koje mogu usmjeravati ponašanje turista u skladu s lokalnim vrijednostima postaje sve izraženija. Ovaj pregled literature razmatra različite prakse u provedbi javnih politika usmjerenih na utjecaj na ponašanje turista i očuvanje lokalne baštine. Javne politike osmišljene za utjecaj na ponašanje turista provodile su se u različitim oblicima u brojnim zemljama (Bhati & Pearce, 2016; Cole, 2007; Li & Chen, 2019; Thompson i sur., 2017), dok je u znanstvenoj li-

with policymakers in Zadar, Šibenik, Split, and Dubrovnik. For instance, the perception that tourist awareness of cultural heritage preservation is low and dependent on seasonal, demographic, and geographic factors confirms the variability of tourist attitudes and subjective norms. The widespread identification of inappropriate dress, littering, and alcohol consumption in public places as key issues supports the idea that tourists may not perceive strong social norms or control over such behaviours. Nudge Theory offers practical insight into the policy responses observed. Cities such as Split and Dubrovnik, which report positive behavioural changes following the introduction of sanctions and awareness measures, provide real-world evidence of how strategic nudges, like verbal warnings, signage, or the threat of sanctions, can influence behaviour without relying solely on strict enforcement. These interventions subtly alter the choice architecture, making respectful behaviour more salient and expected. Dubrovnik's experience, where increased awareness and improved behaviour followed the implementation of soft enforcement and communication strategies, reflects the core principle of nudging: guiding decisions through small but effective contextual shifts. Meanwhile, weaker application of rules and reliance on warnings in Šibenik and Zadar demonstrate the limitations of policy when perceived behavioural control is not reinforced by consistent institutional action. Overall, the results reinforce the potential of behaviourally informed policy approaches to improve tourist conduct and contribute to sustainable heritage management in historic urban destinations.

Public policies and tourist behaviour

As the tourism industry expands, the need for effective public policies that can guide tourist behaviour in a way that aligns with local values becomes increasingly important. This literature review explores various practices in the implementation of public policies aimed at influencing tourist behaviour and preserving local heritage. Public policies designed to influence tourist behaviour were implemented in various forms across different countries (Bhati & Pearce; 2016; Cole, 2007; Li & Chen,

teraturi najveći naglasak stavljen na javne politike povezane s ograničenjima uvedenima tijekom pandemije bolesti COVID-19 (Donaire i sur., 2021; Li i sur., 2020; Srisawat i sur., 2023). Nadalje, više se radova bavi utjecajem politika i regulativa na prookolišne stavove i ponašanje turista (Law & Ting, 2011; Wang i sur., 2018; Wang i sur., 2020). Takve politike često uključuju regulatorne mjere, kampanje podizanja svijesti te mehanizme nadzora i provedbe, usmjerene na zaštitu kulturne baštine i osiguravanje poštovanja u interakcijama između turista i lokalnih zajednica.

Devijantno ponašanje turista negativno utječe na turističko iskustvo i razvoj turizma (Hughes i sur., 2008), pri čemu su kažnjavanje i nagrađivanje česti regulatorni mehanizmi. Međutim, istraživanje Li i Chena (2019) pokazuje da učinkovitost takvih pristupa varira ovisno o razini osjetljivosti pojedinaca (Hundt i sur., 2013), kao i da svijest o utjecajima turizma može posredovati u tim učincima, nudeći vrijedne spoznaje za kvalitetnije upravljanje ponašanjem turista. Gino i Galinsky (2012) ističu da su turisti skloniji neprimjerenom ponašanju zbog osjećaja slabije povezanosti s drugima u okruženju pružanja usluga u turizmu te percepcije nižeg rizika od društvenog neodobravanja.

Unatoč tome, mnoge su destinacije donijele zakone i propise radi suzbijanja ponašanja koja se smatraju nepoštivanjem ili štetnima za lokalnu kulturu i zajednicu (Lytras & Papageorgiou, 2015; Lugosi, 2019; Volgger & Huang, 2019). Primjerice, gradovi poput Venecije (Araya López, 2020) i Barcelone (Blanco-Romero i sur., 2018; Romão i sur., 2023) uveli su novčane kazne za turiste koji se upuštaju u neprimjerene aktivnosti, poput kupanja u javnim fontanama ili nošenja kupaćih kostima u urbanim područjima (Pearce, 2019). Te politike djeluju kao izravna sredstva odvraćanja od nepoželjnog ponašanja, koje u pravilu proizvodi negativne posljedice kako za same turiste tako i za osobe s kojima dolaze u interakciju (Pearce, 2019).

No istraživanje Wan i sur. (2021) pokazalo je da se vjerojatnost neprimjerenog ponašanja smanjuje kada turisti shvate da njihovi postupci izravno ili posredno štete drugima, pri čemu percipirana društvena kontrola ima ključnu posredničku ulogu. Stoga se kao alternativni pristup ističe edukacija turista o lokalnim običajima i očekivanjima

2019, Thompson et al., 2017;), while in the literature the biggest emphasis is on public policies connected with Covid restrictions (Donaire et al., 2021; Li et al., 2020; Srisawat et al., 2023). Furthermore, several papers focus on how do policies and regulations influence pro-environmental attitudes and behaviour of tourists (Law & Ting, 2011; Wang et al., 2018; Wang et al., 2020). These policies often include regulations, awareness campaigns, and enforcement mechanisms aimed at protecting cultural heritage and ensuring respectful interactions between tourists and local communities.

Deviant tourist behaviour negatively impacts both the tourist experience and tourism development (Hughes et al., 2008), with punishment and reward being common regulation methods. However, study Li and Chen (2019) reveals that the effectiveness of these approaches varies based on individuals' sensitivity levels (Hundt et al., 2013), and that awareness of tourism's impact can mediate these effects, offering valuable insights for better managing tourist behaviour. Furthermore, Gino and Galinsky (2012) suggests that tourists are more likely to misbehave due to feeling less connected to others in the service environment and perceiving a lower risk of social disapproval.

Nevertheless, many destinations have enacted laws and regulations to curb behaviours that are considered disrespectful or damaging to local cultures (Lytras & Papageorgiou, 2015; Lugosi, 2019; Volgger & Huang, 2019). For example, cities like Venice (Araya López, 2020) and Barcelona (Blanco-Romero et al., 2018; Romão et al., 2023) have introduced fines for tourists who engage in inappropriate activities, such as swimming in public fountains or wearing swimwear in urban areas (Pearce, 2019). These policies serve as direct deterrents to undesirable behaviour. Such behaviours typically induce negative outcomes for tourists themselves, and for those with whom they interact (Pearce, 2019).

However, Wan et al. study (2021) discovered that when tourists realize their actions directly or indirectly harm others, their likelihood of misbehaviour decreases, with perceived social control playing a key mediating role. Therefore, another approach involves educating tourists about local customs and expectations before they arrive at their

prije dolaska na destinaciju. To se može provoditi putem brošura, signalizacije, digitalnih platformi i videozapisa tijekom leta. Primjerice, u Hrvatskoj je Grad Dubrovnik proveo kampanju pod nazivom *Respect the City*, kojom se posjetitelje potiče na upoznavanje i poštivanje društvenih normi, poput tišine u javnim prostorima i primjerenog odijevanja pri posjetu vjerskim objektima (Marković Vukadin i sur., 2023; Šegota, 2024).

Više autora također je istraživalo koncept obećanja posjetitelja (*visitor pledges*) (Albrecht & Raymond, 2023; Cooper i sur., 2024; Medel, 2020), pri čemu se pokazalo da mogu učinkovito poticati odgovorno ponašanje turista i podržati zaštitu osjetljivih okoliša čak i u situacijama ograničenih provedbenih kapaciteta. Istraživanje provedeno na Grenlandu (Cooper i sur., 2024) pokazuje da intervencije temeljene na obećanjima mogu biti učinkovit upravljački alat za destinacije koje moraju djelovati kako bi zaštitile krhka prirodna područja, ali nemaju dovoljno resursa za nadzor i sankcioniranje neprimjerenog ponašanja.

U nekim se slučajevima javne politike razvijaju u suradnji s lokalnim zajednicama kako bi odražavale vrijednosti i prioritete stanovništva koje je najviše pogođeno turizmom (Frey & George, 2010). Inicijative vođene zajednicom (Sofield i sur., 2017) mogu osnažiti lokalno stanovništvo za aktivno sudjelovanje u upravljanju turizmom i zaštiti kulturne baštine (Bleibleh & Awad, 2020). Programi očuvanja kulturne baštine u gradovima poput Kyota (Kato, 2020) primjeri su uključivanja lokalnih zajednica u definiranje smjernica za ponašanje turista.

Nedavni razvoj u području bihevioralnih javnih politika dodatno ističe važnost kontekstualnih poticaja i arhitekture izbora u oblikovanju ponašanja turista (Kim i sur., 2020; Luna-Cortes i sur., 2024; McKenzie i sur., 2018; Sharma i sur., 2024). Primjerice, strateško postavljanje vizualnih podsjetnika, poput znakova koji prikazuju očekivanja vezana za lokalno odijevanje ili primjereno ponašanje u blizini vjerskih objekata, može djelovati kao pasivan, ali učinkovit bihevioralni poticaj (Gutberlet, 2016; Kim i sur., 2020). Takve suptilne intervencije djeluju aktiviranjem društvenih normi i poticanjem konformizma bez potrebe za formalnom provedbom pravila. Istraživanje Buonincontri i sur. (2017) pokazuje da je veća vjerojatnost poštivanja pravila kada su ona

destination. This can be done through brochures, signage, digital platforms, and in-flight videos. For instance, in Croatia in City of Dubrovnik they have implemented a campaign that encourages visitors to learn about and adhere to social norms, such as being quiet in public spaces and respecting religious sites by appropriate clothing named 'Respect the city' (Marković Vukadin et al., 2023; Šegota, 2024).

More authors have examined visitors' pledges (Albrecht & Raymond, 2023; Cooper et al., 2024; Medel, 2020), showing that they can effectively promote responsible tourist behaviour and support the protection of sensitive environments even where enforcement capacities are limited. In a study conducted on Greenland by Cooper et al. (2024) results indicate that pledge interventions can be an effective management tool for destinations who need to take action to protect fragile wilderness areas, but do not have the resources to police delinquent behaviour.

In some cases, public policies are developed in collaboration with local communities to ensure that they reflect the values and priorities of the people most affected by tourism (Frey & George, 2010). Community-driven initiatives (Sofield et al., 2017) can empower locals to take an active role in managing tourism and protecting their cultural heritage (Bleibleh & Awad, 2020). The Cultural Heritage preservation programs in places like Kyoto (Kato, 2020) are examples where local communities have been involved in setting guidelines for tourist behaviour.

Recent developments in behavioural public policy also highlight the importance of *contextual cues* and *choice architecture* in shaping tourist behaviour (Kim et al., 2020; Luna-Cortes et al., 2024; McKenzie et al, 2018; Sharma et al., 2024). For example, the strategic placement of visual reminders, such as signs depicting local dress expectations or respectful conduct near religious sites, can serve as passive but effective behavioural prompts (Gutberlet, 2016; Kim et al., 2020). These subtle interventions operate by activating social norms and encouraging conformity without the need for formal enforcement. Research by Buonincontri et al. (2017) shows that individuals are more likely to comply with rules when these

pozitivno intonirana i kada je vidljiva usklađenost ponašanja drugih. Nadalje, kombiniranje *nudginga* s emocionalnim apelima, poput poruka koje ističu kulturnu ili duhovnu važnost određene lokacije, može produbiti osjećaj odgovornosti turista (Bicchieri & Dimant, 2022; Engelen i sur., 2018).

Nove tehnologije nude inovativne platforme za bihevioralne intervencije: mobilne aplikacije, QR kodovi i alati proširene stvarnosti mogu pružiti prilagođene informacije o lokalnom bontonu, pomažući turistima da u stvarnom vremenu razumiju i pridržavaju se očekivanih oblika ponašanja. Ti pristupi podupiru širi trend tzv. „mekog transformativnog upravljanja" (*soft transformative governance)* u turizmu (Weaver i sur., 2022), u kojem bihevioralni alati nadopunjuju tradicionalnu regulaciju radi postizanja društveno i kulturno održivih ishoda.

METODOLOGIJA I PODRUČJE ISTRAŽIVANJA

Ovo istraživanje provodi se kvalitativnim istraživačkim pristupom dubinskim intervjuima kako bi se istražile perspektive i strategije donositelja odluka u upravljanju turizmom i kulturnom baštinom u povijesnim gradskim jezgrama. Kvalitativni pristup posebno je prikladan za ovo istraživanje jer omogućuje nijansirano razumijevanje složenih i kontekstualno uvjetovanih pitanja povezanih s upravljanjem turizmom, urbanim planiranjem i očuvanjem baštine.

Kako bi se osiguralo prikupljanje nepristranih i bogatih kvalitativnih podataka, intervjui su provedeni s pomoću deset otvorenih pitanja. Taj je metodološki pristup odabran kako bi se ispitanicima omogućilo slobodno i detaljno izražavanje stavova, čime se osigurava dublji uvid u izazove i prilike s kojima se suočavaju njihovi gradovi. Otvorenim pitanjima u kvalitativnim intervjuima omogućuje se prikupljanje nepristranih i sadržajno bogatih podataka te slobodno i detaljno iznošenje stavova ispitanika (Hillman & Radel, 2018; Schensul, 1999). Istraživanje obuhvaća dubinske intervjue s ključnim donositeljima odluka u svakom od četiri grada. Sudionici istraživanja obuhvaćaju pročelnike odjela za turizam i pročelnike upravnih odjela za komunalne djelatnosti i zaštitu okoliša.

are framed positively and when others' compliance is made visible. Moreover, combining nudges with emotional appeals, such as messages that highlight the cultural or spiritual importance of a location, can deepen tourists' sense of responsibility (Bicchieri & Dimant, 2022; Engelen et al., 2018). In addition, new technologies offer innovative platforms for behavioural interventions: mobile apps, QR codes, and augmented reality tools can deliver customized information about local etiquette, helping tourists understand and adhere to expected behaviours in real time. These approaches support the broader trend toward 'soft transformative governance' in tourism (Weaver et al., 2022), where behavioural tools complement traditional regulation to achieve socially and culturally sustainable outcomes.

METHODOLOGY AND RESEARCH AREA

This study adopts a qualitative research approach, utilizing in-depth interviews to explore the perspectives and strategies of policy makers in the management of tourism and cultural heritage in historical city centres. A qualitative approach is particularly suited to this study as it allows for a nuanced understanding of the complex and context-specific issues related to tourism management, urban planning, and heritage conservation.

To ensure the collection of unbiased and rich qualitative data, we conducted interviews using ten open-ended questions. This method was chosen to allow respondents to express their views freely and in detail, thereby providing deeper insights into the challenges and opportunities faced by their respective cities. The use of open-ended questions in qualitative interviews facilitates the collection of unbiased and rich data, allowing respondents to express their views freely and in detail (Hillman & Radel, 2018; Schensul, 1999). The study involves in-depth interviews with key policy makers in each of the four cities. The participants include Heads of Tourism Departments and Heads of Administrative Departments for Communal Activities and Environmental Protection.

Provedeno je osam intervjua (po dva u svakom gradu), čime je osiguran sveobuhvatan uvid u strategije i politike koje se provode radi upravljanja turizmom uz očuvanje kulturnih i okolišnih vrijednosti tih urbanih središta. Intervjui su provedeni putem interneta u svibnju 2024. godine. Razgovori su transkribirani i analizirani tematskom analizom s naglaskom na prepoznavanje obrazaca i tema povezanih s upravljanjem turizmom, očuvanjem kulturne baštine i urbanim planiranjem. Kodiranje je provedeno metodom redak-po-redak, pri čemu su generirani početni kodovi koji su potom razvrstani u šire tematske cjeline koje odražavaju ključne obrasce politika i ponašanja. Taj sustavni proces kodiranja osigurao je transparentnost i sljedivost u razvoju tema, povezujući konkretne isječke iz intervjua s glavnim nalazima istraživanja. Cilj analize je otkriti strategije koje donositelji odluka primjenjuju kako bi odgovorili na izazove turizma u kulturno i povijesno značajnim gradskim središtima.

Područje istraživanja

Istraživanje je usmjereno na četiri grada u Hrvatskoj. Svaki od njih ima povijesno i kulturno značajne gradske jezgre, od kojih su neke prepoznate kao lokaliteti svjetske baštine UNESCO-a. Riječ je o gradovima Zadru, Šibeniku, Splitu i Dubrovniku, istaknutim obalnim gradovima u Hrvatskoj, preciznije u regiji Dalmacije, s prepoznatljivim turističkim profilom oblikovanim brojem posjetitelja, sezonalnošću i tržišnim fokusom. Unatoč razlikama u veličini i karakteru, svi se u velikoj mjeri oslanjaju na međunarodni turizam.

Zadar, s približno 70 800 stanovnika (Državni zavod za statistiku, 2024a), zabilježio je više od 2,15 milijuna noćenja u 2023. godini (Hrvatska turistička zajednica, 2024), od čega su 88,3 % ostvarili strani gosti. Sezonalnost je izražena, ali umjerena, pri čemu se gotovo polovica (48,7 %) svih noćenja ostvaruje u vršnim ljetnim mjesecima (srpanj i kolovoz), a oko tri četvrtine (74,9 %) u razdoblju od lipnja do rujna. Njemačko tržište dominira s udjelom od 17,9 %, a Zadar svoju turističku ponudu temelji na kulturnom turizmu i baštini pod zaštitom UNESCO-a, privlačeći posjetitelje zainteresirane za povijest i urbano nasljeđe. Šibenik ima približno 42 600 stanovnika (Državni zavod za statistiku, 2024a), koji je 2023.

In total, eight interviews were conducted (two from each city), providing a comprehensive view of the strategies and policies implemented to manage tourism while preserving the cultural and environmental assets of these urban centres. Interviews were conducted online in May 2024. The interviews were transcribed and analysed using thematic analysis, focusing on identifying patterns and themes related to tourism management, heritage conservation, and urban planning. Coding was performed line-by-line to generate initial codes, which were then grouped into broader themes reflecting key policy and behavioural patterns. This systematic coding process ensured transparency and traceability in theme development, linking specific excerpts to the overarching findings of the study. This analysis aims to uncover the strategies employed by policy makers to address the challenges of tourism in culturally and historically significant city centres.

Research area

The research focuses on four cities in Croatia, each with historically and culturally significant city centres, some of which are recognized as UNESCO World Heritage Sites. These cities are Zadar, Šibenik, Split and Dubrovnik, prominent coastal cities in Croatia, more precisely Dalmatia region, each with a distinctive tourism profile shaped by visitor numbers, seasonality, and market focus. Despite their differences in size and character, they all rely heavily on international tourism.

Zadar, with a population of about 70,800 (Državni zavod za statistiku, 2024a), recorded over 2.15 million overnight stays in 2023 (Hrvatska turistička zajednica, 2024), of which 88.3% were foreign guests. Its seasonality is marked but moderate, with nearly half (48.7%) of all overnight stays occurring in peak summer months (July and August), and roughly three-quarters (74.9%) between June and September. Dominated by the German market (17.9%), Zadar promotes its UNESCO-listed heritage and cultural tourism, appealing to visitors interested in history and urban heritage. Šibenik is smaller, with around 42,600 residents (Državni zavod za statistiku, 2024a), and had 1.34 million overnight stays in 2023 (Hrvatska turistička zajednica, 2024), 84.5% of which were foreign. It has

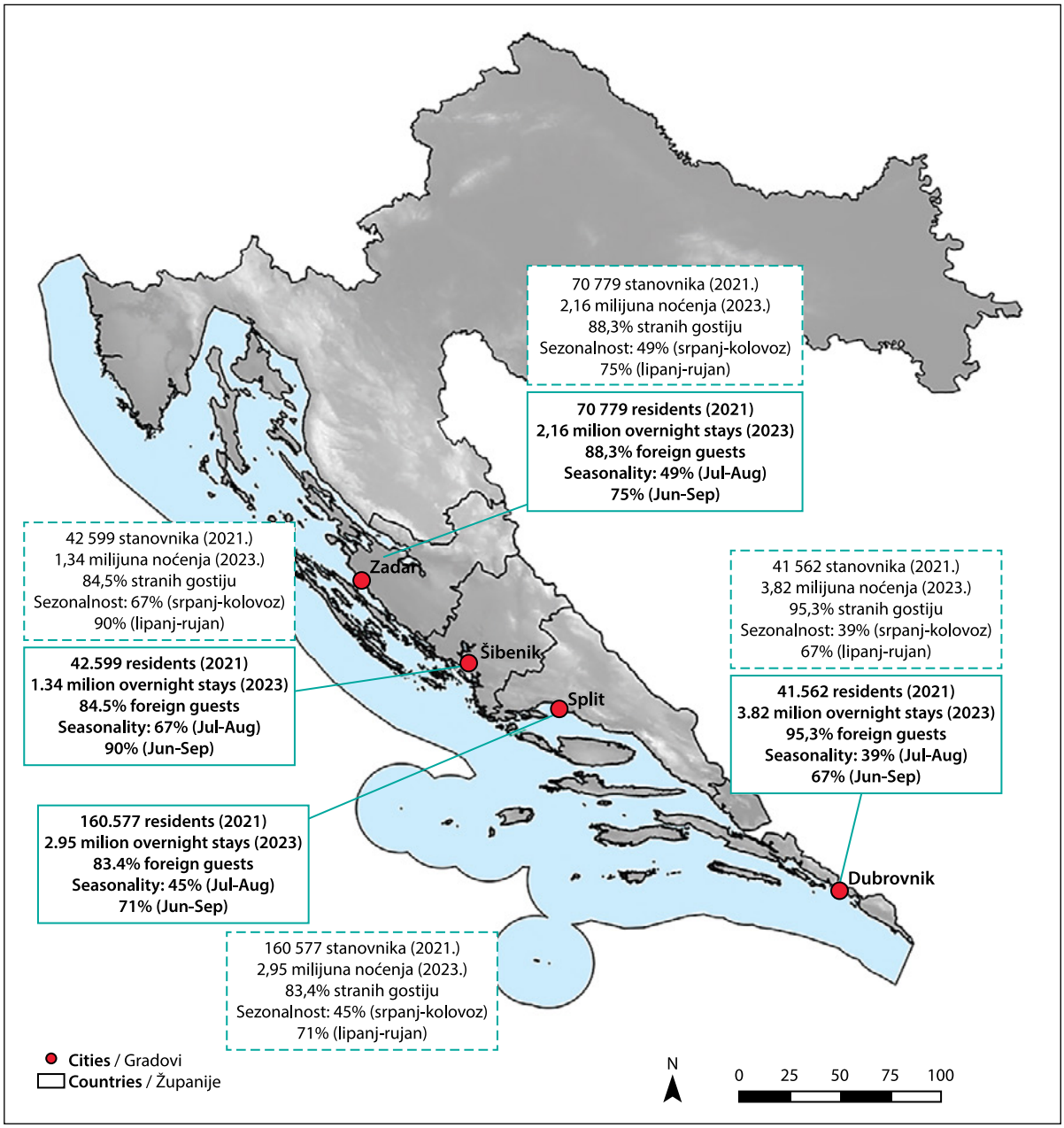
godine ostvario 1,34 milijuna noćenja (Hrvatska turistička zajednica, 2024), od čega su 84,5 % ostvarili strani turisti. Sa 66,9 % noćenja ostvarenih u srpnju i kolovozu te gotovo 90 % u širem ljetnom razdoblju (lipanj-rujan) ima najizraženiju sezonalnost među promatranim gradovima. Kao i u Zadru, najzastupljenije tržište je njemačko (18 %), no Šibenik se razlikuje po bogatom kalendaru kulturnih festivala i događanja koji privlače posjetitelje zainteresirane za kulturnu i umjetničku atmosferu grada. Split je najveći među promatranim gradovima, s više od 160 000 stanovnika (Državni zavod za statistiku, 2024a), te je 2023. godine ostvario gotovo 2,95 milijuna noćenja (Hrvatska turistička zajednica, 2024). Imao je drugi najveći udio stranih gostiju (93,4 %), odmah nakon Dubrovnika, dok je sezonalnost bila blaža: samo 44,9 % noćenja ostvareno je u srpnju i kolovozu, a 71,3 % tijekom ljetne sezone. Najzastupljenije tržište je britansko (11,5 %), a turistički profil Splita oblikuju Dioklecijanova palača pod zaštitom UNESCO-a, dinamična urbana kultura, noćni život i raznovrsna zabavna ponuda, čime se grad pozicionira kao destinacija kulturne baštine i zabave. Dubrovnik se ističe najmanjim brojem stanovnika (oko 41 500) (Državni zavod za statistiku, 2024b), ali i najvećim turističkim prometom s više od 3,8 milijuna noćenja (Hrvatska turistička zajednica, 2024). Također bilježi najveći udio stranih gostiju (95,3 %). Za razliku od Šibenika i Zadra, sezonalnost u Dubrovniku ravnomjernije je raspoređena, s 38,9 % noćenja u srpnju i kolovozu te 67,2 % u razdoblju od lipnja do rujna. Turizam je snažno potaknut britanskim tržištem (20,4 %), a karakteriziraju ga visoka potrošnja i kulturno motivirani posjetitelji koje privlači svjetski poznata povijesna jezgra pod zaštitom UNESCO-a. Zahvaljujući povijesnoj arhitekturi, luksuznom smještaju i ekskluzivnim događanjima, Dubrovnik se pozicionirao kao vrhunska kulturna i baštinska destinacija Hrvatske (Sl. 1.).

Zajedno, ti gradovi prikazuju raznolikost turističke ponude hrvatske obale, od Šibenskog festivala usmjerenog na kulturni turizam i naglaska Zadra na baštinu, preko splitske kombinacije povijesti i noćnog života, do visoko vrijednog, globalno prepoznatog kulturnog turizma Dubrovnika.

Ti su gradovi odabrani zbog svoje bogate povijesne i kulturne baštine, što ih čini ključnim turističkim destinacijama u Hrvatskoj. No ta baština donothe highest seasonality among the four cities, with 66.9% of its stays concentrated in July and August and nearly 90% in the broader summer window (June–September). Like Zadar, its strongest market is Germany (18%), but Šibenik distinguishes itself through a calendar of cultural festivals and events, drawing visitors specifically for its cultural and artistic atmosphere. Split, by contrast, is the largest city of the group with over 160,000 inhabitants (Državni zavod za statistiku, 2024a) and hosted nearly 2.95 million overnight stays in 2023 (Hrvatska turistička zajednica, 2024). It had the highest share of foreign visitors (93.4%) apart from Dubrovnik, yet its seasonality was milder: only 44.9% of overnight stays occurred in July and August, with 71.3% over the summer season. The British market leads (11.5%), and Split's tourism is shaped by its UNESCO-listed Diocletian's Palace, a dynamic urban culture, nightlife, and entertainment options, making it a destination for cultural heritage and leisure. Dubrovnik stands out with the smallest population (around 41,500) (Državni zavod za statistiku, 2024b) but the highest tourism volume, exceeding 3.8 million overnight stays (Hrvatska turistička zajednica, 2024). It also recorded the highest share of foreign visitors at 95.3%. Unlike Šibenik and Zadar, Dubrovnik's seasonality is more spread out, with only 38.9% of stays in July and August and 67.2% across June to September. Its tourism is strongly driven by the UK market (20.4%) and is characterized by high-spending, culturally motivated travellers drawn to its world-famous UNESCO protected old town. Renowned for its historic architecture, luxury accommodations, and exclusive events, Dubrovnik has positioned itself as Croatia's premium cultural and heritage destination (Fig. 1.).

Together, these cities illustrate Croatia's diverse coastal tourism offer, from Šibenik's festival-focused cultural tourism and Zadar's heritage appeal to Split's blend of history and nightlife, culminating in Dubrovnik's high-end, globally recognized cultural tourism.

These cities were selected due to their rich historical and cultural heritage, which makes them key destinations for tourism in Croatia. However, this heritage also presents unique challenges in balancing tourism growth with the preservation of



Slika 1. *Glavna obilježja gradova uključenih u istraživanje*
Figure 1 *Main features of cities involved in research*

Izvor: *autori prema Državnom zavodu za statistiku (2024b) i Hrvatskoj turističkoj zajednici (2024)* / Source: *the authors; based on Croatian Bureau of Statistics (2024b) and Croatian National Tourist Board (2024)*

si I jedinstvene izazove u usklađivanju rasta turizma s očuvanjem kulturnog i okolišnog integriteta.

Kvalitativna priroda ovoga istraživanja omogućuje dubinsko istraživanje iskustava i uvida donositelja politika, čime se pruža vrijedan doprinos razumijevanju održivog upravljanja turizmom u urbanim sredinama bogatima baštinom.

Najveći udio turista u četiri promatrane županije pripada dobnoj skupini od 26 do 35 godina, osobito u Zadarskoj i Šibensko-kninskoj županiji. Dubrovnik, odnosno Dubrovačko-neretvanska županija, bilježi najveći udio starijih turista, što može

cultural and environmental integrity.

The qualitative nature of this research allows for an in-depth exploration of the experiences and insights of policy makers, providing valuable contributions to the understanding of sustainable tourism management in heritage-rich urban environments.

The largest share of tourists in the four observed counties belongs to the 26–35 age group, particularly in Zadar and Šibenik-Knin counties. Dubrovnik, or more precisely the Dubrovnik-Neretva County, records the highest proportion of older tourists, which may suggest the destination's

Tablica 1. *Dobna struktura turista u promatranim županijama (u %)*
Table 1 *Age structure of tourists in the observed counties (in %)*

Županija / dobna skupina ***County / Age group***	**Zadarska /** ***Zadar***	**Šibensko-kninska /** ***Šibenik-Knin***	**Splitsko-dalmatinska /** ***Split-Dalmatia***	**Dubrovačko-neretvanska /** ***Dubrovnik-Neretva***
Do 25 godina / *Up to 25*	7,6	7,0	6,9	5,6
26 – 35 godina	31,1	30,5	26,5	23,3
36 – 45 godina	30,6	27,0	30,6	34,4
46 – 55 godina	19,3	20,1	24,6	24,5
56 i više godina / *56 and over*	11,4	15,4	11,4	12,2
Prosječna dob / *Average age*	40,2	41,4	41,5	41,7

Izvor: *TOMAS (2022./2023.), Institut za turizam (2024)* / Source: *TOMAS 2022/2023, Institute of Tourism (2024)*

upućivati na imidž destinacije pogodnije za kulturni i luksuzni turizam (Tab. 1.). Podaci upućuju na razlike u profilu turista te na potencijalno različite preferencije posjetitelja među regijama. Jasna segmentacija prema dobnim skupinama dodatno pokazuje da su ove županije privlačne mlađoj populaciji, koja češće preferira događanja, festivale i aktivnosti na otvorenom.

Primarni motiv putovanja je more, iako među županijama postoje izražene razlike. U Zadarskoj županiji čak 95,1 % turista dolazi ponajprije zbog mora, što je iznimno visok udio i odražava izrazito sezonski, kupališno orijentiran profil turista. Suprotno tome, u Šibensko-kninskoj (66,9 %) i Dubrovačko-neretvanskoj (69,9 %) županiji taj je udio znatno niži, iako i dalje dominantan. Splitsko-dalmatinska županija, s udjelom od 80,5 %, nalazi se između dviju krajnosti, što upućuje na uravnoteženiju turističku ponudu. Dubrovačko-neretvanska i Splitsko-dalmatinska županija bilježe znatno veće udjele motiva poput kulture i umjetnosti, gradova te obilazaka i razgledavanja. Dubrovnik se pritom posebno ističe: kultura

image as more suitable for cultural and luxury tourism (Tab.1.). These data point to differences in the tourist profile and potentially differing visitor preferences across regions. The clear segmentation by age groups further indicates that these counties are attractive to a younger demographic, which tends to prefer events, festivals, and outdoor activities.

The primary reason for travel is the 'sea,' though notable differences exist among counties. In Zadar County, as many as 95.1% of tourists come primarily for the sea, an exceptionally high share that reflects a highly seasonal, beach-oriented tourism profile. In contrast, in Šibenik-Knin (66.9%) and Dubrovnik-Neretva (69.9%) counties, the proportion is significantly lower, although still dominant. Split-Dalmatia County, with 80.5%, lies somewhere in between, indicating a more balanced offer. Dubrovnik-Neretva and Split-Dalmatia counties show significantly higher shares for motivations such as culture and the arts, cities, and touring/sightseeing. Dubrovnik leads in this respect: culture (22.8%),

Tablica 2. *Motivacija za dolazak turista u promatranim županijama (u %)*
Table 2 *Motivation for tourist arrivals in the observed counties (in %)*

Županija/motivacija ***County / motivation***	**Zadarska /** ***Zadar***	**Šibensko-kninska /** ***Šibenik-Knin***	**Splitsko-dalmatinska /** ***Split-Dalmatia***	**Dubrovačko-neretvanska /** ***Dubrovnik-Neretva***
More / *Sea*	95,1	66,9	80,5	69,9
Kultura i umjetnost / *Culture and the arts*	0,5	15,0	16,3	22,8
Gradovi / *Cities*	2,2	23,5	26,0	31,2
Obilasci/razgledavanje / *Touring/sightseeing*	0,6	7,3	24,9	26,7
Zabava i festivali / *Entertainment and festivals*	10,3	8,0	8,9	4,1
Događanja i manifestacije / *Events and happenings*	23,1	11,9	2,8	1,9

Izvor: *TOMAS (2022./2023.), Institut za turizam (2024)* / Source: *TOMAS 2022/2023, Institute of Tourism (2024)*

(22,8 %), gradovi (31,2 %) i obilasci (26,7 %), što jasno potvrđuje njegov status kulturne i urbane destinacije koja nadilazi tradicionalni odmor uz more. Zadarska županija izdvaja se po visokom udjelu turista motiviranih „događanjima i manifestacijama" (23,1 %), što može upućivati na prisutnost specifičnih lokalnih festivala ili događanja, ali se također može povezati s dobnom strukturom prikazanom u Tablici 1. Motiv „zabava i festivali" pokazuje relativno ujednačen, ali niži udio među županijama, pri čemu je iznenađujuće nizak udio u Dubrovniku (4,1 %), što može odražavati imidž grada kao ozbiljnije, kulturno orijentirane destinacije (Tab. 2.).

Iako Tablice 1. i 2. pružaju koristan uvid u dobnu strukturu i motive putovanja, važno je naglasiti da se podaci istraživanja TOMAS prikupljaju na razini županija, a ne na razini gradova. Stoga ti rezultati ne predstavljaju točan demografski ni motivacijski profil turista koji posjećuju Zadar, Šibenik, Split ili Dubrovnik kao pojedinačne gradove. Umjesto toga, oni pružaju ilustrativni kontekstualni pregled koji pomaže u približnom sagledavanju širih trendova posjetitelja u županijama u kojima se ti gradovi nalaze.

Dobna struktura i motivi putovanja turista značajno utječu na obrasce ponašanja u destinaciji. Mlađi turisti, osobito oni motivirani zabavom, događanjima i noćnim životom, skloniji su češćem upuštanju u rizična i neprimjerena ponašanja, poput prekomjerne konzumacije alkohola, buke i narušavanja javnog reda.

Ograničenja istraživanja

Istraživanje se temelji na malom broju dubinskih intervjua (n = 8) s donositeljima politika iz četiriju hrvatskih gradova. Iako takav pristup omogućuje detaljno istraživanje strategija specifičnih za pojedini kontekst, rezultati se ne mogu potpuno generalizirati na druge gradove ili regije s drukčijim sociokulturnim i gospodarskim uvjetima. Nadalje, oslanjanje na intervjue s donositeljima politika može dovesti do pristranosti jer odgovori ispitanika mogu odražavati službene stavove, a ne osobna mišljenja. S obzirom na kvalitativnu i tematsku prirodu analize, rezultati su interpretativni i ovisni o kontekstu te statistička generalizacija nije moguća.

cities (31.2%), and touring (26.7%), which clearly confirms Dubrovnik's status as a cultural and urban destination that goes beyond the traditional seaside holiday. Zadar County stands out for the high share of tourists motivated by 'events and happenings' (23.1%), which may suggest the presence of specific local festivals or events, and can also be related to the age structure presented in Table 1 'Entertainment and festivals' show a relatively even but lower share across counties, with a surprisingly low percentage in Dubrovnik (4.1%), possibly reflecting the city's image as a more serious, culturally-oriented destination (Tab 2).

Although Tables 1 and 2 provide useful insight into age structure and travel motivations, it is important to clarify that TOMAS data are collected at the county level, not at the city level. Therefore, these results do not represent the exact demographic or motivational profile of tourists specially visiting Zadar, Šibenik, Split, or Dubrovnik as individual cities. Instead, they offer and illustrative contextual overview, helping to approximate broader visitor trends in the counties in which these cities are located.

Ultimately, the age structure and travel motivations of tourists significantly influence behavioural patterns at the destination. Younger tourists, particularly those motivated by entertainment, events, and nightlife, tend to engage more frequently in risky and inappropriate behaviours, such as excessive alcohol consumption, noise, and public disorder.

Research limitations

The study is based on a small number of in-depth interviews (n = 8) with policy makers from four Croatian cities. While this allows for a deep exploration of context-specific strategies, the findings may not be fully generalizable to other cities or regions with different socio-cultural and economic conditions. Additionally, relying on interviews with policy makers may introduce bias, as respondents could provide answers reflecting official positions rather than personal views. Given the qualitative and thematic nature of the analysis, the results are interpretative and context-dependent, and statistical generalization is not possible.

Etička razmatranja

Svim sudionicima pružene su detaljne informacije o svrsi istraživanja, metodologiji i načinu korištenja podataka. Prije početka intervjua od svakog je sudionika pribavljena informirana suglasnost, čime je osigurano da razumiju kako je njihovo sudjelovanje dobrovoljno i da mogu odustati u bilo kojem trenutku bez posljedica. Identiteti sudionika zaštićeni su korištenjem pseudonima ili anonimizacijom pojedinih podataka koji bi mogli dovesti do njihove identifikacije. To je bilo osobito važno s obzirom na mali broj sudionika i potencijalnu osjetljivost dijeljenih informacija jer se odnose na javne politike i upravljanje gradovima.

Rezultati istraživanja prikazani su transparentno, uz jasno navođenje konteksta u kojem su podaci prikupljeni te svih potencijalnih ograničenja istraživanja. To obuhvaća priznavanje pristranosti i ograničenja svojstvenih primijenjenoj metodologiji te osiguravanje da su doneseni zaključci utemeljeni na prikupljenim podacima.

STUDIJA SLUČAJA: LOKALNA REGULACIJA KAO BIHEVIORALNA INTERVENCIJA

Ovo istraživanje ispituje kako se četiri hrvatska obalna grada – Zadar, Šibenik, Split i Dubrovnik – koriste lokalnim javnim politikama kako bi utjecali na ponašanje turista, osobito u pogledu odijevanja i javnog ponašanja u povijesno i kulturno osjetljivim urbanim prostorima. Svaki od tih gradova posjeduje istaknuta područja kulturne baštine, pri čemu je dijelove njihova urbanog tkiva prepoznao UNESCO, a svi su donijeli odluke o komunalnom redu osmišljene radi reguliranja javnog ponašanja kao odgovora na ubrzani rast turizma i s njime povezane društvene izazove.

Lokalne odluke i bihevioralni ciljevi

Upravni odjeli za komunalne djelatnosti i zaštitu okoliša u svakom su gradu donijeli posebne pravne odredbe koje se izričito odnose na neprimjereno ponašanje turista, osobito u vezi s nor-

Ethical considerations

All participants were provided with detailed information about the study's purpose, methodology, and how the data would be used. Informed consent was obtained from each participant before the interviews commenced, ensuring that they understood their participation was voluntary and that they could withdraw at any time without any consequences. The identities of the participants were protected using pseudonyms or by anonymizing specific details that could lead to their identification. This was particularly important given the small number of participants and the potential sensitivity of the information shared, as it relates to public policy and urban management.

The findings from the study are reported transparently, ensuring that the context in which the data was collected, and any potential limitations of the study are clearly communicated. This includes acknowledging the biases and limitations inherent in the study's methodology and ensuring that the conclusions drawn are supported by the data collected.

CASE STUDY: LOCAL REGULATION AS A BEHAVIORAL INTERVENTION

This study examines how four Croatian coastal cities—Zadar, Šibenik, Split, and Dubrovnik—integrate local public policy to influence tourist behaviour, particularly regarding dress codes and public conduct in historically and culturally sensitive urban spaces. Each of these cities features prominent heritage sites, with parts of their urban fabric recognized by UNESCO, and all have adopted municipal decisions on communal order designed to regulate public behaviour in response to the rapid growth of tourism and associated social challenges.

Local ordinances and behavioural goals

The Administrative Departments for Communal Activities and Environmental Protection in each city have enacted specific legal provi-

mama odijevanja u javnim prostorima. Te mjere nisu isključivo regulatorne, već predstavljaju i bihevioralne intervencije jer ciljaju na vidljiva i kulturno osjetljiva ponašanja koja izravno utječu na percepciju urbane baštine i kvalitetu života stanovnika.

U Zadru članak 74.b Odluke o komunalnom redu propisuje minimalni kodeks odijevanja u povijesnoj jezgri. Zabranjuje se kretanje „neodjeven, djelomično odjeven, bez gornjeg ili donjeg dijela odjeće, u kupaćem kostimu ili dijelu kupaćeg kostima", dok se minimalno prihvatljivom odjećom smatraju kratke hlače ili suknja te košulja ili majica kratkih rukava. Izričit cilj te odredbe je očuvanje javnog reda i pristojnosti u prostorima kulturne baštine te zaštitu kulturnog dostojanstva.

Šibenik primjenjuje sličan pristup u člancima 72. i 125. kojima se zabranjuje kretanje gradom bez odgovarajuće odjeće te propisuje novčana kazna u iznosu od 500 kuna za nepoštivanje odredbi. Preciznost zakonskih odredbi i novčana sankcija upućuju na namjeru formaliziranja društvenih normi u provediva pravila, čime se jačaju subjektivne norme i percipirana kontrola ponašanja u skladu s teorijom planiranog ponašanja (Alonso i sur., 2015).

Split kombinira prostorno zoniranje s ograničenjima ponašanja. Na svim javnim gradskim površinama, članci 90. i 10. stavak 1. točka 18. zabranjuju pojavljivanje u javnosti u kupaćem kostimu ili bez odjeće, osim na plažama ili uz bazene. Članak 155. propisuje novčanu kaznu u iznosu od 650 kuna, što odražava nešto stroži pristup provedbi. Strateško razgraničenje zona ponašanja usklađeno je s načelima arhitekture izbora iz teorije *nudginga*, jasno definirajući prihvatljivo ponašanje u skladu s prostornim kontekstom.

U Dubrovniku članak 95. sadrži jedan od najopsežnijih popisa zabranjenih ponašanja u povijesnoj jezgri, uključujući hodanje u kupaćim kostimima ili bez odjeće, bacanje otpada, pljuvanje te neprimjereno ponašanje u blizini spomenika. Ta široka ograničenja odražavaju holistički pogled na društvene i prostorne učinke turizma. Dubrovačka politika dodatno zabranjuje konzumaciju hrane i pića u blizini kulturnih spomenika, čime se dodatno štiti vizualni i simbolički integritet lokaliteta baštine.

sions that explicitly address inappropriate behaviour by tourists, particularly regarding clothing norms in public spaces. These measures are not only regulatory but are also behavioural interventions, targeting visible and culturally sensitive actions that directly impact the perception of urban heritage and the quality of life of residents.

In Zadar, Article 74b of the Decision on Communal Order mandates a minimum dress code in the historical centre. It prohibits walking 'unclothed, partially clothed, without a top or bottom, in a bathing suit or part of a bathing suit,' while defining minimal acceptable attire as shorts or a skirt and a shirt or T-shirt. This provision explicitly aims to maintain public decorum in heritage areas and preserve cultural dignity.

Šibenik takes a similar approach in Articles 72 and 125, banning movement through the city without appropriate clothing and imposing a monetary fine of HRK 500 for non-compliance. The law's specificity and monetary sanction suggest an intention to formalize social norms into enforceable rules, reinforcing both subjective norms and perceived behavioural control as outlined in the Theory of Planned Behaviour (Alonso et al., 2015).

Split combines geographic zoning with behavioural restrictions. Within all public city areas, Articles 90 and 10(1)(18) prohibit appearing in public in bathing suits or without clothing, except on beaches or pool areas. Article 155 stipulates a fine of HRK 650, reflecting a slightly more aggressive enforcement strategy. The strategic delineation of behavioural zones aligns with choice architecture principles from Nudge Theory, clearly framing acceptable behaviour based on spatial context.

In Dubrovnik, Article 95 includes one of the most comprehensive lists of prohibited conduct in the historic centre, including walking in bathing suits or without clothing, littering, spitting, and behaving inappropriately near monuments. These wide-ranging restrictions reflect a holistic view of tourism's social and spatial impacts. Dubrovnik's policy also prohibits consumption of food or drink near cultural monuments, further protecting the visual and symbolic integrity

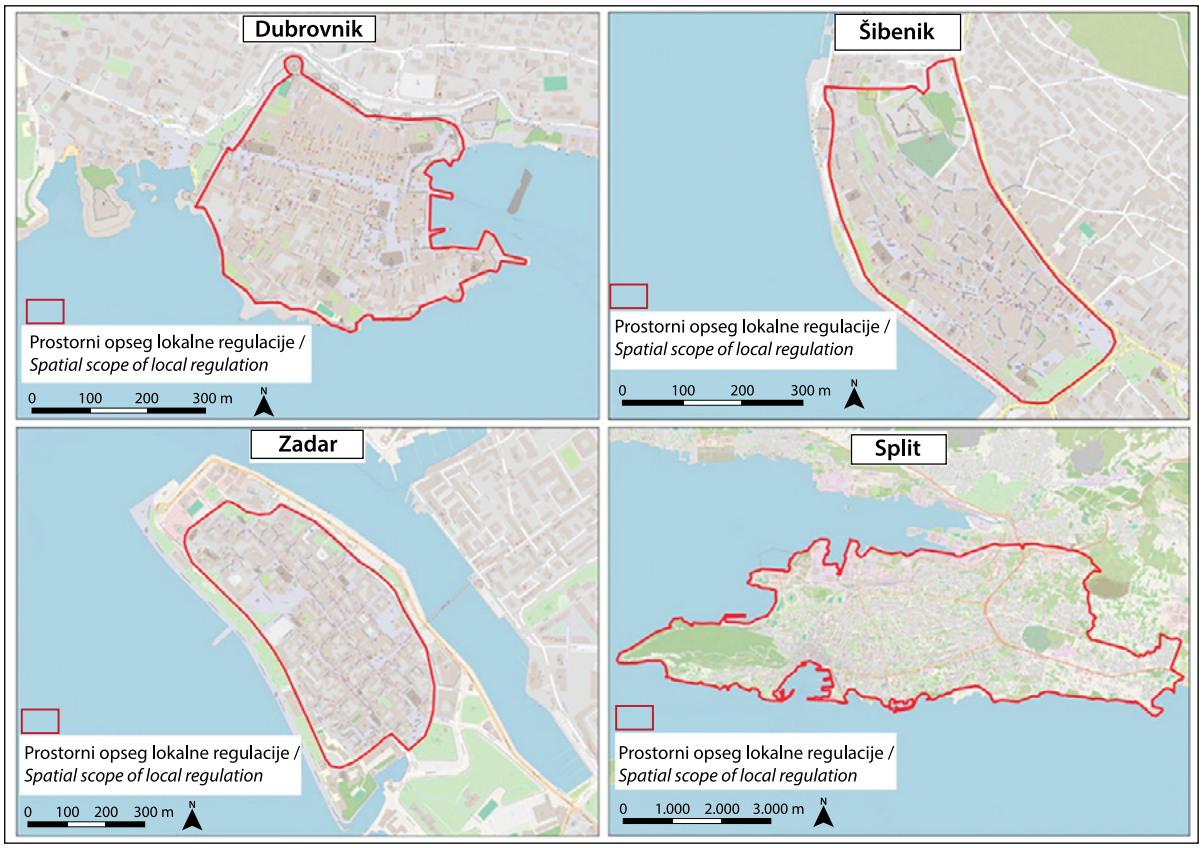
Kao što je prikazano u prethodnom poglavlju, u sva četiri obalna grada lokalne odluke kojima se regulira ponašanje turista pokazuju zamjetne razlike u tematskom obuhvatu pravila i njihovu prostornom dosegu, odražavajući različite upravljačke strategije zaštite kulturne baštine i upravljanja pritiskom posjetitelja (Sl. 2.).

U Zadru se navedene regulative primjenjuju na užu povijesnu jezgru, jasno definiranu povijesnu cjelinu omeđenu glavnim ulicama i trgovima, gdje su propisani minimalni standardi odijevanja radi očuvanja dostojanstva kulturno osjetljivih područja. Šibenik na sličan način ograničava pravila o odijevanju na stari grad, zonu precizno definiranu okolnim ulicama poput Ulice Vladimira Nazora i Zagrađa, čime se dodatno potvrđuju očekivanja ponašanja unutar njegova kompaktno zaštićenog središta. Split primjenjuje dvodijelni prostorni pristup: odluka se prvotno odnosi na Zonu A, povijesni i najturističkiji dio grada, gdje je izričito zabranjeno pojavljivanje u javnosti bez odgovarajuće odjeće; međutim, kasniji dio istog dokumenta proširuje ovo pravilo

of heritage sites.

As can be seen from previous section, across the four coastal cities, local ordinances regulating tourist behaviour reveal notable differences in both the thematic scope of rules and their spatial coverage, reflecting distinct governance strategies for protecting cultural heritage and managing visitor pressure (Fig. 2.).

Zadar's regulations apply specifically to the *uža povijesna jezgra,* a clearly delineated historic core bounded by major streets and public squares, where minimal clothing standards are mandated to preserve the dignity of culturally sensitive areas. Šibenik similarly confines its clothing rules to the old town, a zone precisely defined by surrounding streets such as Ulica Vladimira Nazora and Zagrađe, reinforcing behavioural expectations within its compact heritage centre. Split presents a two-tiered spatial approach: the ordinance initially focuses on *Zone A*, the historical and most touristic part of the city, where appearing in public without adequate clothing is explicitly prohibited; howev-



Slika 2. *Prostorni obuhvat lokalne regulative u odabranim gradovima*
Figure 2 *Spatial scope of local regulations in selected cities*

Izvor: *L. Matotek (2025), izrađeno na zahtjev autora* / Source: *created by L. Matotek (2025) at the author's request.*

na sve javne gradske površine, s iznimkom samo za označene plaže i bazenske zone. Ta dvostruka struktura pokazuje prijelaz od ciljanog očuvanja baštine prema regulaciji ponašanja na razini cijelog grada kao način pojednostavljenja provedbe i oblikovanja ponašanja posjetitelja u urbanom prostoru.

Dubrovačka regulativa koristi se najširim i najopsežnijim okvirom unutar svoje povijesne jezgre upisane na popis Svjetske baštine, pri čemu pravila obuhvaćaju ne samo odijevanje, već i konzumaciju hrane, bacanje otpada i opće ponašanje u blizini spomenika, što odražava holističku strategiju zaštite izrazito osjetljivog i preopterećenog baštinskog prostora. Zajedno, te varijacije, od lokaliziranih povijesnih jezgri do regulacije na razini cijelog grada, pokazuju kako se lokalne vlasti koriste različitim prostornim okvirima kako bi utjecale na ponašanje posjetitelja, upravljale društvenim učincima te zaštitile kulturnu baštinu i kvalitetu života stanovnika u svojim destinacijama.

Od pravila do ponašanja: povezivanje politike i psihologije

Lokalne regulative pokazuju kako se spoznaje iz bihevioralne znanosti mogu učinkovito integrirati u lokalnu politiku. Kao što ističe OECD (2023), primjena znanja o ljudskom ponašanju otvara mogućnosti za oblikovanje politika koje povećavaju njihovu prihvaćenost i učinkovitost. Dok zakoni postavljaju formalne granice, način prikaza i komunikacije tih pravila, kroz signalizaciju, provedbu i javni diskurs, djeluje kao poticaj koji jača društvene norme i jasno pokazuje očekivano ponašanje.

Razlike u provedbi, uočene u intervjuima, od verbalnih upozorenja u Zadru do redovitog sankcioniranja u Splitu, upućuju na različite pristupe primjeni bihevioralnih mjera. U gradovima u kojima je provedba vidljivija i dosljednija, poput Splita i Dubrovnika, donositelji politika primijetili su poboljšanja u ponašanju turista te veću javnu svijest o pravilima. Ti rezultati sugeriraju da percipirane posljedice ponašanja, poput novčanih kazni ili opomena, snažno utječu na odluke turista, osobito kada su pravila jasno komunicirana i vidljivo provedena.

er, a later section of the same document extends this rule to *all public city areas*, with exceptions only for designated beaches and pool zones. This dual structure demonstrates progression from targeted heritage protection to citywide behavioural regulation as a means of simplifying enforcement and shaping visitor conduct across the urban space. Dubrovnik employs the broadest and most comprehensive framework within its World Heritage-listed historic centre, where rules encompass not only clothing but also food consumption, littering, and general conduct near monuments, reflecting a holistic protection strategy for a highly sensitive and congested heritage environment. Taken together, these variations—from localized historic cores to full-city regulatory coverage—show how local governments use different spatial scopes to influence visitor behaviour, manage social impacts, and safeguard the cultural and residential quality of life in their respective destinations.

From rules to behaviour: linking policy to psychology

These local regulations exemplify how behavioural science insights can be embedded into municipal policy. As the OECD (2023) emphasizes, leveraging human behaviour knowledge creates opportunities to design policies that enhance uptake and effectiveness. While laws provide formal boundaries, the framing and communication of those rules—through signage, enforcement, and public discourse—serve as nudges that reinforce social norms and signal the expected conduct.

The differences in enforcement observed through our interviews—ranging from verbal warnings in Zadar to regular sanctioning in Split—highlight variations in the implementation of behavioural interventions. In cities where enforcement is more visible and consistent, such as Split and Dubrovnik, policymakers noted improvements in tourist behaviour and greater public awareness. These findings suggest that the perceived behavioural consequences, fines or reprimands, influence tourists' decision-making, especially when those policies are clearly communicated and visibly enforced.

REZULTATI I RASPRAVA

Za potrebe rada provedeno je kvalitativno istraživanje. S ciljem prikupljanja informacija i podataka od donositelja odluka u četiri hrvatska grada na obali – Zadru, Šibeniku, Splitu i Dubrovniku – provedeni su dubinski intervjui s otvorenim pitanjima. Navedeni gradovi, koje obilježavaju atraktivne povijesne jezgre i visok intenzitet turističkih dolazaka, predstavljaju relevantan kontekst za istraživanje utjecaja turizma na kulturne norme te istraživanje načina na koji lokalne politike odgovaraju na takve izazove. Provedeni intervjui s osam ispitanika, direktorima turističkih zajednica te pročelnicima upravnih odjela za komunalne djelatnosti i zaštitu okoliša, omogućili su cjelovit uvid u strategije i percepcije dionika u destinacijama. Otvorena pitanja smanjila su pristranost istraživača te ispitanicima omogućila artikuliranje stavova oblikovanih stvarnim iskustvima upravljanja turizmom (Beaver & Busse, 2000; Schensul, 1999). Budući da se istraživanje temelji na kvalitativnim intervjuima potrebno je istaknuti da se rezultati ne mogu generalizirati na sve turiste i na sve hrvatske obalne gradove. Umjesto toga, oni predstavljaju dubinske kontekstualne uvide utemeljene na percepcijama dionika u turističkim zajednicama i gradskim odjelima.

Prije iznošenja detaljnih rezultata induktivnim postupkom kodiranja provedena je tematska analiza. Transkripti intervjua kodirani su redak po redak, pri čemu su generirani početni kodovi koji su potom tematski razvrstani. Postupak kodiranja rezultirao je s pet dominantnih tema: (1) varijabilnost kulturne osviještenosti turista; (2) najčešći oblici neprimjerenog ponašanja; (3) reakcije zajednice i neformalna društvena regulacija; (4) razlike u pristupima gradova u provedbi propisa te (5) učinkovitost politika i promjena ponašanja. Navedene teme strukturiraju i usmjeravaju interpretaciju rezultata prikazanih u nastavku (Tab. 3.). Svaka je tema izravno proizašla iz kodiranih podataka te služi kao analitička prizma za povezivanje pojedinačnih iskaza ispitanika sa širim obrascima ponašanja i dinamikom lokalnih javnih politika.

Rezultati su strukturirano izloženi kroz teme i kodove, a detaljno se razmatraju u sljedećim

RESULTS AND DISCUSSION

This study employed a qualitative research approach using in-depth interviews with open-ended questions to gather rich, nuanced data from policymakers in four coastal Croatian cities, Zadar, Šibenik, Split, and Dubrovnik. These cities, each with attractive historical centres and high tourist inflow, provide a relevant setting for investigating how tourism impacts cultural norms and how local policies address these challenges. Interviewing eight officials, heads of tourism departments and heads of administrative departments for communal activities and environmental protection, ensured a comprehensive view of municipal strategies and perceptions. The open-ended question format minimized researcher bias and allowed respondents to articulate perspectives shaped by real-world experiences in managing tourism (Beaver & Busse, 2000; Schensul, 1999). It must be noted that the findings cannot be statistically generalized to all tourists or all Croatian coastal cities, as the study is based on qualitative interviews. Instead, they represent in-depth contextual insights based on the perceptions of municipal officials.

Before presenting the detailed findings, a thematic analysis was conducted following a standard inductive coding procedure. Interview transcripts were coded line-by-line, generating initial codes that were then clustered into higher-order themes. The coding process produced five dominant themes: (1) variability in tourists' cultural awareness; (2) common forms of inappropriate behaviour; (3) community reactions and informal social regulation; (4) differences in municipal enforcement approaches, and (5) policy effectiveness and behavioural change. These themes are structured and inform the interpretation of the results that follow (Table 3). Each theme emerged directly from the coded data and serves as an analytical lens for connecting individual statements of respondents with broader behavioural patterns and municipal policy dynamics.

These themes and codes structure the presentation of findings, which are discussed in

Tablica 3. *Pregled tema, kodova i ilustrativnog značenja*
Table 3 *Overview of themes, codes, and illustrative meaning*

Tema / *Theme*	**Kodovi / *Codes***	**Opis / značenje u podacima / *Description / meaning in data***
1. Varijabilnost kulturne osviještenosti turista	Niska razina osviještenosti, sezonske razlike, razlike u dobi, razlike prema zemlji podrijetla	Ispitanici su naveli da se razumijevanje kulturnih normi među turistima značajno razlikuje ovisno o sezoni, demografskim obilježjima te zemlji podrijetla.
2. Najčešći oblici neprimjerenog ponašanja	Neprimjereno odijevanje, bacanje otpada, buka, konzumacija alkohola na javnim mjestima	Ispitanici iz jedinica lokalnih samouprava istaknuli su ponavljajuće oblike ponašanja koji negativno utječu na povijesne urbane prostore i kulturnu baštinu.
3. Reakcije zajednice i neformalna društvena regulacija	Pritužbe stanovnika, frustracija zajednice, zaštita kulturnih vrijednosti	Lokalno stanovništvo često reagira na neprimjereno ponašanje, najčešće prijavljujući incidente, očekivanja zajednice dodatno učvršćuju neformalne društvene norme.
4. Razlike u pristupima provedbi propisa na razini gradova	Usmena upozorenja, slaba provedba, dosljedno izricanje novčanih kazni, odvraćajući učinak	Gradovi se razlikuju u načinu primjene propisa, od blažih upozorenja do dosljednog sankcioniranja, što utječe na razinu pridržavanja pravila turista.
5. Učinkovitost politika i promjena ponašanja	Vidljivost provedbe, višejezična signalizacija, predvidljiva pravila, intervencije temeljene na „nudge" pristupu	Učinkovit utjecaj na ponašanje ovisi o jasnoći komunikacije pravila i dosljednosti njihove provedbe, u skladu s teorijom poticanja (*Nudge Theory*) i načelima kontrole ponašanja.

Izvor: *analiza autora na temelju kvalitativnih intervjua s gradskim službenicima (N = 8)* / Source: *the authors' analysis based on qualitative interviews with municipal officials (N = 8)*

poglavljima. Primijenjeni metodološki pristup pokazao se osobito učinkovitim u otkrivanju suptilne i često kontekstno uvjetovane prirode turističkog ponašanja te njegova percipiranog utjecaja na kulturnu baštinu. Uključivanjem dionika iz gradskih odjela odgovornim za područje turizma i zaštite okoliša istraživanje je omogućilo slojevito razumijevanje izazova s kojima se suočava očuvanje kulturnog dostojanstva povijesnih urbanih prostora. Kvalitativni podaci pokazali su da su donositelji odluka ne samo svjesni heterogenosti ponašanja turista, već se istodobno suočavaju i s ograničenjima postojećih intervencija. Intervjui su ispitanicima omogućili da objasne kako se kulturna neosjetljivost, poput neprimjerenog odijevanja, bacanja otpada, buke i konzumacije alkohola na javnim mjestima, očituje u različitim oblicima, ovisno o sezoni i demografskim obilježjima turista. Takva razina uvida teško bi se mogla postići isključivo kvantitativnim metodama, što dodatno potvrđuje vrijednost intervjua s otvorenim pitanjima u istraživanju složenih društveno-kulturnih odnosa.

greater detail in the following sections. Used methodological approach proved particularly effective in uncovering the nuanced and often context-dependent nature of tourist behaviour and its perceived impact on cultural heritage. By engaging directly with municipal officials responsible for both tourism and environmental management, the study captured a layered understanding of the challenges faced in preserving the cultural dignity of historic urban spaces. The qualitative data revealed that policymakers are not only aware of the behavioural heterogeneity among tourists but are also grappling with the limitations of existing interventions. The interviews allowed respondents to explain cultural insensitivity, such as inappropriate dress, littering, noise, and public drinking, manifests in different forms across seasons and tourist demographics. This depth of insight would have been difficult to obtain through quantitative measures alone, reinforcing the value of open-ended interviews in exploring complex socio-cultural dynamics.

Ponašanje turista i kulturna osviještenost

U ovom se potpoglavlju, u skladu s metodološkom prirodom dubinskih intervjua, interpretiraju kvalitativni rezultati. Budući da kvalitativni intervjui ne omogućuju statističku generalizaciju, izneseni navodi odražavaju obrasce identificirane tematskom analizom, a ne numeričke raspodjele.

Jedna od središnjih tema proizašla iz podataka odnosi se na ograničenu razinu svijesti turista o očuvanju kulturne baštine. Nekoliko ispitanika istaknulo je da se ta razina svijesti razlikuje ovisno o sezoni, dobnoj skupini i zemlji podrijetla, što upućuje na to da je ponašanje turista oblikovano kontekstualnim i sociokulturnim čimbenicima, a ne jedinstvenim ili ujednačenim obrascima. Ta varijabilnost odražava bihevioralnu heterogenost razmatranu u teoriji planiranog ponašanja, osobito u pogledu stavova i subjektivnih normi (Alonso i sur., 2015). Ispitanici su naglasili da se turisti koji nisu upoznati s lokalnim kulturnim vrijednostima mogu nenamjerno ponašati na načine koji se percipiraju kao nepoštivanje ili ometanje, osobito u zaštićenim povijesnim jezgrama.

U svim intervjuima jedna od najčešće ponavljanih tema odnosila se na neprimjereno odijevanje na lokacijama s kulturnim značenjem. Svi su ispitanici naveli taj problem među najistaknutijim izazovima povezanima s ponašanjem turista, naglašavajući njegovu stalnu prisutnost u sva četiri grada obuhvaćena istraživanjem. Bacanje otpada, buka i konzumacija alkohola na javnim mjestima također su se često spominjali, ali uz veće razlike među ispitanicima, što dodatno potvrđuje kvalitativni karakter nalaza. Takvi oblici ponašanja, iako se naizgled mogu činiti manjim prekršajima, mogu znatno narušiti doživljaj urbanog prostora i kulturno dostojanstvo povijesnih lokaliteta. Ti rezultati u skladu su s postojećom literaturom koja upućuje na to da neprimjereno ponašanje turista u kulturno osjetljivim zonama može narušiti lokalni identitet i umanjiti dobrobit zajednice (McKercher & du Cros, 2012). Navedeni tematski obrasci potvrđuju da je ponašanje turista višedimenzionalno i snažno ovisno o kontekstu. Umjesto ukazivanja na mjerljive razine (ne)pridržavanja pravila, intervjui otkrivaju način na koji lokalni donositelji odluka percipiraju bihevioralne izazove te kako te percep-

Tourist behaviour and cultural awareness

In this subchapter, the findings are interpreted qualitatively, in accordance with the methodological nature of in-depth interviews. As qualitative interviews do not allow statistical generalization, the statements below reflect patterns identified through thematic analysis rather than numerical distributions.

One of the central themes that emerged from the data concerns tourists' limited awareness of cultural heritage preservation. Several respondents noted that this awareness varies depending on the season, age group, and country of origin, suggesting that tourist behaviour is shaped by contextual and socio-cultural factors rather than uniform tendencies. This variability reflects the behavioural heterogeneity discussed in the Theory of Planned Behaviour, particularly regarding attitudes and subjective norms (Alonso et al., 2015). Respondents emphasised that tourists who are unfamiliar with local cultural values may inadvertently behave in ways that are perceived as disrespectful or disruptive, especially in historically significant areas.

Across interviews, one of the most recurrent themes was inappropriate dress in culturally sensitive locations. Every respondent mentioned this issue among the most prominent behavioural challenges, highlighting its persistent visibility in all four case-study cities. Littering, noise, and alcohol consumption in public were also frequently mentioned, but with greater variability among participants, reinforcing the qualitative nature of the findings. These behaviours, while seemingly minor infractions, can significantly degrade the urban experience and cultural dignity of historic sites. This aligns with the existing literature suggesting that tourist misbehaviour in culturally sensitive zones can erode local identity and diminish community well-being (McKercher & du Cros, 2012). Together, these thematic patterns underscore that tourist behaviour is multifaceted and context dependent. Rather than indicating measurable levels of (non)compliance, the interviews reveal how local policy makers perceive behavioural challenges and how these perceptions shape urban

cije oblikuju upravljanje gradskim prostorom i napore usmjerene na očuvanje kulturne baštine.

Nadalje, rezultati upućuju na jasan raskorak između ponašanja turista i očekivanja lokalnog stanovništva u osjetljivim prostorima kulturne baštine, čime se naglašava potreba za ciljanim strategijama podizanja razine svijesti. Činjenica da su ispitanici procijenili razinu svijesti turista o očuvanju baštine niskom te da su istaknuli njezine oscilacije ovisno o sezoni, dobi i podrijetlu, dodatno naglašava važnost kulturološki prilagođene komunikacije i edukacijskih aktivnosti. Takva nedosljednost u ponašanju potvrđuje postavke teorije planiranog ponašanja, osobito u pogledu utjecaja subjektivnih normi i stavova na djelovanje pojedinaca (Alonso i sur., 2015). Nadalje, jednoglasna zabrinutost zbog neprimjerenog odijevanja, uz probleme bacanja otpada, buke i konzumacije alkohola na javnim mjestima, pokazuje kako čak i naizgled sitni postupci mogu kumulativno narušiti društvenu i kulturnu strukturu povijesnih urbanih sredina. Takva ponašanja ne ugrožavaju samo estetsku i simboličku vrijednost lokaliteta kulturne baštine, nego dodatno opterećuju odnos između lokalnog stanovništva i turističkog sektora. Kako ističu McKercher i du Cros (2012), takvi poremećaji pridonose postupnoj eroziji identiteta mjesta i lokalnog ponosa, čime se dodatno potvrđuje potreba da jedinice lokalne samouprave primijene proaktivnije i kulturološki osviještene javnopolitičke intervencije.

Javni odgovori i percipirane društvene norme

Većina ispitanika navela je da lokalno stanovništvo na takva ponašanja reagira negativno, često prijavljujući prekršaje nadležnim službama. Time se potvrđuje da su subjektivne norme, odnosno očekivanja zajednice u pogledu primjerenog ponašanja snažno prisutne na lokalnoj razini te da značajno utječu na to kako stanovnici reagiraju na percipirane prijestupe. Negativne reakcije lokalnog stanovništva dodatno potvrđuju tvrdnju da održivi turizam mora uvažavati perspektive zajednice domaćina kao dio oblikovanja javnih politika (Ruhanen, 2013).

Ispitanici su istaknuli da takve reakcije zajednice nisu samo izrazi nezadovoljstva, već predstavljaju i

management and cultural preservation efforts.

Furthermore, these results point to a clear disconnect between tourist behaviour and local expectations in culturally sensitive areas, emphasizing the need for targeted awareness-raising strategies. The fact that respondents rated tourists' awareness of heritage preservation as low, and noted its fluctuation by season, age, and origin, underscores the importance of culturally nuanced communication and education efforts. This behavioural inconsistency supports the Theory of Planned Behaviour, particularly in relation to how subjective norms and attitudes influence actions (Alonso et al., 2015). Moreover, the unanimous concern about inappropriate dress, alongside issues like littering, noise, and public alcohol consumption, illustrates how even minor acts can collectively disrupt the social and cultural fabric of historic urban environments. These behaviours not only compromise the aesthetic and symbolic value of heritage sites but also strain the relationship between residents and the tourism industry. As suggested by McKercher and du Cros (2012), such disruptions contribute to a gradual erosion of place identity and local pride, reinforcing the need for municipalities to adopt more proactive, culturally informed policy interventions.

Public response and perceived social norms

Most respondents reported that local populations react negatively to such behaviour, often reporting violations to competent services. This confirms that subjective norms, community expectations about proper behaviour, are strongly present at the local level, and they influence how residents respond to perceived transgressions. The negative reaction from locals also reinforces the argument that sustainable tourism must consider host community perspectives as integral to policy design (Ruhanen, 2013).

Respondents noted that these community responses are not only expressions of frustration but also serve as informal mechanisms of social regulation, reflecting a strong local attachment to cultural values and shared public spaces. In several cases, this resident vigilance has spurred

neformalne mehanizme društvene regulacije, odražavajući snažnu lokalnu privrženost kulturnim vrijednostima i zajedničkim javnim prostorima. U nekoliko slučajeva upravo je budnost stanovnika potaknula jedinice lokalne samouprave na uvođenje ili izmjenu lokalnih propisa, poput pravila odijevanja u povijesnim jezgrama ili ograničenja konzumacije alkohola na javnim površinama, čime se pokazuje da javno raspoloženje može utjecati na formalne oblike upravljanja. Međutim, ispitanici su također naglasili da nedostatak dosljedne provedbe propisa i nedovoljna edukacija turista i dalje predstavljaju prepreke potpunom usklađivanju ponašanja posjetitelja s očekivanjima zajednice. Time se upućuje na potrebu za integriranim komunikacijskim strategijama koje ne samo da informiraju turiste, nego i osnažuju stanovnike kao aktivne dionike u upravljanju turizmom.

Prakse provedbe i učinkovitost politika

Odgovori iz intervjua upućuju na različite razine provedbe propisa među gradovima, čime se dobiva uvid u praktičnu primjenu komunalnih odluka i njihovih učinaka na ponašanje. U Zadru su ispitanici naglasili da su usmena upozorenja dominantna strategija i da takva upozorenja turisti uglavnom pozitivno prihvaćaju te da se formalne kazne ne provode. Takav pristup „blagog poticaja" (*soft nudge*) pridonosi podizanju svijesti bez posezanja za represivnim mjerama. Međutim, predstavnici Šibenika priznali su da je bez obzira na postojanje propisa njihova provedba slaba te su istaknuli potrebu za njihovom dosljednijom primjenom i višim novčanim kaznama kako bi se povećala učinkovitost.

Nasuprot tome, Split pokazuje sustavniji i strože provediv pristup, uz redovito sankcioniranje i vidljiva poboljšanja u ponašanju turista nakon izricanja kazni i donošenja gradskih odluka. Slično tome, iskustvo Dubrovnika ukazuje na ravnotežu između upozorenja i ciljano primijenjenih kazni. Ispitanici su naveli da iako je broj izrečenih kazni relativno ograničen, njihov simbolički i odvraćajući učinak dovodi do veće razine poštivanja pravila i osviještenosti među turistima. Ti rezultati odražavaju temeljna načela teorije poticaja (*Nudge Theory*) prema kojima promjene u okruženju donošenja

municipalities to implement or revise local regulations, such as dress codes in historic centres or restrictions on public drinking, demonstrating how public sentiment can shape formal governance. However, the officials also emphasized that a lack of consistent enforcement and insufficient tourist education remain barriers to fully aligning visitors' behaviour with community expectations. This highlights a need for integrated communication strategies that not only inform tourists but also empower residents as active stakeholders in tourism governance.

Enforcement practices and policy effectiveness

Interview responses indicate varied levels of enforcement across cities, shedding light on the practical application of communal orders and their behavioural effects. In Zadar, officials emphasized that verbal warnings are the dominant strategy, with no formal penalties applied, although these warnings are often well-received by tourists. This light-touch approach represents a soft nudge, creating awareness without resorting to punitive measures. However, Šibenik officials acknowledged that while regulations exist, their implementation is weak, and they called for more consistent enforcement and higher fines to improve effectiveness.

In contrast, Split demonstrates a more structured and enforced approach, with regular sanctioning and tangible improvements in tourist behaviour noted following the application of fines and municipal decisions. Similarly, Dubrovnik's experience highlights a balance between warnings and targeted penalties. Respondents noted that while the number of fines remains limited, their symbolic and deterrent effect has led to increased tourist compliance and awareness. These findings reflect the core principles of Nudge Theory, where changes to the choice environment, such as the visible presence of rules, signage, or enforcement officers—can lead to self-regulation and improved conduct (OECD, 2023).

Moreover, comparative insights suggest that enforcement practices are most effective when they are perceived as both legitimate and pre-

odluka, poput vidljive prisutnosti pravila, signalizacije ili službenih osoba zaduženih za provedbu, mogu potaknuti samoregulaciju i primjerenije ponašanje (OECD, 2023).

Nadalje, usporedni rezultati upućuju na to da su prakse provedbe najučinkovitije kada se percipiraju kao legitimne i predvidljive. Službenici u Splitu i Dubrovniku istaknuli su važnost vidljivosti gradske uprave i koordinacije ne samo u sankcioniranju neprimjerenog ponašanja, već i u stvaranju prepoznatljivog okvira koji potiče dobrovoljno pridržavanje pravila. Prisutnost višejezične signalizacije, informativnih kampanja na ulaznim točkama te uniformiranog osoblja u povijesnim zonama doprinosi oblikovanju društvenog okruženja u kojem se pristojno i odgovorno ponašanje podrazumijeva i dodatno potiče. Suprotno tome, gradovi s nedosljednom ili minimalnom provedbom propisa bilježe niže razine pridržavanja pravila i veće nezadovoljstvo lokalne zajednice, što potvrđuje da pasivna regulacija sama po sebi nije dostatna u uvjetima snažnog turističkog pritiska. Rezultati upućuju na zaključak da uspješna provedba politika ovisi o kombinaciji strateških poticaja, jasne komunikacije i responzivnog sustava provedbe koji je usklađen s očekivanjima lokalne zajednice i senzibilitetom turista.

Teorijski utemeljeni uvidi u provedbi propisa

Raznolikost u provedbi javnih politika ilustrira ključne koncepte ponašanja. U gradovima poput Splita i Dubrovnika, u kojima su pravila jasno komunicirana i dosljedno se provode, donositelji politika izvijestili su o pozitivnim promjenama u ponašanju turista, što upućuje na visoku razinu percipirane kontrole ponašanja. U sredinama u kojima je provedba nedosljedna, kao što su Šibenik i Zadar, utjecaj na ponašanje znatno je oslabljen. Te razlike naglašavaju da učinkovitost javnih politika ne ovisi isključivo o kvaliteti normativnog okvira, već i o načinu njegove provedbe i vidljivosti u praksi, što je u skladu s naglaskom OECD-a (2023) na dizajn javnih politika fokusiran na pojedinca.

Takva varijacija ujedno je u skladu s teorijom planiranog ponašanja (Ajzen, 1991), prema kojoj je ponašanje pojedinca oblikovano stavovima, subjektivnim normama i percipiranom kontrolom

dictable. Officials in Split and Dubrovnik stressed the importance of municipal visibility and coordination, not only in sanctioning misbehaviour but in creating a recognizable framework that encourages voluntary compliance. The presence of multilingual signage, information campaigns at entry points, and uniformed personnel in historic areas contribute to shaping a social environment where respectful behaviour is both expected and reinforced. Conversely, cities with inconsistent or minimal enforcement reported lower levels of compliance and greater community dissatisfaction, underlining that passive regulation alone is insufficient in contexts of high tourist pressure. Thus, the data suggests that successful policy implementation depends on a combination of strategic nudges, clear communication, and a responsive enforcement mechanism that aligns with both community expectations and tourist sensibilities.

Theory-driven insights on enforcement

The diversity in policy enforcement illustrates key behavioural concepts. In cities like Split and Dubrovnik, where rules are both clearly communicated and consistently enforced, policymakers reported positive behavioural change, indicating high perceived behavioural control among tourists. Where enforcement is inconsistent, as in Šibenik and Zadar, the intended influence on behaviour is diminished. These differences underscore how policy effectiveness is contingent not only on regulation design but also on its delivery and visibility, echoing the OECD's (2023) emphasis on human-centred public policy design.

This variation aligns with the Theory of Planned Behaviour (Ajzen, 1991), which posits that behaviour is shaped by attitudes, subjective norms, and perceived behavioural control. When tourists are aware of expectations or subjective norms, understand the consequences of their actions and attitudes, and believe they can comply due to clear rules, infrastructure and perceived behavioural control, they are more likely to engage in respectful conduct. In Split and Dubrovnik, structured enforcement com-

ponašanja. Kada su turisti upoznati s očekivanjima i subjektivnim normama, razumiju posljedice vlastitih postupaka i stavovima prema tim postupcima te vjeruju da se mogu pridržavati pravila zahvaljujući jasno definiranim propisima, odgovarajućoj infrastrukturi i visokoj razini percipirane kontrole ponašanja, veća je vjerojatnost da će se ponašati obzirno i u skladu s lokalnim standardima.

U Splitu i Dubrovniku čini se da strukturirana provedba, u kombinaciji s vidljivim signalima poput informativne signalizacije, prisutnosti službenog osoblja i medijskih kampanja, jača sve tri sastavnice navedene teorije, čime se olakšava usklađivanje ponašanja turista s lokalnim kulturnim normama. Suprotno tome, nedostatak jasnoće i nedosljednost u provedbi u Šibeniku i Zadru oslabljuju navedene mehanizme, omogućujući veće varijacije u ponašanju i češće nepridržavanje pravila. Ta teorijska perspektiva pridonosi razumijevaju odgovora na to zašto slični regulatorni okviri mogu dovesti do različitih ishoda, ovisno o tome na koji se način komuniciraju, kako se percipiraju i kako se provode u praksi.

TEORIJSKE I PRAKTIČNE IMPLIKACIJE

Unatoč razlikama u provođenju propisa, sva četiri grada prepoznaju važnost bihevioralnih intervencija, u rasponu od novčanih kazni do usmenih upozorenja i kampanja podizanja svijesti. Split i Dubrovnik, koji su pokazali dosljedniju i vidljiviju provedbu, izvijestili su o pozitivnijim promjenama u ponašanju turista. Te su se promjene očitovale putem primjene novčanih kazni i formalnih sankcija, ali i putem usmenih upozorenja, strateški postavljenom signalizacije te kampanja podizanja svijesti. Posebno je značajno da su upravo Split i Dubrovnik, zahvaljujući dosljednoj i vidljivoj provedbi, zabilježili izraženije pozitivne promjene u ponašanju posjetitelja. Taj nalaz u skladu je s tvrdnjom Li i Chena (2019) da jasna i dosljedna provedba propisa povećava učinkovitost politika usmjerenih na oblikovanje ponašanja turista. Suprotno tome, primjeri Zadra i Šibenika ukazuju na ograničenja bihevioralnog utjecaja u kontekstima u kojima izostaje institucionalna dosljednost ili

bined with visible cues like signage, personnel and media campaign, appears to strengthen all three components, facilitating behavioural alignment with local cultural standards. Conversely, the lack of clarity and follow-through in Šibenik and Zadar weakens these mechanisms, allowing for greater behavioural variance and non-compliance. This theoretical lens helps explain why similar regulatory frameworks can yield different outcomes depending on how they are communicated, perceived, and enacted on the ground.

THEORETICAL AND PRACTICAL IMPLICATIONS

Despite differences in enforcement, all four cities recognized the importance of behavioural interventions—ranging from fines to verbal warnings and awareness campaigns. Split and Dubrovnik, which demonstrated more consistent and visible enforcement, reported more positive behavioural changes among tourists. These ranged from fines and formal sanctions to verbal warnings, strategic signage, and awareness campaigns. Notably, Split and Dubrovnik, which demonstrated more consistent and visible enforcement, reported more positive changes in tourist behaviour. This finding aligns with Li and Chen's (2019) assertion that clear and consistent enforcement enhances the effectiveness of policy interventions designed to influence tourist behaviour. Conversely, Zadar and Šibenik illustrated the limitations of behavioural influence in contexts lacking institutional consistency or robust application of existing rules, reinforcing the significance of perceived behavioural control in the Theory of Planned Behaviour (Ajzen, 1991).

These results underscore the potential of behaviourally informed public policies to function not only as corrective measures but also as preventive mechanisms that protect cultural heritage, enhance the tourist experience, and strengthen social cohesion between tourists and local communities (Frey & George, 2010; Sofield et al., 2017). From the sustainability perspective, such policies are essential to balancing tourism devel-

snažna primjena postojećih pravila, čime se dodatno potvrđuje važnost percipirane kontrole ponašanja u okviru teorije planiranog ponašanja (Ajzen, 1991).

Ti rezultati naglašavaju potencijal javnih politika utemeljenih na spoznajama bihevioralnih znanosti da djeluju ne samo kao korektivne mjere, nego i kao preventivni mehanizmi za zaštitu kulturne baštine, unapređenje turističkog iskustva te jačanje društvene kohezije između turista i lokalnog stanovništva (Frey & George, 2010; Sofield i sur., 2017). Iz perspektive održivosti, takve su politike ključne za uspostavljanje ravnoteže između razvoja turizma te očuvanja kulturnog identiteta i dobrobiti lokalnog stanovništva (World Tourism Organization, 2019).

S teorijskog stajališta, ovo istraživanje ističe vrijednost integriranja teorije planiranog ponašanja (TPB) (Ajzen, 1991) i teorije poticaja (*Nudge Theory*) (Thaler & Sunstein, 2008) u razvoj turističkih politika usmjerenih na očuvanje kulturne baštine. TPB polazi od pretpostavke da je ponašanje oblikovano stavovima, subjektivnim normama i percipiranom kontrolom ponašanja. Rezultati dobiveni iz intervjua s lokalnim donositeljima odluka potvrđuju ovaj teorijski okvir: neprihvatljivo ponašanje turista, poput neprimjerenog odijevanja, bacanja otpada ili konzumacije alkohola u javnim prostorima, sustavno se povezivalo s niskom razinom informiranosti, slabom percepcijom lokalnih društvenih normi te minimalnom percepcijom posljedica vlastitih postupaka. Rezultati potvrđuju ranija istraživanja prema kojima su subjektivne norme i percipirana kontrola ponašanja ključne odrednice prosocijalnog i održivog turističkog ponašanja (Alonso i sur., 2015; Lam & Hsu, 2006).

Teorija poticaja također se pokazuje izrazito relevantnom u kontekstu nekonvencionalnih, nekaznenih bihevioralnih intervencija u upravljanju urbanim turizmom. Kao što je vidljivo u primjerima Splita i Dubrovnika, relativno male prilagodbe okruženja u kojem se donose odluke, poput usmenih upozorenja, strateški postavljene signalizacije, zoniranja prostora i vidljive prisutnosti službenika zaduženih za provedbu propisa, mogu značajno utjecati na ponašanje turista. Ti rezultati u skladu su s prijašnjim istraživanjima koja ističu važnost kontekstualnih signala i poruka temeljenih na društvenom razvoju uz očuvanje kulturnog identiteta i lokalne dobrobiti (World Tourism Organization, 2019).

From the theoretical standpoint, this study highlights the value of integrating the Theory of Planned Behaviour (TPB) (Ajzen, 1991) and Nudge Theory (Thaler & Sunstein, 2008) into the development of tourism policies aimed at preserving cultural heritage. TPB posits that behaviour is shaped by attitudes, subjective norms, and perceived behavioural control. Findings from the interviews with local policymakers support this framework: tourist misbehaviour, such as inappropriate dress, littering, and alcohol consumption in public spaces, was consistently attributed to low awareness, weak perception of local social norms, and minimal perceived consequences. These insights corroborate previous research indicating that subjective norms and perceived behavioural control are critical determinants of pro-social and sustainable tourist behaviour (Alonso et al., 2015; Lam & Hsu, 2006).

Nudge Theory also emerges as highly relevant in the context of non-coercive behavioural interventions for urban tourism management. As demonstrated in Split and Dubrovnik, relatively minor adjustments in the choice environments, such as verbal warnings, strategically placed signage, zoning regulations, and the visible presence of enforcement officers, can significantly influence tourist behaviour. These findings are consistent with prior studies emphasizing the role of contextual cues and social norm messaging in shaping behaviour without limiting freedom of choice (Buonincontri et al., 2017; Gutberlet, 2016; Kim et al., 2020). Moreover, such interventions align with the emerging concept of 'soft transformative governance,' which integrates behavioural tools with traditional regulation to achieve culturally and socially sustainable outcomes (Weaver et al., 2022).

Additionally, research on nudging suggests that combining behavioural prompts with emotional and culturally framed messaging can deepen tourists' sense of responsibility (Bicchieri & Dimant, 2022; Engelen et al., 2018). This study supports such approaches, highlighting the importance of framing behavioural guidelines in ways that

nim normama u oblikovanju ponašanja bez ograničavanja slobode izbora (Buonincontri i sur., 2017; Gutberlet, 2016; Kim i sur., 2020). Nadalje, takve intervencije podudaraju se s novijim konceptom „mekog transformacijskog upravljanja", koji integrira bihevioralne alate s tradicionalnim regulatornim instrumentima u svrhu postizanja kulturno i društveno održivih rezultata (Weaver i sur., 2022).

Dodatno, istraživanja o primjeni poticaja upućuju na to da kombiniranje bihevioralnih poticaja s emocionalno i kulturno uokvirenim porukama može produbiti osjećaj odgovornosti kod turista (Bicchieri & Dimant, 2022; Engelen i sur., 2018). Ovo istraživanje podupire takav pristup, naglašavajući važnost oblikovanja smjernica za ponašanje na način koji potiče poštovanje lokalne kulturne baštine.

Kad je riječ o praktičnoj primjeni, rezultati pokazuju nekoliko ključnih implikacija za upravljanje turizmom i zaštitu baštine u povijesnim urbanim destinacijama. Jedinice lokalne samouprave trebale bi razviti jasne i kulturno osjetljive smjernice ponašanja koje precizno definiraju očekivane standarde u javnim prostorima. Te smjernice trebale bi biti formalizirane lokalnim propisima te potkrijepljene višejezičnom signalizacijom, tiskanim i digitalnim materijalima te informativnim kampanjama prije dolaska turista na destinaciju (Marković Vukadin i sur., 2023; Pearce, 2019). Takve strategije mogu unaprijediti informiranost turista o lokalnim normama i smanjiti nenamjerne prijestupe u kontekstu kulture. Uspješne inicijative, poput dubrovačke kampanje „Respect the City", ilustriraju učinkovitost ciljane komunikacije usmjerene na ponašanje u podizanju razine svijesti i poticanju obzirnog ponašanja (Šegota, 2024). U skladu s rezultatima Wana i sur. (2021), edukacija turista o društvenim posljedicama njihovih postupaka u odnosu na očekivanja lokalnog stanovništva vezanim za kulturu, i time jačanje percipiranja društvenih normi, može pridonijeti smanjenju devijantnih ponašanja.

Nadalje, učinkovito oblikovanje politika trebalo bi uključivati suradnju s lokalnim zajednicama, turističkim dionicima i gradskim službama kako bi se osiguralo da propisi odražavaju lokalne vrijednosti i prioritete (Bleibleh & Awad, 2020; Kato, 2020). Takvi participativni pristupi povećavaju legitimnost politika, razinu pridržavanja pravila i evoke respect for local heritage.

On a practical level, the findings offer several key implications for tourism governance and heritage protection in historic urban destinations. Municipalities should develop clear, culturally sensitive behavioural guidelines that articulate expected standards in public spaces. These guidelines should be codified in local regulations and supported by multilingual signage, printed and digital materials, and pre-arrival information campaigns (Marković Vukadin et al., 2023; Pearce, 2019). Such strategies can improve tourists' awareness of local norms and reduce inadvertent cultural transgressions. Successful initiatives like Dubrovnik's 'Respect the City' campaign illustrate the effectiveness of targeted behavioural communication in raising awareness and promoting respectful conduct (Šegota, 2024). Consistent with Wan et al. (2021), educating tourists about the social consequences of their actions and local cultural expectations can reduce deviant behaviour by strengthening perceived social norms.

Furthermore, effective policy development should involve collaboration with local communities, tourism operators, and municipal services to ensure that regulations reflect local values and priorities (Bleibleh & Awad, 2020; Kato, 2020). Such participatory approaches enhance the legitimacy of policies, increase compliance, and strengthen community satisfaction. Finally, municipalities should invest in systematic monitoring and evaluation of behavioural outcomes, including the collection of data on infractions, tourist feedback, and policy effectiveness. This information should inform adaptive management strategies that respond to evolving conditions such as seasonal fluctuations, demographic shifts, or changes in visitor volume (Smallman & Ryan, 2020). Digital tools, including mobile apps, QR codes, and real-time communication platforms, offer promising opportunities for delivering tailored, context-specific behavioural guidance (Ni et al., 2025).

In sum, the integration of TPB and Nudge Theory into tourism governance offers a theoretically grounded and practically effective framework for balancing visitor satisfaction with the protection

zadovoljstvo zajednice. Konačno, jedinice lokalne samouprave trebale bi ulagati u sustavno praćenje i vrednovanje bihevioralnih ishoda, uključujući prikupljanje podataka o prekršajima, povratnim informacijama turista i učinkovitosti politika. Ti bi podaci trebali služiti kao temelj za prilagodljive upravljačke strategije u skladu s promjenjivim uvjetima, poput sezonskih oscilacija, demografskih promjena ili promjena u broju posjetitelja (Smallman & Ryan, 2020). Digitalni alati, uključujući mobilne aplikacije, QR kodove i platforme za komunikaciju u stvarnom vremenu, nude mogućnosti za pružanje prilagođenih i kontekstualno specifičnih smjernica ponašanja (Ni i sur., 2025).

Zaključno, integracija teorije planiranog ponašanja i teorije poticaja u upravljanje turizmom pruža teorijski utemeljen i praktično učinkovit okvir za uravnoteživanje zadovoljstva posjetitelja s očuvanjem lokalnog kulturnog i društvenog integriteta. Korištenjem spoznaja bihevioralnih znanosti u oblikovanju kontekstualno primjerenih i na pojedinca usmjerenih politika gradovi mogu unaprijediti održivost urbanog turizma i istodobno zaštititi svoju jedinstvenu kulturnu baštinu.

ZAKLJUČAK

Ovo se istraživanje bavilo ulogom bihevioralnih znanosti u oblikovanju ponašanja turista u povijesnim gradskim jezgrama u gradovima u Hrvatskoj, s posebnim naglaskom na lokalne politike kojima se regulira javno ponašanje, poput neprimjerenog odijevanja. Smješteno u širi kontekst izazova prekomjernog turizma i masovne turistifikacije, osobito izraženih u gradovima poput Dubrovnika, Splita, Zadra i Šibenika, istraživanje pokazuje na koji način mjere javne politike utemeljene na bihevioralnim spoznajama mogu pridonijeti zaštiti kulturne baštine i promicanju primjerenog, odnosno respektabilnog ponašanja turista. Izneseni zaključci integriraju nalaze tematskog kodiranja te odražavaju prostorne razlike među četiri grada, pri čemu se naglašavaju razlike u lokalnim upravljačkim kontekstima koji oblikuju i provedbu i učinkovitost bihevioralnih intervencija.

Lokalne javne politike u hrvatskim obalnim gradovima, poput Zadra, Šibenika, Splita i Dubrovof local cultural and social integrity. By leveraging behavioural science insights to design contextually appropriate and human-centred policies, cities can enhance the sustainability of urban tourism while safeguarding their unique cultural heritage.

CONCLUSION

This study explored the role of behavioural science in shaping tourist behaviour in Croatian historical city centres, specifically through the lens of local policies that regulate public conduct such as inappropriate clothing. Set within the broader challenges of overtourism and mass touristification, particularly evident in cities like Dubrovnik, Split, Zadar, and Šibenik, our research shows how policy measures informed by behavioural insights can contribute to protecting cultural heritage and promoting respectful tourist behaviour. The conclusions presented here integrate findings of the thematic coding and reflect the spatial variations across the four cities, highlighting how differences in local governance contexts shape both the implementation and effectiveness of behavioural interventions. Local policy measures in Croatian coastal cities such as Zadar, Šibenik, Split, and Dubrovnik regulate inappropriate tourist clothing in historic areas primarily through municipal ordinances that define minimum dress codes and impose penalties for non-compliance. These ordinances explicitly target culturally sensitive spaces, often UNESCO-protected heritage zones, by mandating that visitors wear appropriate attire, such as shirts, T-shirts, skirts, or shorts, and prohibit walking unclothed or in swimwear outside designated beach areas. Enforcement varies across cities: while Zadar relies largely on verbal warnings as soft nudges, Split and Dubrovnik combine clear geographic zoning, signage, and fines to reinforce expectations. This differentiation underscores that policy effectiveness depends not just on legal provisions but on the consistency and visibility of enforcement practices.

Qualitative data collected from interviews with key municipal stakeholders revealed consistent concerns about inappropriate tourist behaviour, with particular emphasis on dress code violations in culturally sensitive areas. Local authorities iden-

nika, neprimjereno turističko odijevanje u povijesnim jezgrama reguliraju ponajprije komunalnim odlukama kojima se propisuju minimalni standardi odijevanja i predviđaju sankcije za njihovo kršenje. Te su odluke izrijekom usmjerene na kulturno osjetljive prostore, često zone zaštićene u okviru UNESCO-ove svjetske baštine, te nalažu nošenje primjerene odjeće, poput majica, košulja, suknji ili kratkih hlača, dok se kretanje bez odjeće ili u kupaćim kostimima izvan područja plaža zabranjuje. Provedba tih propisa razlikuje se među gradovima. Dok se Zadar u velikoj mjeri oslanja na usmena upozorenja kao oblik „blagog poticaja", Split i Dubrovnik kombiniraju jasno definirano prostorno zoniranje, informativnu signalizaciju i novčane kazne kako bi dodatno osigurali očekivane obrasce ponašanja. Takve razlike upućuju na zaključak da učinkovitost javnih politika ne ovisi isključivo o pravnim odredbama, nego i o dosljednosti te vidljivosti provedbenih praksi.

Kvalitativni podaci prikupljeni intervjuima s ključnim dionicima na razini gradskih uprava ukazali su na zabrinutost zbog neprimjerenog ponašanja turista, pri čemu se osobito ističu povrede pravila odijevanja u prostorima kulturne baštine. Lokalna tijela takve oblike ponašanja prepoznaju kao ozbiljnu prijetnju dostojanstvu javnih prostora i uspostavljenim kulturnim normama, čime se dodatno potvrđuje važnost očuvanja bihevioralnih standarda u okruženjima bogatim kulturnom baštinom. U tom kontekstu, pristupi utemeljeni na bihevioralnim znanostima, osobito spoznaje teorije planiranog ponašanja i teorije poticanja (*nudge theory*), mogu znatno unaprijediti postojeće lokalne politike. Polazeći od pretpostavke da je ponašanje turista oblikovano stavovima, subjektivnim normama i percipiranom kontrolom ponašanja, donositelji odluka mogu osmisliti intervencije koje jasnije komuniciraju društvena očekivanja i jačaju razinu pridržavanja pravila. Primjerice, strateška uporaba višejezične signalizacije, prostorno zoniranje koje jasno označava prihvatljive obrasce ponašanja te prisutnost i vidljivost službenih osoba u javnom prostoru mogu djelovati kao arhitektura izbora koja „potiče" turiste prema obzirnom i odgovornom ponašanju, bez primjene prisilnih mjera. Dodatno, komunikacijske kampanje, poput dubrovačke inicijative „Respect the City", mogu

tified such conduct as a significant threat to the dignity of public spaces and cultural norms, confirming the importance of preserving behavioural standards in heritage-rich environments. Therefore, behavioural science approaches, especially insights from the theory of planned behaviour and nudge theory, can significantly enhance these local policy efforts. By understanding that tourist conduct is shaped by attitudes, subjective norms, and perceived behavioural control, policymakers can design interventions that clarify social expectations and strengthen compliance. For example, strategic use of multilingual signage, zoning that signals appropriate behaviour, and visible enforcement officers can serve as choice architecture that 'nudges' tourists toward respectful conduct without resorting to coercion. Additionally, communication campaigns, like Dubrovnik's 'Respect the City' initiative—help raise cultural awareness before and during visits, shifting attitudes and subjective norms in favour of respectful behaviour.

Ultimately, integrating behavioural science into urban tourism governance enables cities to balance visitor freedom with the preservation of cultural dignity. By combining clear rules with culturally sensitive communication and consistent enforcement, local authorities can foster shared responsibility for safeguarding historic urban spaces while maintaining a positive, sustainable tourism experience for both visitors and residents.

This study offers a foundation for understanding the application of behavioural science in regulating tourist behaviour within culturally sensitive urban spaces. However, several avenues remain open for further scholarly exploration that could deepen both theoretical insights and practical outcomes. One promising direction involves investigating the long-term effects of behavioural interventions. While the current study captures policy impacts during a specific time frame, longitudinal research is necessary to evaluate whether observed behavioural changes among tourists are sustained over multiple seasons or fade once the novelty or visibility of enforcement diminishes. Such research would also help determine the durability of nudging strategies in complex and dynamic tourism environments. Another critical area involves examining how tourists from diverse cultural backgrounds interpret and respond

pridonijeti podizanju kulturne osviještenosti prije i tijekom boravka, mijenjajući stavove i subjektivne norme u smjeru poštivanja lokalnih vrijednosti.

U konačnici, integracija bihevioralnih znanosti u sustav upravljanja urbanim turizmom omogućuje gradovima uspostavu ravnoteže između slobode kretanja i ponašanja posjetitelja te očuvanja kulturnog dostojanstva prostora. Kombinacijom jasnih pravila, kulturološki osjetljive komunikacije i dosljedne provedbe, lokalne vlasti mogu poticati osjećaj zajedničke odgovornosti za zaštitu povijesnih urbanih prostora, istodobno osiguravajući pozitivno i održivo turističko iskustvo za posjetitelje i stanovnike.

Ovo istraživanje pruža polazište za razumijevanje primjene bihevioralnih znanosti u regulaciji ponašanja turista u kulturno osjetljivim urbanim prostorima. Međutim, ostaje otvoren niz istraživačkih područja koji mogu dodatno produbiti teorijske spoznaje i unaprijediti praktične učinke javnih politika. Jedan od važnih smjerova budućih istraživanja odnosi se na ispitivanje dugoročnih učinaka bihevioralnih intervencija. Dok se ovo istraživanje usredotočuje na učinke politika u određenom razdoblju, longitudinalna istraživanja nužna su kako bi se utvrdilo održavaju li se uočene promjene u ponašanju.

Drugo važno područje odnosi se na ispitivanje načina na koji turisti iz različitih kulturnih sredina razumijevaju i prihvaćaju očekivanja lokalne zajednice vezana za ponašanje. S obzirom na to da se norme skromnosti, razine buke i javnog ponašanja znatno razlikuju među društvima, buduća istraživanja mogla bi analizirati kako te razlike utječu na spremnost turista da prihvate lokalne propise i intervencije. Usporedne analize među kulturama mogle bi pružiti vrijedne smjernice za prilagodbu poticajnih mjera i komunikacijskih poruka uzimajući u obzir sociokulturna obilježja različitih skupina posjetitelja.

Uz razumijevanje ponašanja turista, potrebno je posvetiti veću pozornost i stavovima lokalnog stanovništva. Način na koji lokalne zajednice percipiraju turističke politike kao pravedne, legitimne i učinkovite ima ključnu ulogu u njihovoj uspješnosti. Kvalitativna i kvantitativna istraživanja usmjerena na stavove stanovnika mogu pridonijeti boljem razumijevanju pragova tolerancije, očekivanja u to local behavioural expectations. Given that norms around modesty, noise, and public conduct vary significantly across societies, future studies could explore how these differences influence tourists' receptiveness to local regulations and interventions. Cross-cultural analyses would provide valuable insights into the customization of nudges and policy messaging based on the socio-cultural profiles of visitor populations.

In addition to understanding tourist behaviour, more attention should be paid to the perspectives of residents. The extent to which local communities perceive tourism policies as fair, legitimate, and effective plays a crucial role in the success of such policies. Qualitative and quantitative research focused on resident attitudes can shed light on their tolerance thresholds, expectations for tourist conduct, and willingness to participate in governance processes, thereby strengthening the alignment between tourism policy and community well-being. While this study focused on the regulation of dress codes, future research should extend its scope to other prevalent forms of tourist misconduct, such as noise pollution, littering, public intoxication, and disrespect for religious or historical sites. Investigating the behavioural mechanisms behind these actions, as well as the effectiveness of both punitive and non-punitive interventions, can broaden the toolkit available to urban policymakers and tourism managers.

Finally, these future research directions hold the potential to advance a more nuanced and practical understanding of how behavioural science can inform sustainable tourism governance. As global travel continues to expand, the integration of context-sensitive, evidence-based, and culturally respectful behavioural policies will become increasingly vital to preserving the integrity of host communities while enhancing the quality of the tourist experience.

Author Contributions:

I.M.V.: literature review, conceptualization, methodology, visualization, writing – original draft preparation, writing – final version

S.B.Ž.: literature review, conceptualization, writing – original draft preparation, writing – final version,

pogledu ponašanja turista te spremnosti stanovnika na sudjelovanje u procesima upravljanja, čime se dodatno jača usklađenost turističkih politika s dobrobiti zajednice. S obzirom na to da se ovo istraživanje usredotočilo na regulaciju odijevanja, buduća bi istraživanja trebala proširiti fokus i na druge česte oblike neprimjerenog ponašanja turista, poput prekomjerne buke, bacanja otpada, javne opijenosti te nepoštivanja vjerskih ili povijesnih lokaliteta. Analiza bihevioralnih mehanizama koji stoje u podlozi takvih ponašanja, kao i učinkovitosti kaznenih i nekaznenih intervencija, može proširiti skup alata dostupnih donositeljima odluka u jedinicama lokalnih samouprava i turističkim zajednicama.

Naposljetku, navedeni smjerovi budućih istraživanja imaju potencijal pridonijeti razvoju razrađenijeg i operativno primjenjivog razumijevanja načina na koji bihevioralne znanosti mogu informirati održivo upravljanje turizmom. U uvjetima kontinuiranog rasta globalnih turističkih kretanja, integracija kontekstualno osjetljivih, empirijski utemeljenih i kulturološki uvažavajućih bihevioralnih politika postajat će sve važnija za očuvanje integriteta lokalnih zajednica, ali i za unaprjeđenje kvalitete turističkog iskustva.

Doprinos autora: I.M.V.: pregled literature, konceptualizacija, metodologija, vizualizacija, pisanje – izrada izvornog rukopisa, pisanje – konačna verzija; S.B.Ž.: pregled literature, konceptualizacija, pisanje – izrada izvornog rukopisa, pisanje – konačna verzija; N.M.: istraživanje, priprema intervjua, pisanje – izrada izvornog rukopisa

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SAMOSTALNA PUTOVANJA ŽENA – ISKUSTVA I PROSTORNE PRAKSE PUTNICA

SOLO FEMALE TRAVEL – EXPERIENCES AND SPATIAL PRACTICES OF FEMALE TRAVELLERS

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Cilj ovoga rada je razmotriti ključne aspekte samostalnog putovanja žena koji se ističu u dosadašnjim znanstvenim istraživanjima s posebnim naglaskom na motivaciju samostalnih putnica, odnos roda i prostora, ograničenja i pitanje sigurnosti te strategije nošenja s rizicima. U analizi je korištena relevantna strana znanstvena literatura iz područja turizma, rodnih studija i feminističke geografije. Iako je motivacija za samostalno putovanje često povezana s osobnim razvojem, osnaživanjem i željom za upoznavanjem novih prostora, putnice se suočavaju s mnogobrojnim prostornim i društvenim ograničenjima. Kao odgovor na te izazove, razvijaju različite strategije prilagodbe kojima se nastoje oduprijeti strahu i rodnim stereotipima. Uočen je nedostatak istraživanja usmjerenih na analizu percepcije turističkih destinacija kao poželjnih i sigurnih ili nepoželjnih i nesigurnih za samostalne putnice te na identifikaciju ključnih čimbenika koji oblikuju te percepcije. Za dublje razumijevanje ovoga fenomena važno je uključiti sociodemografske podatke i prostorni kontekst čime se otvara prostor za daljnja istraživanja iz geografskih perspektiva. Buduća istraživanja mogu pridonijeti oblikovanju turističke ponude koja više odgovara potrebama i sigurnosti samostalnih putnica.
Ključne riječi: samostalna putovanja žena, pregled literature, rod, prostorna ograničenja, strategije prilagodbe

The aim of this paper is to examine the key aspects of solo female travel highlighted in previous scientific research, with a particular focus on the motivations of solo female travellers, the relationship between gender and space, limitations and safety concerns, and strategies for mitigating risks. The analysis draws on relevant academic literature from the fields of tourism, gender studies, and feminist geography. Although motivations for solo travel are often linked to personal development, empowerment, and the desire to explore new places, female travellers face numerous spatial and social constraints. In response to these challenges, they develop various coping strategies aimed at resisting fear and gender stereotypes. However, there is a noticeable lack of research focused on analysing the perception of tourist destinations as either desirable and safe or undesirable and unsafe for solo female travellers, as well as on identifying the key factors that shape these perceptions. For a deeper understanding of this phenomenon, it is important to include sociodemographic data, along with the spatial context, which opens up opportunities for further research from geographical perspectives. Future studies may contribute to shaping a tourism offer that better meets the needs and ensures the safety of solo female travellers.
Keywords: solo female travel, literature review, gender, spatial constraints, adaptation strategies

UVOD

Samostalni putnici sve su važniji segment turističkog tržišta, a posebno je uočljiv trend porasta samostalnih putovanja žena (Ghadban i sur., 2023; Yang i sur., 2019). Bolje mogućnosti stjecanja obrazovanja i prilika za zaradu, višak slobodnog vremena i raspoloživih prihoda, zajedno s promicanjem globalnih putovanja i rastom individualizma, utječu na porast broja žena u turističkoj industriji (Bryson, 1994; Wilson & Little, 2005). Povećanje broja putnica posljednjih nekoliko desetljeća može se pripisati i povećanju dobi sklapanja braka i majčinstva, smanjenju stope nataliteta te više razvoda braka (Junek i sur., 2006; Laesser i sur., 2009). Te demografske i društvene promjene otvorile su nove mogućnosti za slobodno vrijeme i putovanja žena (Kim & Beck, 2009).

Sedamdesetih godina prošlog stoljeća počelo se značajnije pisati o pojmu selektivnih oblika turizma koji, među ostalim, podrazumijevaju traženje „autentičnijeg" i netradicionalnog odmora turista, a istovremeno i smanjenje popularnosti putovanja u okviru paket-aranžmana i povećanje broja individualnih putovanja (Cockburn-Wootten i sur., 2006; Ejupi & Medaric, 2022; Rabotić, 2013). U suvremenom, globaliziranom turističkom svijetu turisti se opisuju kao individualisti, fleksibilni, spontani, nepredvidljivi i ekološki osviješteni (Wilson & Harris, 2006). Samostalni putnici uglavnom očekuju opušteno, riskantno i avanturističko iskustvo (Mani & Jose, 2020), a podaci pokazuju da je među njima više žena. Tako podaci agencije Road Scholar[1] pokazuju da do 30 % sudionika njihovih tura putuje samostalno, a čak 85 % samostalnih putnika čine žene, dok prema podacima Condor Ferriesa[2] žene nadmašuju muškarce u samostalnim putovanjima u omjeru 67 % prema 37 % (Condor

[1] Road Scholar je američka neprofitna organizacija sa sjedištem u Bostonu (Massachusetts) specijalizirana za obrazovne putne programe namijenjene prije svega starijim osobama. Organizacija nudi razne oblike putovanja, uključujući solo putovanja, avanture namijenjene samo ženama, obiteljska putovanja za bake i djedove i drugo.

[2] Condor Ferries bio je operater putničkih i teretnih trajektnih usluga između Ujedinjenog Kraljevstva, Guernseyja, Jerseya i Francuske. Od ožujka 2025. godine operacije koje su se odnosile isključivo na Guernsey preuzeo je Brittany Ferries. Operater je svake godine prikupljao statistička izvješća o samostalnim putovanjima žena te ih objedinjavao u jedinstveni godišnje izvješće.

INTRODUCTION

Solo travellers have become an increasingly important segment of the tourism market in recent times, with a particularly noticeable rise in the number of women travelling alone (Ghadban et al., 2023; Yang et al., 2019). Improved access to education and income opportunities, more free time and disposable income, along with the promotion of global travel and the rise of individualism, influenced the growing presence of women in the tourism industry (Bryson, 1994; Wilson & Little, 2005). The increase in female travellers over the past few decades can also be attributed to rising marriage and motherhood age, declining birth rates, and more frequent divorces (Junek et al., 2006; Laesser et al., 2009). These demographic and social changes opened up new possibilities for women's leisure and travel (Kim & Beck, 2009).

In the 1970s, the concept of selective forms of tourism gained significance, including the search for more "authentic" and non-traditional travel experiences. This shift led to a decline in package tours and a rise in the number individual travel (Cockburn-Wootten et al., 2006; Ejupi & Medaric, 2022; Rabotić, 2013). In the contemporary globalized tourism market, tourists are described as individualistic, flexible, spontaneous, unpredictable, and environmentally conscious (Wilson & Harris, 2006). Solo travellers often seek a more relaxed, risky, and adventurous experience (Mani & Jose, 2020), and data suggest that women today travel alone more frequently than men. According to Road Scholar[1], up to 30% of their tour participants travel solo, with women making up 85% of this group (Road Scholar, 2024). Similarly, Condor Ferries[2] reports that women outnumber men in solo travel at a ratio of 67% to 37% (Condor

[1] Road Scholar is a U.S. based nonprofit organization headquartered in Boston, Massachusetts, that specializes in educational travel programs primarily designed for older adults. The organization offers a variety of travel experiences, including solo trips, women-only adventures, grandparent-grandchild family trips, and more.

[2] Condor Ferries was a provider of passenger and freight ferry services between the United Kingdom, Guernsey, Jersey, and France. As of March 2025, operations specifically related to Guernsey were taken over by Brittany Ferries. The operator collected annual statistical reports on solo female travel and compiled them into a comprehensive yearly report.

Ferries, 2025; Road Scholar, 2024). Također, 73 % turističkih agenata navodi da žene češće od muškaraca putuju samostalno (Condor Ferries, 2025).

Prema Gibson i suradnici (2013), turizam je socio-kulturni fenomen u smislu da je iskustvo putnika oblikovano različitim kulturnim čimbenicima, od kojih je spol jedan od najvažnijih. Naime, dugo je spol uvelike definirao mogućnosti za odlazak na samostalno putovanje. Žene putnice bile su, i u određenoj mjeri još uvijek jesu, ograničene ulogama supruga, majki i njegovateljica (Chiang & Jogaratnam, 2006). No, samostalna putovanja pružaju ženama fizički i mentalni prostor za otpor stereotipima o rodnim ulogama i rekonstrukciju vlastitog identiteta (Otegui-Carles i sur., 2022).

Ženska samostalna putovanja definiraju se kao putovanja u kojima žene same stižu na odredište, odnosno ne putuju u sklopu paket-aranžmana, grupe ili ture (McNamara & Prideaux, 2010). U nekim se definicijama ističe samovoljni izostanak društva (bez obitelji, partnera ili prijatelja) (Mani & Jose, 2020) ili nemogućnost pronalaska društva za zajedničko putovanje (Yang, 2020). Samostalne putnice takav način putovanja odabiru zbog različitih razloga i motivacije, a karakteristično za te definicije je: samostalno planiranje putovanja, samostalni odlazak na putovanje i provođenje vremena na putovanju samostalno (u potpunosti ili u nekom dijelu) (McNamara & Prideaux, 2010; Mani & Jose, 2020; Yang, 2020).

Rastući trend samostalnih putovanja žena potaknuo je niz istraživanja o tome kasnih 1990-ih. Većina znanstvenih istraživanja bavi se iskustvima putnica iz razvijenih zemalja, posebice iz SAD-a, Ujedinjenog Kraljevstva, Australije i Novog Zelanda (Jordan & Aitchison, 2008; Jordan & Gibson, 2005; Thomas & Mura, 2019; Weatherby & Vidon, 2018; Wilson & Harris, 2006; Wilson & Little, 2008), a u novije vrijeme sve više istraživanja obuhvaća žene iz Azije (Nguyen & Hsu, 2022; Osman i sur, 2020; Seow & Brown, 2020; Teng i sur., 2023; Yang i sur., 2018a; Yang i sur., 2018b) te posebno iz muslimanskih država (Iran, Turska, Saudijska Arabija) (Hosseini i sur., 2021; Nikjoo i sur., 2021; Nikjoo i sur., 2023; Seyfi i sur., 2020; Siddiqui & Bano, 2023).

U kontekstu feminističke geografije, samostalna putovanja žena ponajviše istražuju Wilson i Little

Ferries, 2025). Additionally, 73% of travel agents state that women are more likely to travel solo than men (Condor Ferries, 2025).

Gibson et al. (2013) noted that tourism is a socio-cultural phenomenon, meaning that travellers' experiences are shaped by various cultural factors, with gender being one of the most significant. For a long time, gender largely defined the ability to embark on solo journeys. Female travellers were, and to some extents still are, constrained by roles as wives, mothers, and caregivers (Chiang & Jogaratnam, 2006). However, solo travel provides women with physical and mental space to resist gender role stereotypes and reconstruct their identity (Otegui-Carles et al., 2022).

Women's solo travel is defined as travel where women arrive at a destination alone, without being part of a package tour, group, or guided trip (McNamara & Prideaux, 2010). Some definitions emphasize the voluntary absence of company (without family, partners, or friends) (Mani & Jose, 2020) or the inability to find travel companions (Yang, 2020). Female solo travellers choose this type of travel for various reasons and motivations, but all definitions share key aspects: independent travel planning, travelling alone, and spending time solo (entirely or partially) during the journey (McNamara & Prideaux, 2010; Mani & Jose, 2020; Yang, 2020).

The increasing trend of women's solo travel has spurred numerous studies on the topic since the late 1990s. Most of these scientific studies have focused on travellers from developed countries, particularly the United States, the United Kingdom, Australia, and New Zealand (Jordan & Aitchison, 2008; Jordan & Gibson, 2005; Thomas & Mura, 2019; Weatherby & Vidon, 2018; Wilson & Harris, 2006; Wilson & Little, 2008). However, in recent years, there has been a rise in research covering women from Asia (Nguyen & Hsu, 2022; Osman et al., 2020; Seow & Brown, 2020; Teng et al., 2023; Yang et al., 2018a; Yang et al., 2018b) and particularly from Muslim countries (Iran, Turkey, Saudi Arabia) (Hosseini et al., 2021; Nikjoo et al., 2021; Nikjoo et al., 2023; Seyfi et al., 2020; Siddiqui & Bano, 2023).

From the perspective of feminist geography, solo female travel has been primarily explored by

(2005; 2008) te Yang i suradnici (2018a; 2019). Wilson i Little (2005; 2008) analiziraju kako samostalne putnice doživljavaju „geografiju straha" u javnim prostorima koji su često percipirani kao nesigurni za žene te istražuju ograničenja s kojima se putnice suočavaju, uključujući brigu o sigurnosti, društvene percepcije i rodne norme. Yang i suradnici (2018a; 2019) perspektivom feminističke geografije pokazuju da kombinacija roda, kulture, klase i drugih društvenih čimbenika utječe na to kako azijske samostalne putnice oblikuju svoj identitet i snalaze se u rodno obilježenim prostorima i percipiranim rizicima. Benjamin i Schwab (2023) u feminističkom okviru uspoređuju vlastita iskustva samostalnog putovanja unutar sustava prilagođenog za muškarce. S druge strane, neki autori poput Heimtun i Abelsen (2013) tek usput spominju teorijske aspekte feminističke geografije, dok primarno ispituju koje su vrste samostalnih putovanja poželjnije među spolovima.

Premda je tema samostalnih putovanja žena sve prisutnija u inozemnim istraživanjima, u Hrvatskoj je i dalje vidljiv značajan nedostatak znanstvenih radova o tome. Naime, ne postoje znanstveni radovi, disertacije i knjige na hrvatskom jeziku koji bi se sustavno bavili tom temom. U medijskom prostoru može se pak pronaći velik broj članaka i priloga (prema Google pretraživanju i više od 50 000) koji se bave temama poput preporuka destinacija pogodnih za samostalne putnice, savjetima za sigurno putovanje, putopisima i ponudama putničkih agencija specijaliziranih za tzv. girls only putovanja. Međutim, domaća akademska istraživanja iz područja geografije ili rodnih studija koja bi se fokusirala na tu problematiku zasad izostaju.

Cilj ovoga rada je razmotriti aspekte samostalnog putovanja žena koji se u dosadašnjoj znanstvenoj literaturi izdvajaju kao ključni. Na temelju pregleda relevantne literature u ovom se radu posebno obrađuju četiri teme: 1. motivacije samostalnih putnica, 2. odnos roda i prostora, 3. ograničenja i percepcija sigurnosti na putovanju te 4. strategije nošenja s rizicima na samostalnom putovanju, koje su usko povezane s percepcijom sigurnih prostora i mjesta. Ova tema do sada je većinom obrađena iz perspektive turizma, rodnih studija i feminističke geografije. U analizi je korištena relevantna znanstvena literatura iz navedenih područja te se

Wilson and Little (2005, 2008) and Yang et al. (2018a, 2019). Wilson and Little (2005, 2008) analyse how solo female travellers experience the "geography of fear" in public spaces, which are often perceived as unsafe for women, and examine the constraints female travellers face, including safety concerns, societal perceptions, and gender norms. Yang et al. (2018a, 2019), using feminist geographic perspectives, demonstrated how the intersection of gender, culture, class, and other social factors shapes the ways in which Asian solo female travellers construct their identities and navigate gendered spaces and perceived risks. Benjamin and Schwab (2023), through a feminist lens, compare their own solo travel experiences within systems designed primarily for men. Conversely, some authors, such as Heimtun and Abelsen (2013), only briefly reference the theoretical aspects of feminist geography, focusing primarily on which types of solo travel are more desirable among different genders.

Although the topic of solo female travel is increasingly addressed in international research, there remains a significant lack of scientific work on this subject in Croatia. Specifically, there are no scientific articles, dissertations, or books in the Croatian language that systematically address this topic. In the media space, a large number of articles and features can be found (according to a Google search, more than 50,000) dealing with topics such as recommendations of destinations suitable for solo female travellers, safety travel tips, travelogues, and offers from travel agencies specialized in so-called "women only" trips. However, academic research in the fields of geography or gender studies focusing on this issue is still lacking in Croatia.

The aim of this paper is to examine the key aspects of solo female travel highlighted in previous scholarly literature. Based on a review of relevant sources, this paper specifically addresses four topics: 1) the motivations of solo female travelers; 2) the relationship between gender and space 3) travel constraints and perceptions of safety, and 4) risk management strategies during solo travel, which are closely tied to the perception of safe spaces and places. This topic has mostly been explored from the perspectives of tourism, gender studies, and

zaključci rada temelje na tom skupu materijala. U manjoj mjeri proučeni su i pojedini stručni izvori i literatura (npr. turistički vodiči namijenjeni samostalnim putnicama).

POVIJESNI OSVRT NA SAMOSTALNA PUTOVANJA ŽENA

Žene su tijekom povijesti bile uvelike ograničene u planiranju i odlasku na samostalno putovanje. Najranije poznate putnice bile su hodočasnice koje su putovale u Jeruzalem i Svetu zemlju. Primjerice, postoje zapisi da je Helena hodočastila u Svetu zemlju 327. godine, dok se prvi dokumentirani ženski putopis pripisuje opatici Egeriji, rimskoj građanki koja je samostalno putovala 383. godine (Wilson & Harris, 2006). Iako su 16. i 17. stoljeće bili razdoblje istraživanja svijeta, putovanja i kolonijalnih osvajanja, ta su područja tada bila smatrana isključivo muškom sferom. Unatoč tome, neke su žene i u tom razdoblju putovale i istraživale samostalno, a nastavile su to činiti i u 18. i 19. stoljeću (Wilson & Little, 2005). To su uglavnom bile dobro obrazovane i imućne žene, no unatoč njihovu društvenom statusu, takva su putovanja smatrana neprimjerenima, posebno za ugledne dame (Jordan & Gibson, 2005). Ipak, krajem 19. stoljeća društvene i političke promjene omogućile su ženama više suvremenih putovanja. U usporedbi s prethodnim generacijama, društvene konvencije koje su se odnosile na uloge i ponašanja žena značajno su se promijenile u većem dijelu zapadnog svijeta (Wilson & Little, 2005). Posebno velike strukturne promjene u razdoblju nakon Drugoga svjetskog rata dovele su do povoljnijih društvenih okolnosti za žene (Yang i sur., 2020).

Suvremeno tržište ženskih putovanja počelo se intenzivnije razvijati na zapadu 1970-ih (Frohlick, 2013). Primjerice, u SAD-u žene su već u 1970-ima, iako s nižim primanjima i većom stopom nezaposlenosti u odnosu na muškarce, imale veći udio u međunarodnim putovanjima (52 %) od muškaraca (48 %) (Zrnc, 1974). Žene s boljim obrazovanjem i većim prihodima pokazale su veću sklonost putovanju te je broj žena koje su putovale u inozemstvo nadmašivao broj muškaraca u svim dobnim skupinama, osim u dobi

feminist geography. The analysis draws on relevant academic literature from these fields, and the conclusions of the paper are based on that set of materials. To a lesser extent, certain professional sources and literature were also studied (e.g., tourist guides for solo female travellers).

HISTORICAL OVERVIEW OF WOMEN'S SOLO TRAVEL

Women have historically been largely restricted in planning and embarking on solo travel. The earliest known female travellers were pilgrims who journeyed to Jerusalem and the Holy Land. For instance, records indicate that Helena made a pilgrimage to the Holy Land in 327 AD, while the first documented female travelogue is attributed to the nun Egeria, a Roman citizen who travelled alone in 383 AD (Wilson & Harris, 2006). Although the 16th and 17th centuries were marked by global exploration, travel, and colonial conquests, these activities were predominantly considered male domains. Despite this, some women also travelled and made explorations independently during this period and continued to do so in the 18th and 19th centuries (Wilson & Little, 2005). These travellers were mainly well-educated and wealthy women. However, despite their social status, such journeys were deemed inappropriate, particularly for distinguished ladies (Jordan & Gibson, 2005). Nevertheless, from the late 19th century onward, social and political changes enabled greater participation of women in modern travel. Compared to previous generations, social conventions regarding women's roles and behaviours significantly changed in much of the Western world (Wilson & Little, 2005). Particularly massive social transformations took place after the World War II, and resulted in structural conditions for women (Yang et al., 2020).

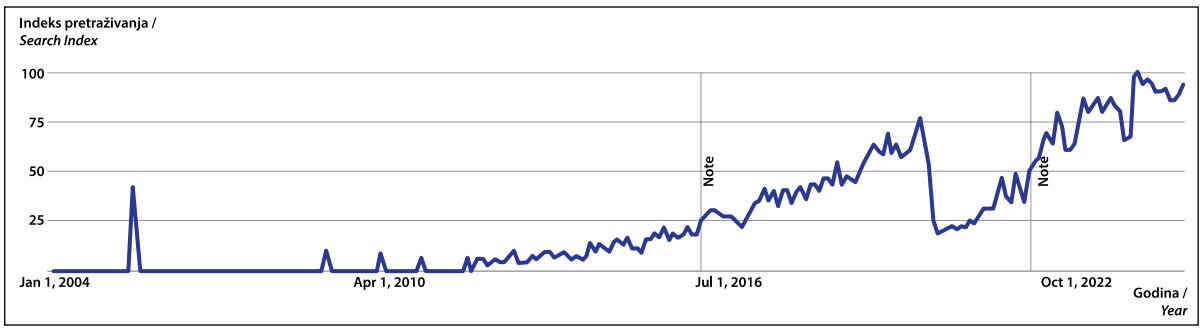
The contemporary female travel market therefore began to emerge primarily in the West in the 1970s (Frohlick, 2013). Despite lower incomes and higher unemployment rates compared to men, U.S. women in the 1970s already had a higher share of international travel (52%) than men (48%) (Zrnc, 1974). Women with higher education and

od 25 do 34 godine, vjerojatno zbog toga što su žene u toj dobnoj skupini često bile posvećene brizi za djecu i domaćinstvo (Zrnc, 1974). Udio žena u toj tržišnoj niši nastavio je rasti 1980-ih i 1990-ih šireći se i na azijske države, ponajprije na Japan i Kinu, a od 21. stoljeća i na Aziju općenito (Yang i sur., 2017). Recentna istraživanja pokazuju da žene danas predstavljaju polovicu suvremenoga turističkog tržišta s projekcijom da će njihov udio još više rasti, posebno na području Azije gdje se očekuje porast putovanja žena od 400 % do 2030. (Su & Wu, 2020; Yang i sur., 2017). Collins i Tisdell (2002) ističu da na potražnju za samostalnim putovanjima utječu brojni demografski i socioekonomski čimbenici poput etničkog identiteta, nacionalnosti, dobi, veličine obitelji, spola, bračnog statusa, religije, prihoda, zanimanja i obrazovanja.

S pomoću Google Trendsa može se vidjeti kretanje broja pretraživanja pojma solo female travel (hrv. samostalno žensko putovanje) u 21. stoljeću. Google Trends alat analizira koliko je puta na internetskoj tražilici Google pretraživan navedeni pojam u određenom zadanom razdoblju (u ovom slučaju analizirana su sva pretraživanja pojma u tražilici od 2004. do 2024. godine). Interes za pojam pokazuje dugoročni rast, s minimalnim zanimanjem do 2010. kada počinje snažan rast, vjerojatno potaknut društvenim mrežama i osnaživanjem žena (Sl. 1.). U 2017. godini Google pretraživanja za ovaj pojam porasla su za 52 % u usporedbi s prethodnom godinom, a tijekom četiri godine prije početka pandemije COVID-19 pretraživanje se povećalo šest puta. Pandemija COVID-19 uzroko-

income levels demonstrated a greater tendency to travel, with the number of women travelling abroad surpassing men in all age groups except 25 - 34, likely due to family obligations (Zrnc, 1974). The share of women in this market niche continued to grow in the 1980s and 1990s, spreading to Asian countries, especially Japan and China, and from the 21st century onwards to Asia in general (Yang et al., 2017). Recent research shows that women represent half of the contemporary travel market, and it is projected that their participation in tourism will continue to grow, and this growth will be especially remarkable in the Asia, with an estimation of a 400% increment by 2030 (Su & Wu, 2020; Yang et al., 2017). Collins and Tisdell (2002) emphasized that the demand for solo travel is influenced by numerous demographic and socioeconomic factors such as ethnic identity, nationality, age, family size, gender, marital status, religion, income, occupation, and education.

Using Google Trends, it is possible to observe the trend in the number of searches for the term "solo female travel" in the 21st century. The Google Trends tool analyses how many times a given term was searched on the Google search engine within a specified time period (in this case, all searches for the term on the search engine from 2004 to 2024 were analysed). Interest in the term shows long-term growth, with minimal attention until 2010, when a sharp increase began, likely driven by social media and women's empowerment (Fig. 1). In 2017, Google searches for this term increased by 52% compared to the previous year, and in the four years before the COVID-19 pandemic,



Slika 1. *Interes i pretraživanje pojma solo female travel na internetskoj tražilici Google od 2004. do 2024. Godine**
Figure 1 *Interest and search trends for the term "solo female travel" on the Google search engine from 2004 to 2024.**
Izvor / Source : *Google Trends, 2025.*

** Brojevi predstavljaju globalni interes za pretraživanje pojma tijekom određenog razdoblja. Vrijednost 100 označava najveću popularnost pojma. Vrijednost 50 znači da je popularnost pojma upola manja od najviše zabilježene vrijednosti. Rezultat 0 znači da nije bilo dovoljno podataka za taj pojam.*
** The numbers represent global search interest over a given time period. A value of 100 indicates the highest popularity for the term. A value of 50 means the term's popularity is half of the peak value. A result of 0 means there was not enough data for the term.*

vala je značajan pad interesa 2020., ali postpandemijski oporavak (2021.–2024.) doveo je do rekordne popularnosti. To ukazuje na sve veći interes za samostalna ženska putovanja.

Iako je pandemija COVID-19 znatno utjecala na međunarodna putovanja i izmijenila dinamiku turizma u 2020. i 2021., tržište samostalnih putnika imalo je potencijal oporavljati se brže u odnosu na druge segmente turističkog sektora (Teng i sur., 2023). Zbog potrebe održavanja fizičke distance i smanjenja socijalnih interakcija među ljudima, situacija s pandemijom COVID-19 dodatno je utjecala na povećanje privlačnosti samostalnih putovanja (Otegui-Carles i sur., 2022).

MOTIVACIJE SAMOSTALNIH PUTNICA

Najopćenitije, dvije su kategorije razloga zbog kojih se žene odlučuju putovati samostalno: a) zbog nedostatka društva i b) prema vlastitom izboru (Mehmetoglu i sur., 2001; Yang, 2020). Istraživanje provedeno 2022. godine na globalnom uzorku od 4000 žena koje su prethodno samostalno putovale pokazuje da čak 54 % njih nema društvo za putovanje (Statista, 2024a). S druge strane, mnoge se žene odlučuju otići na samostalno putovanje iako imaju društvo s kojim bi mogle putovati. Motivacije su, na temelju analize relevantne literature, sažeto prikazane u Tab. 1. u tematskim kategorijama oblikovanim na osnovi najzastupljenijih motiva u dosadašnjim istraživanjima. Primjerice, Ejupi i Medaric (2022) navode tri dimenzije motiva za samostalno putovanje: psihološka (želja za avanturom, bijeg od rutine, samopouzdanje i dr.), kulturološka (razgledavanje, posjet muzejima, upoznavanje lokalne kulture i dr.) i osobna (posjet rodbini i prijateljima, upoznavanje novih ljudi, učenje novih vještina, osobni razvoj i dr.). Chiang i Jogaratnam (2006) nadalje identificiraju četiri ključne motivacije za samostalno putovanja žena: iskustvo, bijeg od rutine, opuštanje i socijalizacija, a Pereira i Silva (2018), uz navedene, spominju još nekoliko (ukupno osam dimenzija motivacije): bijeg od svakodnevnih obaveza, samoidentitet i razvoj, izazov, povezanost s drugima, učenje, avantura, nove životne perspektive i autonomija.

searches grew sixfold. The COVID-19 pandemic caused a significant drop in interest in 2020, but the post-pandemic recovery (2021–2024) led to record popularity. This indicates a growing interest in solo female travel.

Although the COVID-19 pandemic significantly impacted international travel and altered tourism dynamics in 2020 and 2021, the solo travel market had a potential to recover more quickly compared to other segments of the tourism sector (Teng et al., 2023). Due to the need for physical distancing and reduced social interactions, the COVID-19 pandemic increased the appeal of solo travel (Otegui-Carles et al., 2022).

MOTIVATIONS OF SOLO FEMALE TRAVELLERS

Broadly speaking, there are two main categories of reasons why women choose to travel solo: (a) due to a lack of travel companions and (b) by personal choice (Mehmetoglu et al., 2001; Yang, 2020). A study conducted in 2022 on a global sample of 4,000 women who had previously travelled solo found that as many as 54% of them did not have a travel companion (Statista, 2024a). Conversely, many women choose to go on a solo trip even though they had someone they could travel with. Motivations, based on the analysis of relevant literature, are summarized in Table 1 through thematic categories formed on the basis of the most frequently represented motives in previous research. For example, Ejupi and Medaric (2022) highlight three dimensions of motivations for solo travel: psychological (desire for adventure, escape from routine, self-confidence, etc.), cultural (sightseeing, visiting museums, exploring local culture, etc.), and personal (visiting family and friends, meeting new people, learning new skills, personal development, etc.). Chiang and Jogaratnam (2006) further identify four key motivations for solo female travel: experience, escape from routine, relaxation, and socialization. Pereira and Silva (2018) expand these categories to eight motivational dimensions, including escaping daily obligations, self-identity and development, challenge, connection with others, learning, adventure, new life perspectives, and autonomy.

Istraživanja pokazuju da samostalne putnice na svojim putovanjima traže samootkrivanje, obrazovanje, iskustva drugih kultura, slobodu od svojih kućnih ograničenja i obaveza, oporavak od stresa i razvoj neovisnosti (Cockburn-Wootten i sur., 2006; Hassan & Damir, 2022). Teng i suradnici (2023) također navode da su unutarnje vrijednosti ključni motivacijski čimbenici za samostalno putovanje žena, s bijegom/opuštanjem kao dominantnim doprinosom. Samostalne putnice često žele pobjeći iz uobičajene rutine, tražeći nove kulturne kontekste izvan svoje uobičajene okoline (Pereira & Silva, 2018).

Samostalna putovanja nadalje pružaju iskustvo koje donosi priliku za introspekciju i rast. Većina putnica samostalno putovanje veže uz osjećaj vlastitog razvoja i obrazovanja (Jordan & Gibson, 2005). Za mnoge žene prevladavanje potencijalnih prepreka na putovanju i suočavanje sa svime što ih dočeka na putu pridonosi osjećaju samopouzdanja koji ima učinak i po povratku kući (Jordan & Gibson, 2005; Lagier i sur., 2021). Wilson i Harris (2006) u istraživanju ženskog samostalnog putovanja i slobodnog vremena opisali su solo putovanje kao smisleno putovanje. Smisleno putovanje smatra se iskustvom u kojem pojedinci traže ili nalaze povećan osjećaj samopouzdanja i osnaživanja. To uključuje promišljanje o svojim mogućnostima i perspektivama života te razmatranje ili ponovno promišljanje odnosa s društvom i drugima oko sebe (Wilson & Harris, 2006). U njihovu istraživanju žene su opisale svoja putnička iskustva kao transformirajuća, duboko značajna i osnažujuća. Mani i Jose (2020) dodaju dimenziju transformacije koju samostalno putovanje može pružiti ženama. Samostalnim istraživanjem nepoznatog žene razvijaju hrabrost, neovisnost i oštrinu uma. Ta iskustva potiču ih na promatranje, slušanje te da budu prisutne u trenutku i inspirirane (Mani & Jose, 2020).

Važnost samostalnih putovanja odražava se i u priznanju obitelji, prijatelja i kolega. To priznanje, zajedno s novim izazovima s kojima se suočavaju na putovanjima, značajno pridonosi osjećaju osnaženosti u osobnim i profesionalnim sferama života (Wilson & Harris, 2006). Nadalje, dobrobit samo-

Solo female travellers seek self-discovery, education, cultural experiences, freedom from household constraints and obligations, stress recovery, and the development of independence during their journeys (Cockburn-Wootten et al., 2006; Hassan & Damir, 2022). Teng et al. (2023) also state that intrinsic values are key motivational factors for women's solo travel, with escape/relaxation being the dominant contributor. Solo travellers often wish to break free from routine, seeking new cultural contexts beyond their usual environment (Pereira & Silva, 2018).

Solo travel further provides a deeply personal experience that offers opportunities for introspection and growth. Most female travellers associate solo travel with a sense of personal development and education (Jordan & Gibson, 2005). For many women, overcoming potential travel obstacles and facing whatever challenges arise along the way contributes to a sense of confidence that remains even after returning home (Jordan & Gibson, 2005; Lagier et al., 2021). Wilson and Harris (2006), in their research on women's solo travel and leisure, described solo travel as a meaningful journey. A meaningful journey is considered an experience in which individuals seek or find an increased sense of confidence and empowerment. It involves reflecting on one's life opportunities and perspectives, as well as reconsidering relationships with society and those around them (Wilson & Harris, 2006). In their study, women described their travel experiences as transformative, deeply significant, and empowering. Mani and Jose (2020) also highlight the transformative dimension that solo travel can provide for women. Through independent exploration of the unknown, women develop courage, independence, and mental sharpness. These experiences encourage them to observe, listen, be present in the moment, and feel inspired (Mani & Jose, 2020).

The significance of solo travel is also reflected in the recognition received from family, friends, and colleagues. This recognition, along with the new challenges faced during their travels, significantly contributes to a sense of empowerment in both personal and professional spheres of life (Wilson & Harris, 2006). Furthermore, the benefits of solo travel arise from meaningful social and cultural interactions with other travellers and hosts, prompting individuals to reconsider their own values

Tablica 1. *Glavne kategorije motivacija za samostalna putovanja žena na temelju analize literature*
Table 1 *Main categories of motivations for solo female travel based on literature review*

Kategorije motivacije / ***Categories of motivation***	**Specifični razlozi/motivacije /** ***Specific reasons/motivations***
Osobni razvoj / *Personal development*	Introspekcija, osobni rast, samoidentitet, osnaživanje, samopouzdanje, neovisnost, testiranje vlastitih granica, razvoj hrabrosti i snalažljivosti / *Introspection, personal growth, self-identity, empowerment, self-confidence, independence, testing one's limits, developing courage and resourcefulness*
Bijeg i opuštanje / *Escape and relaxation*	Bijeg od rutine i svakodnevnih obaveza, oporavak od stresa, sloboda od kućnih ograničenja / *Escaping routine and everyday obligations, recovering from stress, freedom from household constraints*
Kulturološko i socijalno iskustvo / *Cultural and social experience*	Upoznavanje novih ljudi, razgledavanje, iskustvo drugih kultura, posjet rodbini i prijateljima / *Meeting new people, sightseeing, experiencing other cultures, visiting relatives and friends*
Praktični razlozi / *Practical reasons*	Nedostatak suputnika, poteškoće u usklađivanju s drugima (vrijeme, budžet), praktične okolnosti / *Lack of a travel companion, difficulties coordinating with others (time, budget), practical circumstances*

Izvor / Source: *prema Chiang i Jogaratnam (2006); Ejupi i Medaric (2022); Hassan i Damir (2022); Jordan i Gibson (2005); Lagier i sur. (2021); Mani i Jose (2020); Pereira i Silva (2018); Statista (2024a); Teng i sur. (2023); Wilson i Harris (2006); Yang (2020)* / Source: *Chiang & Jogaratnam (2006); Ejupi & Medaric (2022); Hassan & Damir (2022); Jordan & Gibson (2005); Lagier et al. (2021); Mani & Jose (2020); Pereira & Silva (2018); Statista (2024a); Teng et al. (2023); Wilson & Harris (2006); Yang (2020).*

stalnih putovanja proizlazi iz značajnih socijalnih i kulturnih interakcija s drugim putnicima i domaćinima, što potiče na preispitivanje vlastitih vrijednosti na individualnoj i društvenoj razini (Wilson & Harris, 2006).

Analiza motivacija ukazuje na to da samostalna putovanja žena nadilaze puki nedostatak suputnika i predstavljaju važan aspekt osobnog razvoja, samostalnosti i životne transformacije. Pritom se ističu introspekcija, razvoj hrabrosti i testiranje vlastitih granica, ali i praktični razlozi poput fleksibilnosti u planiranju putovanja bez potrebe za usklađivanjem s drugima. Osim toga, samostalna putovanja omogućuju ženama da potpuno urone u nova kulturna i socijalna iskustva, što dodatno obogaćuje njihovu perspektivu i jača povezanost s globalnom zajednicom. Bez obzira na početni razlog putovanja, istraživanja pokazuju da iskustva koja žene stječu na tim putovanjima često dovodi do dubljeg razumijevanja sebe i svoje okoline, većeg samopouzdanja te jačeg osjećaja slobode i osnaženosti.

ODNOS RODA I PROSTORA

Samostalna putovanja žena zanimljiva su tema iz geografske perspektive, posebno iz aspekta feminističke geografije koja se razvija pod utjecajem poststrukturalističkih teorijskih pravaca.

on both a personal and societal level (Wilson & Harris, 2006). All these perspectives highlight the importance of solo travel as a means of personal development, discovering resourcefulness, building self-confidence, and fostering independence.

The analysis of motivations indicates that women's solo travel goes beyond the mere lack of a travel companion and represents a significant aspect of personal growth, independence, and life transformation. Key factors include introspection, the development of courage, and testing personal limits, as well as practical reasons such as the flexibility to plan trips without the need to coordinate with others. Additionally, solo travel allows women to fully immerse themselves in new cultural and social experiences, further enriching their perspectives and strengthening their connection to the global community. Regardless of the initial reason for travel, research shows that the experiences women gain from these journeys often lead to a deeper understanding of themselves and their surroundings, increased self-confidence, and a stronger sense of freedom and empowerment.

THE RELATIONSHIP BETWEEN GENDER AND SPACE

Solo female travel is an interesting topic from a geographical perspective, particularly within the framework of feminist geography, which has de-

Poststrukturalizam dovodi do propitivanja tradicionalnog geografskog znanja te naglašava koncept situiranog znanja koje govori da je znanje uvijek limitirano, specifično, parcijalno, ovisno o podrijetlu (Šakaja, 2015). Feministička geografija upućuje na to da je većina postojećeg geografskog znanja oblikovana iz pozicije bijelog, heteroseksualnog muškarca srednje klase sa Zapada, dok su znanja i iskustva žena u velikoj mjeri zanemarivana (Šakaja, 2015). Taj pravac unutar geografije javlja se 1980-ih osnivanjem istraživačke skupine „Žene i geografija" (*The Women and Geography Study Group*) radi proučavanja geografskih aspekata rodne diferencijacije i promicanja feminističke perspektive u istraživanju i obrazovanju (Mohammad, 2016).

Na samostalnim putovanjima žene se kreću nepoznatim prostorima i različitim kulturnim kontekstima, udaljene od sigurnosti poznatog okruženja, što neminovno dovodi do pitanja brige za vlastitu sigurnosti. Valentine (1989) je još potkraj 1980-ih prostorno-vremenska ograničenja u kretanju koja doživljavaju žene opisala pojmom geografije ženskog straha. Ta se perspektiva može dobro primijeniti i u proučavanju samostalnih ženskih putovanja jer se geografija straha samostalnih putnica manifestira na različite načine osobnim strahom i strahom bliskih osoba za njih (Wilson & Little, 2008). Brojna istraživanja koja su provele feminističke geografkinje i drugi autori ukazuju na to da postoje jasne razlike korištenja javnog prostora između muškaraca i žena i u tome kako ga doživljavaju (Aitchison, 1999; Carr, 1998; 2001; Curson & Kitts, 2000; Domosh, i sur., 2001; Koskela, 1997; Mehta, 1999; Mowl & Towner, 1995; Pain, 1991; Rose, 1993; Massey, 1994). Naime, žene doživljavaju znatno veća ograničenja u kretanju i korištenju javnih prostora zbog straha da će biti izložene potencijalnim nasilnim ili seksualnim napadima (Bastomski & Smith, 2017; Bialeschki & Chapel, 1999; Listerborn, 2016; Pain, 1991). Iako je strah žena od kriminala često veći od stvarnog rizika, proporcionalan je njihovoj percepciji rizika koju oblikuju društvo, obrazovni sustav i mediji (Reid & Konrad, 2004). Strah je, naime, donekle društveni konstrukt koji se oblikuje putem utjecaja medija, filmova i fikcije, čime se ojačava rodni identitet

veloped under the influence of poststructuralist theoretical approaches. Poststructuralism challenges traditional geographical knowledge and emphasizes the concept of situated knowledge, which suggests that knowledge is always limited, specific, partial, and dependent on origin (Šakaja, 2015). According to feminist geography most existing geographical knowledge was shaped from the perspective of a white, heterosexual, middle-class Western man, while the knowledge and experiences of women were largely overlooked (Šakaja, 2015). This direction within geography emerged during the 1980s with the establishment of the Women and Geography Study Group, with the aim to examine the geographical aspects of gender differentiation and to promote the feminist perspective in research and education (Mohammad, 2016).

During solo travels, women navigate unfamiliar spaces and diverse cultural contexts, removed from the safety of known environments, which inevitably raises concerns about personal security. As early as the late 1980s, Valentine described the spatial-temporal constraints on women's mobility with the concept of the geography of women's fear (Valentine, 1989). This perspective is highly applicable to the study of solo female travel, as the geography of fear manifests in various ways, including personal fear and the concerns of close acquaintances (Wilson & Little, 2008). Numerous studies by feminist geographers and other researchers highlighted clear gender differences in how men and women use and experience public space (Aitchison, 1999; Carr, 1998, 2001; Curson & Kitts, 2000; Domosh et al., 2001; Koskela, 1997; Mehta, 1999; Mowl & Towner, 1995; Pain, 1991; Rose, 1993; Massey, 1994). Women experience significantly greater restrictions in movement and public space usage due to the fear of potential violent or sexual assault (Bastomski & Smith, 2017; Bialeschki & Chapel, 1999; Listerborn, 2016; Pain, 1991). Although women's fear of crime is often greater than the actual risk, it is proportional to their perceived risk, which is shaped by society, the education system, and the media (Reid & Konrad, 2004). Fear is, to some extent, a social construct influenced by media, films, and fiction, reinforcing the gendered identity of women as vulnerable

žene kao ranjive osobe. Percepcija straha i sigurnosti pritom može biti vrlo subjektivna, ovisna o individualnim iskustvima, pri čemu granice između „sigurnih" i „nesigurnih" mjesta nisu jasno definirane (Pain, 1991). Osjećaj straha utječe na sudjelovanje žena u aktivnostima slobodnog vremena te žene češće od muškaraca izbjegavaju situacije/mjesta koja percipiraju nesigurnima (Bialeschki & Chapel, 1999). Žene koje putuju same posebno su osjetljive na prijetnje fizičkog napada, seksualnog uznemiravanja i neželjenih pogleda što ograničava njihov izbor destinacija i otežava socijalne interakcije na putovanjima (Heimtun & Abelsen, 2013). Mnogi javni prostori i turistička mjesta kodirana su kao „muška" i oblikovana za kretanje i uživanje muškaraca, što u određenim socio-kulturnim kontekstima podrazumijeva isključivanje i izolaciju žena (Pritchard & Morgan, 2000).

Proširujući tezu geografkinje Gill Valentine o geografiji straha, Wilson i Little (2008) spominju geografiju ženskog straha od putovanja koja odražava ideju da je samostalno putovanje na neki način nesigurno te u određeno vrijeme i na određenim mjestima neprikladno. Samostalne putnice jasno se izdvajaju različitima od norme što ih čini vidljivima i ranjivijima te su mnoge od njih iskusile strah koji se uglavnom temelji na anticipaciji muškog nasilja i uznemiravanja (Wilson & Little, 2008). Kao rezultat toga, samostalne putnice percipiraju, doživljavaju i koriste turističke krajolike i prostor drukčije od muških putnika. Turistički prostor pretežno je oblikovan iskustvima muških turista iz razvijenih zapadnih država čineći ga obilježenim rodnim i rasnim karakteristikama (Yang i sur., 2018b). U regijama u kojima se društveni položaj žena razlikuje od položaja u zapadnim državama, primjerice na Bliskom istoku, žene su još opreznije jer znatno češće dobivaju mušku pozornost (Junek i sur., 2006). Istraživanja su pokazala da su putnice identificirale određena mjesta u destinacijama koja je potrebno izbjegavati kako bi se u najvećoj mjeri smanjio rizik povezan s neželjenim pogledima, dobacivanjima ili napadima (Wilson & Little, 2008). Kao mjesta visokog rizika identificirane su uske, mračne i slijepe ulice, parkovi, stanice javnog prijevoza, podzemne garaže i (određeni tip) smještaja (Bialeschki & Chapel, 1999; England & Simon,

individuals. The perception of fear and security is highly subjective, depending on individual experiences, with no clear boundaries between "safe" and "unsafe" places (Pain, 1991). This sense of fear affects women's participation in leisure activities, as they are more likely than men to avoid situations or locations perceived as unsafe (Bialeschki & Chapel, 1999). Women travelling alone are particularly vulnerable to threats of physical assault, sexual harassment, and unwanted attention, which can limit their choice of destinations and hinder social interactions while travelling (Heimtun & Abelsen, 2013). Many public spaces and tourist sites are coded as "male" and designed for men's movement and enjoyment, which, in certain socio-cultural contexts, leads to the exclusion and isolation of women (Pritchard & Morgan, 2000).

Expanding on geographer Gill Valentine's concept of the geography of women's fear, Wilson and Little (2008) introduce the concept of the "geography of women's travel fear," reflecting the perception that solo travel is unsafe and, in certain times and in certain places, inappropriate. Independent female travellers stand out from social norms, making them more visible and vulnerable, with many experiencing fear primarily based on the anticipation of male violence and harassment (Wilson & Little, 2008). As a result, solo female travellers perceive, experience, and navigate tourism spaces differently than male travellers. Tourism spaces are predominantly shaped by the experiences of male tourists from developed Western countries, making them inherently gendered and racialised (Yang et al., 2018b). In regions where women's social status differs significantly from that in Western countries, such as the Middle East, women are even more vigilant due to significantly higher levels of male attention (Junek et al., 2006). Research has shown that female travellers identified certain places within destinations that should be avoided to minimize the risk of unwanted stares, catcalling, or attacks as much as possible (Wilson & Little, 2008). High-risk areas include narrow, dark, and dead-end streets, parks, public transportation stations, underground parking garages, and certain types of accommodation (Bialeschki & Chapel, 1999; England & Simon, 2010; Johansson & Haandrikman, 2023; Koskela & Pain, 2000; Valentine, 1989; Wang & Wu, 2020;

2010; Johansson & Haandrikman, 2023; Koskela & Pain, 2000; Valentine, 1989; Wang & Wu, 2020; Wilson & Little, 2008; Yang i sur., 2018a). Većina putnica ipak ističe da veći rizik osjećaju u večernjim ili noćnim satima kada se kreću odredištem. Stoga umjesto da izbjegavaju odlazak na samostalno putovanje zbog potencijalnog rizika, putnice ga nastoje umanjiti prilagodbom svojih prostornih praksi i vlastitog izgleda (Yang i sur., 2018a).

Nadalje, pod utjecajem informacija koje dobivaju s različitih strana, posebno putem različitih medija (društvenih mreža, blogova, vijesti i dr.) putnice stvaraju svoje mentalne mape prostora koje smatraju sigurnima, a koje nesigurnima za samostalno putovanje. Važan element u planiranju samostalnog putovanja je odabir destinacije. Predodžba ili „slika" mjesta ima ključnu ulogu u oblikovanju ljudskog ponašanja u prostoru, utječući na odluke o izboru odredišta, ruti putovanja i načinu kako tamo stići (Kaba, 2021). Samostalne putnice često su ograničene u izboru destinacija i pristupu određenim država zbog straha od negativnih percepcija usmjerenih prema ženama koje putuju same u tim regijama (Wilson & Little, 2005). Posebno negativne percepcije nekih prostora mogu smanjiti pristup tim destinacijama i pridonijeti da takva geografska područja ostanu nepoznata ili skrivena ženama, poput primjerice Bliskog istoka, Afrike i dijelova Azije (Wilson & Little, 2005; Yang i sur., 2018a). Također, neki se prostori društveno kodiraju kao „prostor za muškarce", primjerice Afrika (Ngwira i sur., 2020), što odbija samostalne putnice ili otežava onim ženama koje se ipak odluče putovati u takve prostore. No, percepcija prostora znatno ovisi i o perspektivi iz koje se promatra, odnosno da se percepcije o sigurnosti pojedinih destinacija razlikuju između različitih skupina samostalnih putnica. Primjerice, u istraživanju koje su provele Wilson & Little (2008) na temelju uzorka europskih samostalnih putnica, Europa je identificirana kao sigurna destinacija (Wilson & Little, 2008). Međutim, u drugim istraživanjima, provedenima iz perspektive azijskih samostalnih putnica, Europa je istaknuta kao rizična destinacija (Yang i sur., 2018a; Yang i sur., 2018b). Razlog tome je percepcija da se žene iz Azije u Europi vrlo često

Wilson & Little, 2008; Yang et al., 2018a). Most female travellers, however, emphasize that the sense of danger increases during evening and nighttime when moving through a destination. So, rather than avoiding solo travel altogether, female travellers adapt by modifying their spatial behaviours and appearance to reduce perceived risks (Yang et al., 2018a).

Furthermore, under the influence of information they receive from various sources, particularly through different media (social networks, blogs, news, etc.), female travellers create their own mental maps that define which spaces and countries they consider safe and which they perceive as unsafe for solo travel. A crucial element in planning a solo trip is the choice of destination. The perception or "image" of a place plays a key role in shaping human behaviour in space, influencing decisions about destination selection, travel routes, and how to get there (Kaba, 2021). Solo female travellers are often restricted in their choice of destinations and access to certain countries due to fear of negative perceptions directed at women travelling alone in those regions (Wilson & Little, 2005). Extremely negative perceptions of certain places can limit access to those destinations and contribute to keeping such geographical areas unknown or hidden from women, such as the Middle East, Africa, and parts of Asia perceived as unsafe (Wilson & Little, 2005; Yang et al., 2018a). Additionally, some spaces are socially coded as "male spaces," such as Africa (Ngwira et al., 2020), which discourages solo female travellers or makes it more challenging for women who decide to travel to such places. However, it should be emphasized that the perception of space itself largely depends on the perspective from which it is observed, meaning that perceptions of the safety of certain destinations vary among different groups of solo female travellers. For example, Europe was identified as a safe destination in a study based on the perspectives of European solo female travellers (Wilson & Little, 2008). However, in other studies conducted from the perspective of Asian solo female travellers, Europe was highlighted as a risky destination (Yang et al., 2018a; Yang et al., 2018b). The reason for this is the perception that Asian women in Europe are often racially stereotyped as sexually available or sex workers.

rasno stereotipiziraju kao lake žene ili seksualne radnice.

Popularni vodiči i mediji za samostalne putnice sve češće nude konkretne preporuke destinacija koje smatraju sigurnima i prikladnima za samostalna putovanja. Primjerice, u knjizi Fly Solo (Rodriguez Williamson, 2007) najviše preporučenih destinacija nalazi se u Europi, zatim u Sjevernoj Americi, Aziji te Južnoj i Srednjoj Americi, dok su Bliski istok (osim Dubaija) i Afrika gotovo izostavljeni. Knjiga Go Your Own Way (Conlon i sur., 2007) donosi širi geografski raspon uključujući Aziju i Afriku, dok noviji vodiči poput The Solo Travel Handbook (Reid, 2017) destinacije povezuju s tematskim interesima (primjerice Vijetnam s gastronomijom ili Bali s introspekcijom) čime se sve više uključuju regije poput Jugoistočne Azije, Bliskog istoka i Afrike. Ipak, naglasak u vodičima i dalje je na mjestima koja se percipiraju kao relativno sigurna i liberalnija, poput Dubaija i Jordana (Kittrell, 2021).

Unatoč tome, znanstvena istraživanja koja sustavno analiziraju percepciju i izbor konkretnih destinacija među samostalnim putnicama još su uvijek ograničena. Većina studija fokusira se na šire teme poput sigurnosti, društvenih normi i subjektivne percepcije prostora u turističkim destinacijama (Douglas & Barrett, 2020; Jordan & Aitchison, 2008; Wilson & Little, 2005, 2008; Yang i sur., 2018a). Tek rijetki radovi, poput onih Wilson & Little (2008) te Yang i suradnika (2018a), dublje analiziraju kulturne razlike i osobna iskustva koja utječu na percepciju sigurnosti i izbor destinacija. Njihovi nalazi pokazuju da zapadne putnice često izbjegavaju destinacije poput Bliskog istoka, Južne Amerike, Afrike, Turske i Maroka zbog kulturnih normi, percepcija muške dominacije i straha od nasilja, dok azijske putnice dodatno ističu Europu, Indiju i Bliski istok kao nepoželjne regije zbog seksualnih stereotipa, političke nestabilnosti i patrijarhalnih normi (Wilson & Little, 2008; Yang i sur., 2018a). Odsutnost sustavnih i detaljnih analiza izbora destinacija te razlika u percepcijama među samostalnim putnicama s obzirom na njihove sociodemografske karakteristike, kao i nedostatak razumijevanja razloga zašto je tome tako, predstavlja istraživački jaz u postojećoj literaturi.

Popular guides and media aimed at solo female travellers are increasingly offering recommendations for destinations considered safe and suitable for solo travel. For example, in the book Fly Solo (Rodriguez Williamson, 2007), the most recommended destinations are located in Europe, followed by North America, Asia, and Central and South America, while the Middle East (except for Dubai) and Africa are entirely excluded. The book Go Your Own Way (Conlon et al., 2007) offers a broader geographical scope, including Asia and Africa, while more recent guides such as The Solo Travel Handbook (Reid, 2017) associate destinations with thematic interests (e.g., Vietnam with gastronomy or Bali with introspection), thus increasingly incorporating regions such as Southeast Asia, the Middle East, and Africa. Nevertheless, the guides still emphasize places perceived as relatively safe and more liberal, such as Dubai and Jordan (Kittrell, 2021).

Despite this, academic research that systematically analyses the perception and selection of specific destinations among solo female travellers remains limited. Most studies focus on broader themes such as safety, social norms, and the subjective perception of space within tourist destinations (Douglas & Barrett, 2020; Jordan & Aitchison, 2008; Wilson & Little, 2005, 2008; Yang et al., 2018a). Only a few works, such as those by Wilson and Little (2008) and Yang et al. (2018a), explore in more depth the cultural differences and personal experiences that influence safety perceptions and destination choice. Their findings show that Western female travellers often avoid destinations such as the Middle East, South America, Africa, Turkey, and Morocco due to cultural norms, perceptions of male dominance, and fear of violence, while Asian travellers additionally point to Europe, India, and the Middle East as undesirable regions due to sexual stereotypes, political instability, and patriarchal norms (Wilson & Little, 2008; Yang et al., 2018a). The absence of systematic and detailed analyses of destination choices and differences in perception among solo female travellers based on their sociodemographic characteristics, as well as the lack of understanding of the reasons behind these patterns, represent a research gap in the existing literature.

OGRANIČENJA I PERCEPCIJA SIGURNOSTI NA SAMOSTALNOM PUTOVANJU

Žene koje se odluče za samostalno putovanje suočavaju se s raznovrsnim ograničenjima prije i tijekom putovanja. Prije putovanja određen broj žena osjeća strah koji proizlazi iz vlastitih unutarnjih procjena o sigurnosti samostalnog putovanja i brige bliskih osoba. Obitelj i prijatelji vrlo često izražavaju zabrinutost i iznenađenje zbog želje žena za samostalnim putovanjem što odražava uvjerenje da takav oblik putovanja nije siguran za žene (Valentine 1989; Wilson & Little, 2008). Podrška obitelji često izostaje što katkad dovodi do sukoba s roditeljima (u slučaju mlađih putnica) i skrivanja planova putovanja, a u nekim slučajevima čak i do odustajanja od putovanja (Mani & Jose, 2020). Nadalje, obiteljske obveze mogu biti prepreka za neke žene koje se mogu osjećati krivo jer ostavljaju djecu i partnera samima te zbog toga mogu odustati od putovanja (Seagrave, 2016). Ipak, važno je napomenuti da samostalno putovanje može imati i neke pozitivne učinke na obiteljske odnose. Žene mogu postati preopterećene različitim ulogama (majke, supruge, kćeri), što ih može ograničiti u izražavanju vlastitog identiteta. Samostalna putovanja pružaju priliku za privremeno oslobađanje od tih uloga i ponovno povezivanje sa sobom (Seagrave, 2016). To donosi veće osobno zadovoljstvo koje se može pozitivno odraziti i na obiteljske odnose.

Nadalje, unatoč tome što je samostalno putovanje za žene dobrovoljni izazov, percipirani i stvarni rizici mogu negativno utjecati na njihovo iskustvo samostalnog putovanja (Karagöz i sur., 2021). Percepcija rizika može biti uvjetovana individualnim karakteristikama, poput osobina ličnosti, kulturnog konteksta iz kojeg osoba dolazi i prethodnog iskustva s putovanjima (Carballo i sur., 2022). No, postoje i stvarni rizici, a medijska izvješća o seksualnim napadima i ubojstvima žena dodatno pojačavaju svijest putnica o mogućim negativnim iskustvima na samostalnom putovanju (Yang i sur., 2018a).

Wilson i Little (2005) provele su opširno istraživanje o ograničenjima samostalnih putovanja iz perspektive feminističke geografije te su ih svrstale u četiri kategorije: sociokulturne, osobne, praktične

CONSTRAINTS AND PERCEPTIONS OF SAFETY DURING SOLO TRAVEL

Women who choose to travel solo face various constraints both before and during their journey. Before travelling, some women experience fear stemming from their own internal assessments of solo travel safety and the concerns of close ones. Family and friends often express worry and surprise at a woman's desire to travel alone, reflecting the belief that such travel is unsafe for women (Valentine, 1989; Wilson & Little, 2008). Family support is frequently lacking, sometimes leading to conflicts with parents (in the case of younger travellers) or the withholding of travel plans, and in some cases, even the abandonment of the trip (Mani & Jose, 2020). Furthermore, family obligations can present obstacles for some women who may feel guilty about leaving their children and partners behind, which may lead them to abandon their travel plans (Seagrave, 2016). However, it is important to note that solo travel can also have positive effects on family relationships. Women often become overwhelmed by multiple roles (mother, wife, daughter), which can restrict their self-expression. Solo travel provides an opportunity for temporary relief from these roles and reconnection with oneself (Seagrave, 2016), leading to greater personal satisfaction that can positively impact family dynamics.

Despite the fact that solo travel is a voluntary challenge for women, perceived and real risks can negatively affect their experience (Karagöz et al., 2021). Risk perception may be influenced by individual characteristics, such as personality traits, cultural background, and prior travel experience (Carballo et al., 2022). However, actual risks also exist, and media reports of sexual assaults and murders of women further heighten travellers' awareness of potential negative experiences on solo trips (Yang et al., 2018a).

Wilson and Little (2005) conducted an extensive study on the constraints of solo travel from the perspective of feminist geography and categorized them into four groups: sociocultural, personal, practical, and spatial (Table 2). The first category includes sociocultural constraints

i prostorne (Tab. 2.). Prva kategorija obuhvaća sociokulturna ograničenja koja proizlaze iz društvenih i kulturnih konteksta u kojima žene žive i s kojima se suočavaju na svojim samostalnim putovanjima. Ta ograničenja uključuju utjecaj društvenih očekivanja, uloge i odgovornosti žena, percepcije drugih o njihovim putovanjima te neželjenu pažnju (najčešće muškaraca) na samostalnim putovanjima. Usko povezana sa sociokulturnim aspektom, druga kategorija ograničenja fokusirana je na osobna i unutarnja ograničenja koja proizlaze iz samopercepcija, uvjerenja i emocija, uključujući sumnju u sebe, strah, ranjivost i osjećaj usamljenosti. Treća vrsta ograničenja obuhvaća praktične poteškoće i izazove s kojima se suočavaju žene koje putuju same, uključujući nedostatak vremena i novca, nedostatak lokalnog znanja na odredištu te stres i umor povezani sa samostalnim putovanjem. Četvrta kategorija, posebno zanimljiva za geografe, obuhvaća čimbenike koji utječu na ograničavanje slobode kretanja žena u nekim prostorima, uključujući ograničenja u izboru odredišta te ograničeno kretanje u turističkoj destinaciji (Wilson & Little, 2005). Rezultati istraživanja navedenih kategorija pokazali su da je sociokulturni kontekst dominantan ograničavajući čimbenik za žene i njihove odabire, mogućnosti i iskustva samostalnog putovanja.

Kao što pokazuju mnoga druga istraživanja, pitanje osobne sigurnosti izdvaja se kao ključan ograničavajući čimbenik za odlazak na samostalno putovanje (Ghadban i sur., 2023; Wilson & Little, 2008; Yang, 2020). Žene najčešće izražavaju zabrinutost

arising from the social and cultural contexts in which women live and the challenges they face during solo travel. These constraints involve the influence of societal expectations, women's roles and responsibilities, others' perceptions of their travel, and unwanted attention (mostly from men) while travelling alone. Closely related to the sociocultural aspect, the second category focuses on personal and internal constraints stemming from self-perception, beliefs, and emotions, including self-doubt, fear, vulnerability, and loneliness. The third type of constraint involves practical difficulties and challenges faced by solo female travellers, such as a lack of time and money, limited local knowledge at the destination, and the stress and fatigue associated with solo travel. The fourth category, particularly relevant for geographers, includes factors that limit women's freedom of movement in certain spaces, such as restrictions in destination choice and limited mobility within the tourist location itself (Wilson & Little, 2005). Among all these categories, their research found that the sociocultural context was the dominant limiting factor for women's choices, opportunities, and experiences in solo travel.

As numerous other studies have shown, personal safety emerges as a key limiting factor for undertaking solo travel (Ghadban et al., 2023; Wilson & Little, 2008; Yang, 2020). Women most often express concerns about potential sexual harassment, catcalling, uncomfortable stares, stalk-

Tablica 2. *Ograničenja prije putovanja i tijekom putovanja koja utječu na samostalna putovanja žena*
Table 2 *Constraints before and during travel affecting solo female travellers*

Potkategorija / *Subcategory*	**Ograničenja prije putovanja / *Constraints before travel***	**Ograničenja tijekom putovanja / *Constraints during travel***
Sociokulturna / *Sociocultural*	Društvena očekivanja / *Social expectations*	Stavovi domaćina / *Host attitudes* Neželjena pozornost / *Unwanted attention*
	Uloge i odgovornosti / *Roles and responsibilities*	
	Percepcije drugih / *Others' perceptions*	
Osobna / *Personal*	Sumnje u sebe i strahovi / *Self-doubt and fears*	Strah i ranjivost / *Fear and vulnerability*
		Usamljenost / *Loneliness*
Praktična / *Practical*	Nedostatak vremena i novca / *Lack of time and money*	Nedostatak lokalnog znanja / *Lack of local knowledge*
		Putovanje s drugima (samostalnim putnicima) / T*raveling with others (fellow solo travelers)*
		Stres i umor / *Stress and fatigue*
Prostorna / *Spatial*	Ograničen izbor destinacija / *Limited choice of destinations*	Ograničeno kretanje / *Restricted mobility*
		Upadljivost / *Conspicuousness*

Izvor / Source: *Wilson i Little (2005, p. 162)*

zbog mogućeg seksualnog uznemiravanja, dobacivanja komentara na ulici, neugodnih pogleda, uhođenja i krađe (Karagöz i sur., 2021; Yang i sur., 2018b). Strah i prijetnja nasiljem nad ženama duboko su ukorijenjeni u kulturi, postavljajući se kao „životna činjenica" s kojom se većina djevojčica i žena socijalizira već u ranoj dobi. Različitim obrascima socijalizacije, žene se uči da izbjegavaju određena mjesta kada su same, da budu oprezne prema strancima i noći te da ostaju u sigurnom okviru doma ili njegovoj blizini (Wilson & Little, 2008). Prema istraživanju Statiste (2024) o samostalnim putovanjima, putnice su izbjegavale putovati same uglavnom zbog zabrinutosti za osobnu sigurnost, što je istaknulo 69 % ispitanih žena. Veći troškovi i strah od izgubljenosti druge su najčešće spominjane prepreke (65 % i 50 %) (Statista, 2024b). Istraživanja su pokazala da većina putnica svjesno prihvaća rizike te da su neke od njih čak prihvatile određenu razinu uličnog uznemiravanja kao nešto uobičajeno i normalno u određenim situacijama. Odnosno, odlučile su to interpretirati kao kompliment (Yang i sur., 2018b) što je postao njihov način prilagodbe na situaciju u kojoj se žene percipiraju kao slobodne jedino zato što putuju same.

S obzirom na to da se strah za vlastitu sigurnost, posebno strah od seksualnog uznemiravanja, ističe kao ključni problem za samostalne putnice (Yang, 2020), savjeti o sigurnosti nalaze se u gotovo svim vodičima namijenjenima samostalnim putnicama (Eubanks, 2019; Reid, 2017; Seagrave, 2016). Mnogi autori priručnika za putovanja istražuju problem sigurnosti žena te većina njih daje savjete o primjerenom ponašanju i naglašava da žena treba biti na oprezu. Strah za sigurnost potvrđuje i istraživanje Douglasa i Barretta (2020), koji su usporedili članke namijenjene samostalnim putnicama i putnicima. Članci namijenjeni ženama često istražuju zabrinutost za sigurnost ili prisutnost restriktivnijih rodnih normi na određenim destinacijama, dok su članci usmjereni na muškarce češće fokusirani na romantične i flertujuće interakcije (Douglas & Barrett, 2020). Poruke o mogućim rizicima samostalnih putovanja izraženije su u člancima namijenjenim ženama u odnosu na one namijenjene muškarcima, što pridonosi percepciji da žene koje putuju samostalno doživljavaju više ograničenja od muškaraca. Gotovo svi članci za žene, dok samo polovica onih za muš-

ing, and theft (Karagöz et al., 2021; Yang et al., 2018b). Fear and the threat of violence against women are deeply ingrained in culture, becoming a "fact of life" that most girls and women are socialized into from an early age. Through various patterns of socialization, women are taught to avoid certain places when alone, to be cautious of strangers and nighttime travel, and to stay within the safe confines of home or its immediate surroundings (Wilson & Little, 2008). According to a Statista (2024) study on solo travel, female travellers primarily avoided travelling alone due to concerns about their personal safety, as cited by 69% of surveyed women. Higher costs and fear of getting lost were the second most frequently mentioned barriers (65% and 50%) (Statista, 2024b). However, research has shown that most female travellers consciously accept the risks, with some even normalizing certain levels of street harassment, interpreting it as a common occurrence in specific situations. Some women have chosen to perceive catcalling as a compliment (Yang et al., 2018b), using this interpretation as a coping mechanism in environments where women are perceived as available simply because they are travelling alone.

Given that concerns about personal safety, especially fear of sexual harassment, are the primary challenges for solo female travellers (Yang, 2020), safety tips are included in almost all travel guides aimed at solo female travellers (Eubanks, 2019; Reid, 2017; Seagrave, 2016). Many travel guide authors have explored women's safety issues, with most offering practical advice on appropriate behaviour, emphasizing that women should remain vigilant. Fear of safety risks is further highlighted in a study by Douglas and Barrett (2020), which compared articles aimed at solo female vs. male travellers. Articles targeting female travellers frequently addressed safety concerns or the presence of restrictive gender norms in certain destinations, whereas articles aimed at male travellers focused more on romantic and flirtatious interactions (Douglas & Barrett, 2020). Warnings about potential risks were significantly more pronounced in articles for women than in those for men, reinforcing the perception that solo female travellers face greater limitations. Nearly all arti-

karce, navode barem jedno negativno iskustvo koje se može očekivati na samostalnom putovanju (Douglas & Barrett, 2020).

Navedena ograničenja i brige prije putovanja te na putovanju utječu na iskustvo i zadovoljstvo samostalnim putovanjem. No, unatoč različitim izazovima i ograničenjima koja su uvjetovana ponajprije rodno, žene putnice pronašle su načine prilagodbe situacijama i prostorima, odnosno primjenjuju različite strategije da bi ostvarile svoje putničke ciljeve i otkrivale destinacije samostalno.

STRATEGIJE NOŠENJA S RIZICIMA NA SAMOSTALNOM PUTOVANJU

Većina žena je na svojem putovanju svjesna prisutnosti rizika jer turistički vodiči i društveni mediji ističu sigurnosne savjete samostalnim putnicama kako bi izbjegle potencijalne „opasnosti" povezane uglavnom s muškarcima (Yang i sur., 2018b). Da bi se bolje prilagodile okolini i umanjile mogućnosti različitih vrsta uznemiravanja (neželjeni pogledi, zviždući, dobacivanja, napad), žene primjenjuju različite strategije. Strategije zabilježene u analiziranim znanstvenim istraživanjima kategorizirane su u Tab. 3. Glavne strategije koje primjenjuju samostalne putnice su različiti načini prilagođavanja situacijama i kulturnim kontekstima prostora kojim se kreću kako bi odvukle pozornost od svojeg ženskog tijela (Wilson & Little, 2008, Wilson i sur., 2009). To obuhvaća odijevanje u skladu s lokalnom kulturom i usklađivanje s lokalnim (ženskim) normama ponašanja. Primjerice, u istraživanju koje je provela Kaba (2021) adekvatno prekrivanje tijela odjećom je strategija koju su samostalne putnice najčešće primjenjivale u Turskoj. Putnice su bile svjesne kulturnog kodeksa odijevanja, posebno u konzervativnijim dijelovima države i nastojale su ih poštovati kako bi se bolje uklopile i zaštitile od neželjene pažnje (Kaba, 2021). Nadalje, jedna od najčešćih strategija nošenja s rizikom podrazumijeva stalnu svjesnost o okolnostima u prostoru kojim se kreću te izbjegavanje onih mjesta koja se percipiraju ili se uvriježeno smatraju nesigurnima, što često ovisi o dobu dana. Kretanje nekim prostorima (npr. pustim uličicama, parkovima, podzemnim željezničkim stanicama, izoliranim mjestima) ili posjećivanje nekih

cles written for women included at least one negative experience to anticipate, compared to only half of those targeting male travellers (Douglas & Barrett, 2020).

These pre-travel concerns and in-trip experiences shape women's overall satisfaction with solo travel. However, despite gender-specific challenges and constraints, female travellers develop strategies to navigate different spaces and situations, enabling them to achieve their travel goals and explore destinations independently.

STRATEGIES FOR MANAGING RISKS WHILE TRAVELLING SOLO

Most women are aware of potential risks while travelling, as travel guides and social media heavily emphasize safety tips for solo female travellers to help them avoid perceived "dangers" primarily associated with men (Yang et al., 2018b). To better adapt to their surroundings and reduce the likelihood of various forms of harassment (unwanted stares, whistles, catcalling, assault), women employ different risk-mitigation strategies. The strategies found in the analysed scientific studies were categorized and summarized in Table 3. The main strategies used by solo female travellers are various ways of adapting to situations and cultural contexts of the places they navigate in order to divert attention from their female bodies (Wilson & Little, 2008; Wilson et al., 2009). One of the most common approaches is dressing in accordance with local culture and aligning behaviour with local (female) norms. For example, a study by Kaba (2021) found that covering the body appropriately was the most frequently used strategy among solo female travellers in Turkey. These travellers were aware of cultural dress codes, particularly in conservative parts of the country, and tried to comply to blend in and avoid unwanted attention (Kaba, 2021). Another common risk-management strategy involves constant awareness of one's surroundings and avoiding areas perceived or traditionally considered unsafe, which, as noted earlier, often depends on the time of day. Certain spaces (e.g., deserted alleys, parks, underground train stations, isolated areas) and venues (e.g., bars) are particular-

mjesta (npr. kafića) posebno se izbjegava u večernjim ili noćnim satima (Kaba, 2021; Koskela, 1997; Wilson & Little, 2008; Wilson i sur., 2009; Yang i sur., 2018a; Zhang i sur., 2022). Smanjenje rizika podrazumijeva kretanje u središnjim i prometnijim dijelovima grada, posebno ako se kreću u večernjim satima. Jedna od strategija koju putnice primjenjuju kako bi umanjile osjećaj nesigurnosti je nastojanje da se okruže lokalnim ženama i djecom, npr. u javnom prijevozu (Douglas & Barrett, 2020).

Kako bi odvratile neželjenu pažnju muškaraca putnice nose stvarni ili lažni vjenčani prsten te slike stvarnog ili izmišljenog supruga, što je praksa koju podržavaju i neke vladine web stranice koje pružaju savjete o sigurnosti žena (Kaba, 2021). Nadalje, jedna od taktika je ignoriranje komentara koji im se dobacuju, izbjegavanje kontakta očima te korištenje raznih sredstava (npr. knjiga, mobi-

ly avoided in the evening or at night (Kaba, 2021; Koskela, 1997; Wilson & Little, 2008; Wilson et al., 2009; Yang et al., 2018a; Zhang et al., 2022). Risk reduction also includes sticking to central and busier areas, especially when moving around in the evening. Another strategy that female travellers use to reduce their sense of insecurity is surrounding themselves with local women and children, for example, by being near them on public transportation (Douglas & Barrett, 2020).

To deter unwanted male attention, some solo travellers wear a real or fake wedding ring or carry a photo of a real or imaginary husband, a practice even supported by some government websites offering safety advice for women (Kaba, 2021). Other tactics include ignoring catcalls, avoiding direct eye contact, and using distractions such as books or mobile phones to avoid making eye con-

Tablica 3. *Glavne strategije nošenja s rizicima na samostalnom putovanju*
Table 3 *Main strategies for managing risks while travelling solo*

Kategorija strategija / *Category of strategies*	**Strategije / *Strategies***
Priprema i planiranje / *Preparation and planning*	Informiranje o destinaciji i dijeljenje svojih planova i lokacije s bliskim osobama / *Getting informed about the destination and sharing your plans and location with close contacts* Istraživanje destinacije s lokalnim vodičem / *Exploring the destination with a local guide* Povezivanje s drugim putnicima / *Connecting with other travelers* Primjena iskustava za suočavanje s nepoznatim prostorima i ljudima / *Using prior experience to cope with unfamiliar places and people* Stvaranje mentalnih mapa prostora / *Creating mental maps of spaces* Ograničenje izbora destinacija na temelju percepcije sigurnosti / *Limiting destination choices based on perceived safety*
Prilagodba prostorno- vremenskih praksi / *Adapting spatiotemporal practices*	Izbjegavanje nesigurnih mjesta (uske ulice, podzemne garaže, stanice javnog prijevoza, parkovi…) / *Avoiding unsafe places (narrow streets, underground garages, public transport stations/stops, parks, etc.)* Kretanje prometnijim i središnjim lokacijama / *Sticking to busier, central areas* Izbjegavanje posjećivanja određenih objekata noću (npr. kafića) / *Avoiding visits to certain venues at night (e.g., cafés/bars)* Izbjegavanje kretanja u večernjim satima i noću / *Avoiding being out in the evening and at night*
Prilagodba kulturnim kontekstima i rodnim normama / *Adapting to cultural contexts and gender norms*	Odijevanje u skladu s lokalnom kulturom / *Dressing in accordance with local culture* Usklađivanje s lokalnim (ženskim) normama ponašanja / *Conforming to local (female) norms of behavior* Okruživanje ženama i djecom u javnom prostoru / *Surrounding oneself with women and children in public spaces* Nošenje stvarnog ili lažnog vjenčanog prstena / *Wearing a real or fake wedding ring* Korištenje fotografija stvarnog ili izmišljenog supruga / *Using photos of a real or fictitious husband* Izbjegavanje interakcija s muškarcima / *Avoiding interactions with men* Ignoriranje dobacivanih komentara / *Ignoring comments* Izbjegavanje kontakata očima s nepoznatima / *Avoiding eye contact with strangers*

Izvor / Source: *prema Cockburn-Wootten i sur. (2006); Douglas i Barrett (2020); Kaba (2021); Seagrave (2016); Valentine (1989); Wilson i Little (2008); Wilson i sur. (2009); Yang i sur. (2018a, 2018b)*

tela) da bi se izbjegli pogledi drugih (Douglas & Barrett, 2020).

Unajmljivanje lokalnog vodiča s kojim istražuju destinaciju i upoznavanje drugih putnika još je jedan od načina nošenja s potencijalnim rizikom samostalnog putovanja (Cockburn-Wootten i sur., 2006). Također, informiranje prijatelja i obitelji o planiranim dnevnim aktivnostima i dijeljenje lokacije osiguravana određenu sigurnost (Seagrave, 2016). Mnoge žene oslanjaju se na svoja iskustva koja su im pomogla da se snađu u nepoznatim prostorima te se njima koriste da bi smanjile osjećaje ranjivosti (Cockburn-Wootten i sur., 2006). Povjerenje u vlastitu intuiciju jedan je od najčešćih savjeta koje samostalne putnice daju drugim putnicama, uz korištenje „zdravog razuma", svjesnost o vlastitom ponašanju tijekom putovanja i izbjegavanje nepotrebno rizičnih situacija (Kaba, 2021; Wilson i sur., 2009).

Analiza navedenih strategija koje primjenjuju samostalne putnice odražavaju visoku razinu svijesti o potencijalnim rizicima, ali i aktivnu prilagodbu situacijama kako bi se osigurala sigurnost i osjećaj kontrole. Priprema, planiranje i prilagodba kulturnim, rodnim te prostorno-vremenskim normama pomažu ženama smanjiti ranjivost i povećati samopouzdanje tijekom putovanja. Iako se te strategije često temelje na prevenciji i izbjegavanju rizičnih situacija, one pokazuju snalažljivost, otpornost i sposobnost žena da upravljaju vlastitim iskustvima omogućujući im slobodu istraživanja novih prostora i uživanje u putovanju.

ZAKLJUČNA RAZMATRANJA

Samostalna putovanja žena rastući su segment turističkog tržišta potaknut značajnim promjenama u društvenim normama i rodnim odnosima, sve većom ekonomskom neovisnošću žena, te rastom broja samačkih kućanstva i promjenom stila života (Jordan & Gibson 2005; Wilson & Little, 2005). Za dublje razumijevanje samostalnih putovanja žena ključno je uključiti demografske i socioekonomske podatke poput dobi, obrazovanja, zaposlenosti, razine prihoda, bračnog statusa, etničke pripadnosti i drugog. Ta se tema rijetko proučavala iz perspektive geografskih disciplina poput demogeografije ili ekonomske geografije te bi u budućim istraživanjima

tact with others (Douglas & Barrett, 2020).

Hiring a local guide and connecting with other travellers is another risk-management strategy for solo travel (Cockburn-Wootten et al., 2006). Keeping friends and family informed about daily plans and sharing location data also enhances personal safety (Seagrave, 2016). Many women rely on their past experiences to navigate unfamiliar environments, reducing the feeling of vulnerability (Cockburn-Wootten et al., 2006). One of the most common pieces of advice solo female travellers share with others is to trust their intuition, use common sense, be aware of their behaviour, and avoid unnecessary risks (Kaba, 2021; Wilson et al., 2009).

The analysis of the strategies used by solo female travellers reflects a high level of awareness of potential risks, as well as an active adaptation to situations in order to ensure safety and a sense of control. Preparation, planning, and adaptation to cultural, gender, and spatial-temporal norms help women reduce vulnerability and increase self-confidence during their travels. Although these strategies are often based on prevention and avoiding risky situations, they also highlight resourcefulness, resilience, and the ability of women to manage their own experiences in a way that allows them freedom in exploring new spaces and enjoyment while travelling.

CONCLUDING REMARKS

Solo female travel represents a growing segment of the tourism market, driven by significant changes in social norms and gender relations, increasing economic independence among women, the rise of single-person households, and shifts in lifestyle choices (Jordan & Gibson, 2005; Wilson & Little, 2005). For a deeper understanding of women's solo travel, it is essential to include demographic and socioeconomic data such as age, education, employment, income level, marital status, ethnicity, and other. Although this topic has rarely been studied from the perspective of geographic disciplines like demography or economic geography, it would be beneficial to incorporate these aspects in future research, as well. Analysing changes in demographic structures can help identify factors

bilo korisno uključiti i te aspekte. Analiza promjena u demografskim strukturama može pomoći u prepoznavanju čimbenika koji potiču žene na samostalna putovanja te objasniti razlike u njihovim ponašanjima i percepciji rizika.

U ovom je radu analiza prethodnih istraživanja provedena s fokusom na četiri značajna aspekta samostalnog putovanja. Kao prvo, istraživanja pokazuju da su motivacije za samostalno putovanje višeslojne, a kreću se od potrebe za vlastitim osnaživanjem, osobnim rastom i razvojem samopouzdanja do bijega od svakodnevne rutine i obaveza te želje za upoznavanjem novih kultura, ljudi i običaja (Chiang & Jogaratnam, 2006; Ejupi & Medaric 2022; Jordan & Gibson, 2005; Lagier i sur., 2021; Pereira & Silva, 2018).

Rod i prostor, ograničenja i pitanje sigurnosti te strategije ponašanja samostalnih putnica tri su aspekta rada koja se međusobno se prožimaju. Analiza istraživanja o temi rada upućuje na to da su na samostalnom putovanju žene izložene različitim izazovima. Za većinu žena najveći problem je nošenje s neželjenom muškom pažnjom. Kao odgovor na taj problem, samostalne putnice prilagođavaju svoje prostorne prakse i svoj izgled (Kaba, 2021; Wilson & Little, 2008; Wilson i sur., 2009; Yang i sur., 2018a; Zhang i sur., 2022). Geografski aspekt planiranja putovanja u tom smislu ima važan utjecaj jer prilagodba za većinu putnica počinje odabirom turističkih destinacija. Pri tome su pojedine destinacije i regije svijeta kodirane kao nepoželjne za samostalno putovanje (poput Afrike, Bliskog istoka i muslimanskih država općenitije). Nadalje, na odredištu putnice dodatno usklađuju svoj izgled i ponašanje s lokalnim ženskim normama (npr. u vidu primjerenog načina odijevanja) te ograničavaju svoje prostorno-vremenske prakse. Određena mjesta kod putnica izazivaju nelagodu i strah, zbog čega ih izbjegavaju te prilagođavaju rute kretanja tim kriterijima. Posebno, takva se mjesta izbjegavaju u večernjim i noćnim satima kada postoji i veća mogućnost za neželjeno privlačenje pozornosti.

Istraživanja pokazuju da navedene mjere opreza ipak ograničavaju samostalne putnice u doživljaju prostora i utječu na njihovo zadovoljstvo putovanjem (Jordan & Aitchison, 2008; Wilson & Little, 2005; 2008). Usprkos tome, primjenom navedenih strategija samostalne putnice pronašle su način

that encourage women to travel solo and explain differences in their behaviour and risk perceptions.

The analysis of relevant literature in this study focused on four important aspects of solo travel. Firstly, research indicates that motivations for solo travel are multifaceted, ranging from the need for self-empowerment, personal growth, and confidence development to escaping daily routines and responsibilities, as well as the desire to explore new cultures, people, and traditions (Chiang & Jogaratnam, 2006; Ejupi & Medaric, 2022; Jordan & Gibson, 2005; Lagier et al., 2021; Pereira & Silva, 2018).

The other three key aspects emphasized in this paper - gender and space, constraints and the perceptions of safety, and the behavioural strategies of solo female travellers - are closely interconnected. Analysing previous research on the topic indicates that women face various challenges when travelling alone, with unwanted male attention being the most significant concern for most. In response, solo female travellers adjust their spatial practices and appearance (Kaba, 2021; Wilson & Little, 2008; Wilson et al., 2009; Yang et al., 2018a; Zhang et al., 2022). The geographical aspect of travel planning plays a crucial role in this context, as adaptation for most solo female travellers begins with the selection of tourist destinations. Certain destinations and regions of the world (such as Africa, the Middle East, and Muslim-majority countries in general) are often coded as undesirable for solo female travel. Furthermore, once at their destination, female travellers tend to align their appearance and behaviour with local female norms (e.g., adopting culturally appropriate clothing styles) and further restrict their spatial-temporal practices. Specific locations often evoke discomfort and fear among female travellers, leading them to avoid these places and adjust their travel routes accordingly. In particular, these areas are commonly avoided in the evening and nighttime when the likelihood of attracting unwanted attention is higher.

As previous studies show, such precautionary measures ultimately limit solo female travellers' spatial experiences and affect their overall satisfaction with their travels (Jordan & Aitchison, 2008; Wilson & Little, 2005, 2008). However, by employing these strategies, solo female travellers have

da se odupru strahu i da se odvaže na samostalna putovanja, pokazujući time da su benefiti koje im ono donosi ipak vrjedniji od potencijalnih preprека s kojima se suočavaju samim time što su žene. Jordan i Gibson (2005) u tom su smislu opisuju turizam kao arenu u kojoj žene mogu vježbati otpornost prema rodnim stereotipima.

Žene koje se odluče na samostalno putovanje moraju pažljivo planirati kamo će putovati, uzimajući u obzir različite kriterije od kojih je najvažniji sigurnost destinacije. Unatoč mnogobrojnim vodičima, internetskih člancima i prilozima koji sugeriraju da su određene države ili regije popularnije među samostalnim putnicama, nedostaju sustavni znanstveni i usporedivi podaci. Postoje sekundarni izvori poput podataka turističkih agencija (npr. Condor Ferries, Road Scholar) i rezultata globalnih anketa (npr. Statista), no ti se podaci uglavnom fokusiraju na opći profil samostalnih putnica ili trendove rasta, bez detaljne razrade po državama i regijama. U dosadašnjoj znanstvenoj literaturi, s prostornog aspekta, veći je fokus bio na identifikaciji nesigurnih mjesta unutar destinacija koje putnice doživljavaju kao problematične i koje utječu na njihove prostorne prakse. No nedostaje sustavna analiza koja bi obuhvatila privlačnost destinacija i sigurnosne aspekte u širem prostornom kontekstu, na razini cijelih destinacija, regija ili država. Ta uočena praznina otvara prostor za buduća istraživanja, osobito iz geografske perspektive, koja bi prostornom analizom sigurnosnih čimbenika putovanja pridonijela boljem razumijevanju teme. Prikupljanje i analiza tih podataka omogućili bi dublje razumijevanje prostornih obrazaca i preferencija samostalnih putnica, čime bi se stvorili temelji za oblikovanje učinkovitijih sigurnosnih politika te razvoj raznovrsnije turističke ponude prilagođene specifičnim potrebama i interesima žena koje putuju same.

Autorski doprinosi:

L.M.: istraživanje literature, konceptualizacija istraživanja, metodologija, pisanje – priprema izvornog rada, pisanje – završna verzija. L. S. B.: istraživanje literature, konceptualizacija istraživanja, pisanje – završna verzija, nadzor.

Sukob interesa: Autori izjavljuju da nema sukoba interesa.

found ways to overcome fear and embark on independent journeys, demonstrating that the benefits of solo travel outweigh the potential obstacles they face simply because they are women. In this regard, Jordan and Gibson (2005) described tourism as an area where women can practice resilience against gender stereotypes.

Nevertheless, women who choose to travel solo must carefully plan where they will go, taking into account various criteria, among which safety is the most important. However, despite the numerous guidebooks, online articles, and media features suggesting that certain countries or regions are more popular among solo female travellers, systematic and comparable scientific data are lacking. There are secondary sources such as data from travel agencies (e.g., Condor Ferries, Road Scholar) and results from global surveys (e.g., Statista), but these sources mostly focus on the general profile of solo female travellers or growth trends, without detailed breakdowns by countries or regions. In existing scholarly literature, from a spatial perspective, more attention has been given to identifying unsafe places within destinations that female travellers perceive as problematic and that influence their spatial practices. However, there is a lack of systematic analysis addressing the attractiveness and safety aspects of destinations in a broader spatial context, at the level of entire destinations, regions, or countries. This observed gap opens opportunities for future research, particularly from a geographical perspective, which could, through spatial analysis of safety factors in travel, contribute to a better understanding of the topic. Collecting and analysing such data would enable deeper insight into the spatial patterns and preferences of solo female travellers, thereby laying the groundwork for the development of more effective safety policies and a more diverse tourism offer tailored to the specific needs and interests of women who travel alone.

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PROSTORNA VARIJACIJA (NE)POUZDANOSTI MIGRACIJSKIH PODATAKA KAO SCHRÖDINGEROVA MAČKA DEMOGRAFSKE STATISTIKE U HRVATSKOJ

SPATIAL VARIATION OF (UN)RELIABILITY IN MIGRATION DATA AS SCHRÖDINGER'S CAT OF DEMOGRAPHIC STATISTICS IN CROATIA

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Mnogobrojni empirijski dokazi upućuju na slabiju pouzdanost migracijskih podataka Državnog zavoda za statistiku kao i podcijenjenost intenziteta iseljavanja iz Hrvatske nakon pristupanja Europskoj uniji. Glavnina dokaza temelji se na usporedbi službenih hrvatskih podataka s podacima drugih zemalja, pri čemu službena statistika prikazuje povoljnije stanje od stvarnog. U ovom se radu razmatra prostorni aspekt (ne)pouzdanosti migracijskih podataka unutar Hrvatske. Na podacima regionalne i lokalne razine uspoređuju se razlike migracijskog salda od 2011. do 2021. godine iz dvaju različitih izvora: službenih podataka i podataka dobivenih vitalno-statističkom metodom. Za oba seta podataka korištena je prosječna godišnja stopa migracijskog salda, a njihova razlika, kao promatrana varijabla, istražena je metodama deskriptivne statistike i prostorne analize. Metodološkim okvirom omogućena je procjena razine nepouzdanosti migracijskih, ali i širih demografskih podataka na nižim prostornim razinama. Rezultati pokazuju da kvaliteta demografske statistike u Hrvatskoj znatno varira u prostoru. Precijenjenost migracijskog salda u službenim podacima, kao otprije poznat fenomen na nacionalnoj razini, izražena je na županijskoj razini, a dominantna je pojava i na lokalnoj razini, no različitog intenziteta u prostoru. Za gotovo polovinu svih lokalnih jedinica podaci su ocijenjeni kao zadovoljavajuće pouzdani, dok se za otprilike četvrtinu do trećinu jedinica pouzdanost smatra upitnom. Slabija pouzdanost podataka posebno je izražena u priobalju i većim gradovima, što je posljedica pojačane migracijske aktivnosti, visokog udjela nedefiniranih migracija te nesklada između prijavljenog i stvarnog stanja. Pritom važnu ulogu ima ponašanje stanovništva. Kod dijela jedinica s nižom razinom pouzdanosti podataka nepouzdanost se očituje u podcjenjivanju stvarnih migracijskih tokova u službenim podacima. Takva odstupanja upućuju i na moguće slabosti popisne statistike. Rezultati mogu poslužiti kao alat za preciznije prepoznavanje uzroka nepouzdanosti podataka te prosudbu je li broj stanovnika u određenoj jedinici podcijenjen ili precijenjen. Institucijama se pruža temelj za unaprjeđenje sustava prikupljanja i moguću korekciju podataka u područjima slabije pouzdanosti.

Ključne riječi: demografija; migracije; migracijski saldo; pouzdanost podataka; prostorna analiza; Hrvatska

Numerous empirical findings suggest that migration data published by the Croatian Bureau of Statistics may lack reliability, particularly in underestimating the scale of emigration following Croatia's accession to the European Union. Most evidence is based on comparisons between Croatian official data and those from receiving countries, indicating that Croatian statistics may systematically underestimate emigration trends. This paper considers the spatial dimension of (un)reliability in Croatian migration statistics. The analysis examines the differences in net migration rates between official statistics and vital-statistical method data across regional and local levels from 2011 to 2021. For both datasets, the average annual net migration rate was calculated, and the difference between them – used as the observed variable – was analysed using descriptive statistics and spatial analysis methods. The methodological framework enabled an assessment of the reliability of both migration and broader demographic data at lower spatial scales. Results show considerable spatial variation in data quality. Overestimation of net migration in official data, previously identified at the national level, is also observable at the county level. At the local level, it remains a dominant pattern, though its intensity varies across space. Around half of local units show acceptable levels of data reliability, while in one-quarter to one-third of cases, data quality remains questionable. Coastal areas and large cities stand out for lower reliability, largely due to intense migration dynamics, a high share of unregistered movements, and discrepancies between registered and actual residence – influenced by population behaviour. In some units, unreliable data reflect underestimated migration flows, pointing to potential weaknesses in census data as well. Findings offer a tool for identifying sources of data unreliability and determining whether local population figures are overestimated or underestimated. They also provide institutions with a framework for improving data collection systems and correcting records in areas of low reliability.

Keywords: demography; migration; net migration; data reliability; spatial analysis; Croatia

UVOD

Migracijska statistika zbog metodoloških izazova i problema s prikupljanjem pouzdanih podataka često je najslabiji segment demografske statistike (Ahmad Yar & Bircan, 2023; Willekens, 1994). Slabija pouzdanost migracijske statistike posebno je izražena u zemljama poput Hrvatske koje još nemaju registar stanovništva[1]. U recentnom razdoblju mnogi empirijski dokazi upućuju na nepotpunost i nepouzdanost službenih podataka Državnog zavoda za statistiku (Akrap i sur., 2017; Balija, 2020; Komušanac, 2023; Mesarić Žabčić, 2021; Pavić & Ivanović, 2019; Pokos, 2017; Pokos & Turk, 2022a; Strmota, 2020; Strmota & Ivanda, 2022; Šterc, 2023). Glavnina dokaza svodi se na usporedbu podataka o iseljavanju DZS-a s useljeničkim podacima drugih zemalja poput Njemačke, Austrije ili Irske. Na temelju izrazitog nesklada između podataka domaćeg statističkog zavoda i stranih statističkih zavoda univerzalni je zaključak podcijenjenost intenziteta iseljavanja iz Hrvatske nakon pristupanja Europskoj uniji. To implicira na nepovoljnije stvarno stanje migracijske bilance u odnosu na službene podatke DZS-a. Rezultatima Popisa 2021. godine zaključak je dodatno potvrđen – negativan migracijski saldo za razdoblje od 2011. do 2021. dobiven vitalno-statističkom metodom više je nego dvostruko veći u odnosu na službene podatke. Prema recentnom istraživanju, Hrvatska se ubraja među zemlje s visokom razinom nedovoljno prijavljenih migracija, posebno u emigracijskim statistikama (Dańko i sur., 2024).

Unatoč mnogobrojnim istraživanjima i potvrđenoj slabijoj pouzdanosti migracijske statistike na podacima nacionalne razine, malo se zna o prisutnosti i intenzitetu statističkog nesklada u podacima regionalne i lokalne razine u Hrvatskoj. Kao derivacija slabije pouzdanosti na nacionalnoj razini, logično je i opravdano očekivati slabiju pouzdanost podataka i na regionalnoj i lokalnoj razini. Ipak, postavlja se više nerazjašnjenih pitanja. Vrijedi li opći zaključak o nepouzdanosti migracijske statistike za prostor cijele Hrvatske? Je li intenzitet ne-

[1] Prema Zakonu o središnjem registru stanovništva (NN, 67/2025), puna primjena registra u Hrvatskoj očekuje se od 1. lipnja 2026.

INTRODUCTION

Due to methodological challenges and issues related to the collection of reliable data, migration statistics often represents the weakest segment of demographic statistics (Ahmad Yar & Bircan, 2023; Willekens, 1994). The limited reliability of migration statistics is particularly pronounced in countries such as Croatia, which have not yet established a population register.[1] In recent years, numerous empirical findings have pointed to the incompleteness and unreliability of official data published by the Croatian Bureau of Statistics (CBS) (Akrap et al., 2017; Balija, 2020; Komušanac, 2023; Mesarić Žabčić, 2021; Pavić & Ivanović, 2019; Pokos, 2017; Pokos & Turk, 2022a; Strmota, 2020; Strmota & Ivanda, 2022; Šterc, 2023). The core of the evidence is based on comparisons between the emigration data published by the CBS and the immigration statistics of countries such as Germany, Austria, and Ireland. The significant discrepancy between Croatian and foreign statistical sources has led to a broad consensus that Croatia's official data substantially underestimate the intensity of emigration following accession to the European Union. This, in turn, implies that the actual migration balance is more unfavourable than suggested by official statistics. The findings of the 2021 Census further support this conclusion – the negative migration balance for the 2011–2021 period, calculated using the vital statistics method, is more than twice as high as indicated by official figures. According to a recent study, Croatia is among the countries with a high level of underreported migration, especially regarding emigration statistics (Dańko et al., 2024).

Despite numerous studies and the well-documented unreliability of migration statistics at the national level, little is known about the presence and intensity of statistical discrepancies at the regional and local levels in Croatia. As a derivative of the lower reliability observed nationally, it is logical to expect reduced data reliability at subnational levels as well. Nevertheless, several unresolved questions arise.

[1] According to the Law on the Central Population Register (Official Gazette No. 67/2025), full implementation of the register in Croatia is expected from 1 June 2026.

pouzdanosti podataka prostorno ujednačen? Kako definirati granice nepouzdanosti migracijskih podataka? Postoje li područja u kojima je stvarna migracijska bilanca povoljnija od službenih podataka, što bi odudaralo od generalne teze? Mogu li se uspoređivati različiti migracijski podaci iz različitih izvora? Jesu li popisni podaci pouzdani za područje cijele Hrvatske?

U ovom se radu pokušava odgovoriti na navedena pitanja ili barem otvoriti raspravu o njima. Stoga je predmet istraživanja problematika (ne) pouzdanosti recentnih demografskih podataka u Hrvatskoj, s naglaskom na prostorni aspekt fenomena. Migracijski i popisni podaci za razdoblje od 2011. do 2021. godine upotrebljavaju se u brojnim istraživanjima, pa je za istraživače od iznimne važnosti znati jesu li dovoljno pouzdani za sva područja Hrvatske, postoje li područja za koja to ne vrijedi i koja su to područja. Ovo je istraživanje važno i zbog razvoja metodološkog okvira za procjenu pouzdanosti migracijske statistike na regionalnoj i lokalnoj razini. Nadalje, istraživanje je relevantno jer rezultati mogu pomoći institucijama u poboljšanju metodologije prikupljanja demografskih podataka. U skladu s tim, ciljevi ovoga istraživanja su: (I) analizirati prostorne obrasce (ne)pouzdanosti migracijske statistike u Hrvatskoj za recentno razdoblje, (II) kreirati metodološki okvir za kvantifikaciju intenziteta nepouzdanosti migracijskih podataka, (III) identificirati područja upitne pouzdanosti migracijskih i popisnih podataka u Hrvatskoj. Polazeći od dosadašnjih istraživanja i uvida iz recentnog popisa, postavlja se sljedeća hipoteza: Nepouzdanost demografske statistike u Hrvatskoj pokazuje značajnu prostornu varijaciju, pri čemu se u priobalnim područjima i većim urbanim centrima bilježi veća neusklađenost dvaju izvora podataka, a time i slabija pouzdanost migracijskih i/ili popisnih podataka.

Istraživanje se ogleda u ova tri doprinosa: empirijski, metodološki i praktični. Prostorni aspekt nepouzdanosti demografske statistike u Hrvatskoj empirijski je doprinos te poboljšava shvaćanje varijacije u kvaliteti podataka i omogućuje bolje razumijevanje demografskih procesa. Razvijen inovativni okvir za kvantifikaciju intenziteta nepouzdanosti migracijskih podataka unutar zemlje

Does the general conclusion regarding the unreliability of migration statistics apply uniformly across all areas of Croatia? Is the intensity of data uncertainty spatially uniform? What are the margins of error in migration data across regions? Furthermore, are there areas where the actual migration balance is more favourable than suggested by official statistics, which would challenge the dominant assumption? Can different migration data from various sources be meaningfully compared? Finally, are census data reliable for the entire territory of Croatia?

This paper seeks to address the aforementioned questions or, at the very least, to initiate a discussion around them. Accordingly, the focus of the research is the issue of (un)reliability in recent demographic data in Croatia, with particular emphasis on the spatial dimension of the phenomenon. Migration and census data for the period 2011–2021 have been and will continue to be widely used in various studies. Accordingly, it is essential for researchers to assess the reliability of these data across the entire territory of Croatia, to determine where this reliability may be lacking, and to identify the specific areas concerned. This study is also important for the development of a methodological framework to assess the reliability of migration statistics at the regional and local levels. Furthermore, it is relevant in practical terms, as its findings can assist institutions in improving the methodology for collecting demographic data. In line with this, the objectives of the research are as follows: (I) to analyse the spatial patterns of (un)reliability in Croatian migration statistics for the recent period; (II) to develop a methodological framework for quantifying the intensity of migration data unreliability; and (III) to identify areas of questionable reliability in both migration and census data across Croatia. Based on previous research and insights from the most recent census, the following hypothesis is proposed: The unreliability of demographic statistics in Croatia is characterized by considerable spatial variation, with coastal areas and major cities showing greater discrepancies between the two data sources and, consequently, lower reliability of migration and/or census data.

This study provides three key contributions: empirical, methodological, and practical. The spatial dimension of demographic data unreliability in Croatia provides an empirical contribution, as it enhances the

predstavlja metodološki doprinos. Njime se procjenjuje nesklad među različitim izvorima podataka, a postupak je primjenjiv i u drugim zemljama. Istraživanje ima i praktični doprinos jer rezultati mogu pomoći institucijama u unaprjeđenju metodologije za prikupljanje i analizu migracijskih podataka. Time se osiguravaju preciznije informacije za donošenje i provedbu politika demografske revitalizacije.

Okosnicu rada čini usporedba migracijskih podataka na temelju ovih dvaju izvora: službeni podaci DZS-a i komparativni podaci dobiveni vitalno-statističkom metodom. Nakon izračuna dviju različitih stopa migracijskog salda analizira se njihova razlika. U sljedećem koraku ta se razlika izražava u standardnim devijacijama, što omogućuje objektivnije identificiranje područja izrazitog nesklada u podacima. Za potvrdu rezultata i produbljivanje interpretacije primjenjuje se prostorna statistika.

TEORIJSKI OKVIR

(Ne)pouzdanost migracijskih podataka

Pouzdanost migracijskih podataka temelj je za razumijevanje demografskih kretanja i za oblikovanje javnih politika. Kvalitetna migracijska statistika izravno utječe na učinkovito planiranje gospodarskog razvoja, prostornog uređenja, socijalne skrbi i obrazovanja te na oblikovanje integracijskih i povratničkih politika (Ahmad Yar & Bircan, 2023; Dańko i sur., 2024; Willekens, 2019; Wiśniowski, 2021). Glavni problemi migracijske statistike obuhvaćaju slučajne pogreške pri prikupljanju, podcjenjivanje, ograničeni obuhvat populacije te neusklađenost definicija nacionalnih i međunarodnih standarda (Dańko i sur., 2024; Raymer i sur., 2013). Nepouzdanost migracijskih podataka ogleda se kroz dvije glavne pojave: podcjenjivanje (engl. *undercounting*) i precjenjivanje (engl. *overcounting*) migracijskih tokova. S izazovima u osiguranju pouzdane migracijske statistike suočavaju se i razvijenije zemlje, što otežava izradu dugoročnih projekcija i oblikovanja javnih politika, a najizraženije podcjenjivanje iseljavanja prisutno je kod novijih članica Europske unije, među kojima je i Hrvatska (Dańko i sur., 2024; de Beer i sur., 2010).

understanding of variation in data quality and offers deeper insight into demographic processes. The development of an innovative framework for quantifying the intensity of migration data unreliability within the country represents the methodological contribution. This approach enables the assessment of discrepancies between different data sources and is applicable in other national contexts as well. Finally, the study offers a practical contribution, as its findings may assist institutions in improving the methodology for collecting and analysing migration data. This, in turn, ensures more accurate information for the formulation and implementation of demographic revitalisation policies.

The core of this study is a comparison of migration data from two sources: official data from the Croatian Bureau of Statistics (CBS) and comparative data obtained using the vital-statistical method. After calculating two distinct net migration rates, their difference is analysed. In the next step, this difference is expressed in standard deviations, enabling a more objective identification of areas with significant data discrepancies. In order to validate the results and deepen the interpretation, spatial statistical methods are employed.

THEORETICAL FRAMEWORK

(Un)reliability of Migration Data

The reliability of migration data is a cornerstone for understanding demographic trends and for shaping public policy. High-quality migration statistics directly influence the effective planning of economic development, spatial planning, social welfare, and education, as well as the design of integration and return policies (Ahmad Yar & Bircan, 2023; Dańko et al., 2024; Willekens, 2019; Wiśniowski, 2021). The main challenges in migration statistics include random errors in data collection, undercounting, limited population coverage, and inconsistencies between national and international definitions (Dańko et al., 2024; Raymer et al., 2013). Unreliability in migration data manifests primarily in two ways: undercounting and overcounting of migration flows. Even more developed countries face challenges in producing reliable migration statistics, which complicates the development of long-term

Migracije uključuju promjenu uobičajenog boravišta i obuhvaćaju širok spektar prostornog kretanja stanovništva – od lokalnih do međunarodnih preseljenja. Unatoč njihovoj izrazitoj važnosti u demografskim procesima, precizno definiranje i mjerenje migracija nakon desetljeća metodoloških poboljšanja i dalje predstavlja izazov (Ahmad Yar & Bircan, 2023; Bell i sur., 2015; de Beer i sur., 2010; Kirchberger, 2021; Willekens, 1994). Razlike u definicijama među zemljama, ali i unutar različitih izvora podataka, otežavaju usporedivost i precizno praćenje migracijskih tokova (Pavić & Ivanović, 2019; Raymer i sur., 2013; Willekens, 2019). Tako primjerice neke zemlje definiraju migranta prema administrativnom kriteriju prijave prebivališta, druge se koriste kriterijima trajanja boravka ili samoizvještavanja putem anketa. Dodatnu kompleksnost tematici unosi razlikovanje međunarodnih i unutarnjih migracija. Unutarnje su migracije obično bolje praćene, dok međunarodne zahtijevaju usklađenost definicija i suradnju među zemljama (Dańko i sur., 2024; Wiśniowski, 2021). Podcjenjivanje, kao jedan od najistaknutijih problema u migracijskoj statistici, posebno je izraženo u praćenju iseljavanja jer se odlazak iz zemlje često ne prijavljuje ili se evidentira sa značajnim kašnjenjem. Prema procjenama modela IMEM, u zemljama visokog podcjenjivanja iseljavanja u prosjeku je zabilježeno tek oko 45 % stvarnih emigracijskih tokova (Raymer i sur., 2013). Podaci za Hrvatsku variraju po godinama i po zemljama, no prosječan udio evidentiranih iseljenja još je niži (Balija, 2020; Strmota, 2020).

Jedan od ključnih elemenata za kvalitetu migracijskih podataka je kriterij trajanja boravka. Međunarodne preporuke, uključujući regulativu Europske unije 862/2007, definiraju migranta kao osobu koja mijenja prebivalište na minimalno 12 mjeseci, no mnoge zemlje primjenjuju kraće ili neodređene kriterije, što dovodi do precjenjivanja ili podcjenjivanja tokova (Dańko i sur., 2024; Raymer i sur., 2013). U Hrvatskoj se primjenjuju međunarodne preporuke, a praćenje migracijskih tokova provodi se na temelju podataka o prijavi i odjavi prebivališta i boravišta koje prikuplja Ministarstvo unutarnjih poslova (MUP). Prijava i odjava prebivališta uređe-

projections and policymaking. The undercounting of emigration is particularly prominent in newer European Union member states, including Croatia (de Beer et al., 2010; Dańko et al., 2024).

Migration involves a change in usual residence and encompasses a wide range of spatial population movements – from local relocations to international migration. Despite its critical importance in demographic processes, the precise definition and measurement of migration remain a challenge, even after decades of methodological improvements (Ahmad Yar & Bircan, 2023; Bell et al., 2015; de Beer et al., 2010; Kirchberger, 2021; Willekens, 1994). Differences in definitions between countries, and even among different data sources, complicate the comparability and accurate monitoring of migration flows (Pavić & Ivanović, 2019; Raymer et al., 2013; Willekens, 2019). For example, some countries define a migrant based on administrative registration of residence, others use duration-of-stay criteria or rely on self-reported data through surveys. The distinction between international and internal migration adds further complexity. While internal migration tends to be better tracked, international migration requires harmonised definitions and cooperation between countries (Dańko et al., 2024; Wiśniowski, 2021). Undercounting remains one of the most prominent problems in migration statistics, particularly in capturing emigration, as departures are often unreported or recorded with significant delay. According to estimates from the IMEM model, in countries with high levels of emigration undercounting, only around 45% of actual emigration flows are captured (Raymer et al., 2013). In Croatia, the proportion of recorded emigration varies by year and destination country, but is generally even lower (Balija, 2020; Strmota, 2020).

One of the key elements affecting the quality of migration data is the length-of-stay criterion. International recommendations, including European Union Regulation 862/2007, define a migrant as a person who changes their place of residence for at least 12 months. However, many countries apply shorter or vague criteria, which leads to either overestimation or underestimation of migration flows (Dańko et al., 2024; Raymer et al., 2013). In Croatia, international recommendations are formally adopted, and migra-

ne su Zakonom o prebivalištu (NN, 144/2012 i 158/2013). Postojeći administrativni pristup ovisi o pravovremenoj i točnoj prijavi građana, što može dovesti do podcjenjivanja stvarnih migracijskih tokova.

Izvori i metode procjena migracijskih tokova

Pouzdanost migracijske statistike ovisi o kvaliteti izvora podataka, pri čemu svaki od njih ima specifične prednosti i ograničenja. Administrativni izvori, kao što su registri stanovništva, prijave i odjave prebivališta te baze podataka o boravišnim dozvolama temelj su službene migracijske statistike u mnogim zemljama (Ahmad Yar & Bircan, 2023; Wiśniowski, 2021). Njihove su glavne prednosti kontinuirano prikupljanje i široka obuhvatnost podataka. Međutim, kvaliteta podataka ovisi o pravnom okviru, učinkovitosti administracije i ponašanju stanovništva (Ahmad Yar & Bircan, 2023). U kontekstu Hrvatske, to je posebno izraženo nakon 2013. godine kada administrativna obveza odjave prebivališta nije dovoljno motivirana ni sankcionirana (Pokos & Turk, 2022a; Strmota & Ivanda, 2022). Popisi stanovništva često uključuju pitanja o mjestu rođenja i prethodnom stanovanju, stoga je moguća sveobuhvatna analiza migracijskih obrazaca, što je napose vrijedno u zemljama koje nemaju registre stanovništva. Međutim, ključni nedostatak popisnih podataka je povremeno prikupljanje podataka i kašnjenje u dostupnosti rezultata, čime je ograničena korisnost za pravovremeno praćenje migracijskih kretanja (Ernsten i sur., 2018; Kirchberger, 2021; Lomax, 2022). U Hrvatskoj popisni podaci služe kao korektiv administrativnim podacima, premda i njih karakteriziraju metodološki izazovi, poput nepreciznog i „fiktivnog" popisivanja te znatnog udjela odsutnog stanovništva (Lajić & Mišetić, 2013; Pokos & Turk, 2022b). Razvoj novih tehnologija otvorio je prostor za korištenje alternativnih izvora podataka, poput digitalnih tragova mobilnih telefona, podataka društvenih mreža i administrativnih evidencija trećih strana, koji omogućuju procjenu migracija gotovo u stvarnom vremenu (Kirchberger, 2021; Wiśniowski, 2021). Unatoč pravovremenosti i iscrpnosti takvih podataka, problemi privatnosti,

tion flows are monitored based on data on the registration and deregistration of residence and temporary stay, collected by the Ministry of the Interior (MUP). The procedures for residence registration and deregistration are governed by the Law on Permanent Residence (Official Gazette 144/2012 and 158/2013). This administrative approach relies on timely and accurate reporting by citizens, which can result in undercounting of actual migration flows.

Sources and Methods for Estimating Migration Flows

The reliability of migration statistics depends on the data sources, each with its own strengths and weaknesses. Administrative sources, such as population registers, residence registration and deregistration systems, and databases on residence permits, form the basis of official migration statistics in many countries (Ahmad Yar & Bircan, 2023; Wiśniowski, 2021). Their main advantages include continuous data collection and broad coverage. However, the quality of such data depends on the legal framework, the efficiency of public administration, and the behaviour of the population (Ahmad Yar & Bircan, 2023). In the Croatian context, this issue has become particularly relevant since 2013, when the administrative obligation to deregister residence was neither sufficiently encouraged nor sanctioned (Pokos & Turk, 2022a; Strmota & Ivanda, 2022). Censuses often include questions on place of birth and previous residence, allowing for a more comprehensive analysis of migration patterns, especially valuable in countries that lack a population register. However, a major limitation of census data is that they are collected infrequently and published with delays, which restricts their usefulness for timely migration monitoring (Ernsten et al., 2018; Kirchberger, 2021; Lomax, 2022). In Croatia, census data serve as a corrective to administrative sources, although they face methodological challenges, too – such as imprecise or 'fictitious' enumeration and a significant share of absent population (Lajić & Mišetić, 2013; Pokos & Turk, 2022b). The development of new technologies has opened the possibility of using alternative data sources, such as digital traces from mobile phones, social media data, and third-party administrative records, enabling near

reprezentativnosti i metodološke obrade i dalje ograničavaju njihovu širu primjenu u službenim statistikama.

Metode procjene migracija dijele se na direktne i indirektne. Direktne metode temelje se na službenim registrima ili anketama koje izravno bilježe prijave i odjave prebivališta ili promjene mjesta stanovanja. Glavna je prednost ažurnost i prostorna preciznost, dok je slabost izostanak evidentiranja u sustavu pri preseljenju, što je čest slučaj kod iseljavanja (Ahmad Yar & Bircan, 2023). Indirektne metode primjenjuju se kada direktni podaci nisu dostupni ili su upitne kvalitete, a migracijske tokove procjenjuju posredno, na temelju demografskih bilanci. Vitalno-statističkom metodom promjene u populaciji između dviju vremenskih točaka, obično popisnih godina, objašnjavaju se zbrojem prirodne promjene (razlike nataliteta i mortaliteta) i neto migracije. Drugim riječima, migracijski saldo dobiva se kao odstupanje ili rezidual između ukupne promjene i prirodne promjene te se ta metoda naziva i rezidualnom metodom (Shryock & Siegel, 1973; Siegel & Hamilton, 1952). Prednost metode njezina je primjenjivost u slučajevima nedostatka migracijskih podataka, no pouzdanost ovisi o točnosti popisnih i vitalnih podataka (Winkler & Curtis, 2023). Metoda preživljavanja koristi se očekivanim stopama smrtnosti kako bi se procijenilo preostalo stanovništvo iz referentne točke u prošlosti, pri čemu razlika između očekivanog i zabilježenog broja stanovnika podrazumijeva migraciju (Siegel & Hamilton, 1952). Metoda mjesta rođenja (engl. *place-of-birth*) uspoređuje mjesto rođenja i mjesto stanovanja u popisnim podacima, čime se rekonstruiraju migracijski obrasci, osobito unutarnjih migracija (United Nations, Department of Economic and Social Affairs, Population Division [UN DESA], 1970). Vitalno-statistička metoda načelno je najtočnija jer mjeri sve događaje, uključujući migrante umrle tijekom intervala, te stopu migracijskog salda lako inkorporira uz stopu prirodne i ukupne promjere čime izravnava bilancu. Uz preduvjet pouzdanosti podataka, dodatnu manu u analizi prostornih podataka može predstavljati to da nisu svi vitalni događaji geografski pravilno alocirani, već prema mjestu prebivališta (Shryock & Siegel, 1973; Siegel & Hamilton, 1952; UN DESA, 1970; Winkler & Curtis, 2023).

real-time migration estimates (Kirchberger, 2021; Wiśniowski, 2021). Despite their timeliness and richness, issues of privacy, representativeness, and methodological consistency still limit their broader use in official statistics.

Methods for estimating migration are generally divided into direct and indirect approaches. Direct methods are based on official registers or surveys that record changes of residence or the registration and deregistration of address. Their main advantage lies in timeliness and spatial precision, while the main limitation is the failure to record moves that are not reported – especially common in the case of emigration (Ahmad Yar & Bircan, 2023). Indirect methods are used when direct data are unavailable or unreliable, and estimate migration flows indirectly, typically through demographic balancing techniques. The vital statistics method explains population change between two time points – usually census years – by summing natural change (the difference between births and deaths) and net migration. In other words, net migration is calculated as the residual between total population change and natural change, which is why this approach is also referred to as the residual method (Siegel & Hamilton, 1952; Shryock & Siegel, 1973). Its advantage lies in its applicability when migration data are missing. However, its reliability depends on the accuracy of census and vital statistics data (Winkler & Curtis, 2023). The survival method uses expected mortality rates to estimate the remaining population from a reference point in the past; the difference between the expected and recorded population is then interpreted as migration (Siegel & Hamilton, 1952). The place-of-birth method compares place of birth and place of residence in census data, which enables the reconstruction of migration patterns – especially internal migration (UN, 1970). The vital statistics method is generally considered the most accurate, as it captures all demographic events, including the deaths of migrants during the interval. Moreover, it allows the migration balance to be integrated with natural and total population change, thus maintaining consistency in demographic accounting. However, one limitation in spatial analysis is that not all vital events are geocoded precisely but are often assigned on the base of official residence (Shryock & Siegel, 1973; Siegel & Hamilton, 1952; UN, 1970; Winkler & Curtis, 2023).

Unaprjeđenje pouzdanosti migracijske statistike kombinacijom više izvora

Jedinstven zaključak brojnih istraživanja je da nijedan pojedinačni izvor ne može pružiti potpunu i pouzdanu sliku migracijskih kretanja. Stoga je za preciznije praćenje migracijskih tokova nužno kombinirati različite izvore podataka (Ahmad Yar & Bircan, 2023; Bell i sur., 2015; Calhoun i sur., 2021; Ernsten i sur., 2018; Kirchberger, 2021; Raymer i sur., 2007; Raymer i sur., 2011; Willekens, 1994; Wiśniowski, 2021). Baker i sur. (2013) usporedbom popisnih podataka i procjena stanovništva za New Mexico zaključuju kako su veće pogreške migracijskih podataka u područjima s većom fluktuacijom stanovništva. Calhoun i sur. (2021) usporedili su popisne podatke i dva tipa administrativnih podataka (porezne prijave i zdravstvenog registra) u New Brunswicku te zaključuju da je popis podložan podzastupljenosti mladih, imigranata i mobilnih skupina. Foley i sur. (2023) usporedbom popisnih i zdravstvenih podataka slično utvrđuju manju pouzdanost administrativnih podataka za kućanstva studenata i mlađih osoba. De Beer i sur. (2010) dokumentiraju velike neujednačenosti u europskim bilateralnim migracijskim tokovima, naglašavajući važnost integracije podataka. Slične nalaze potvrđuju i hrvatska istraživanja (Balija, 2020; Pavić & Ivanović, 2019; Pokos & Turk, 2022a; Strmota, 2020), koja identificiraju sustavne probleme poput nejasno definiranih obveza odjave prebivališta, što dodatno opravdava potrebu za primjenom kombiniranih pristupa u analizama migracijskih kretanja.

Projekti poput IMEM-a (Raymer i sur., 2013) i QuantMiga (Aristotelous i sur., 2022) primjenjuju napredne statističke metode kao što su Bayesovi modeli i log-linearne simulacije kako bi se kombinacijom administrativnih izvora, anketa i ekspertnih procjena proizvele harmonizirane procjene migracijskih tokova na europskoj razini. Projekt QuantMig (Aristotelous i sur., 2022) nadograđuje taj pristup bilateralnim usporedbama tokova i korekcijama trajanja boravka. Dańko i sur. (2024) dodatno unaprjeđuju metode kombiniranja integracijom ekspertnih procjena, metapodataka i modelskih korekcija, stvarajući sustav rangiranja ze-

Improving the Reliability of Migration Statistics by Combining Multiple Data Sources

A consistent conclusion across numerous studies is that no single data source can provide a complete and reliable picture of migration flows. Therefore, in order to achieve more accurate monitoring of migration patterns, it is essential to combine different data sources (Ahmad Yar & Bircan, 2023; Bell et al., 2015; Calhoun et al., 2021; Ernsten et al., 2018; Kirchberger, 2021; Raymer et al., 2007; Raymer et al., 2011; Willekens, 1994; Wiśniowski, 2021). When Baker et al. (2013) were comparing census data and population estimates for New Mexico, they found that larger migration data errors occurred in areas with greater population turnover. Calhoun et al. (2021) compared census data with two types of administrative records (tax filings and health registry data) in New Brunswick and concluded that the census underrepresents youth, immigrants, and mobile groups. Similarly, Foley et al. (2023), when they compared census and health data, found that administrative data were less reliable for student households and younger individuals. De Beer et al. (2010) documented large inconsistencies in European bilateral migration flows, highlighting the importance of data integration. Similar findings are echoed in Croatian research (Balija, 2020; Pavić & Ivanović, 2019; Pokos & Turk, 2022a; Strmota, 2020), which identified systemic issues such as the lack of clearly defined obligations for deregistering – further supporting the need for combined approaches in the analysis of migration dynamics.

Projects such as IMEM (Raymer et al., 2013) and QuantMig (Aristotelous et al., 2022) apply advanced statistical methods, such as Bayesian models and log-linear simulations, to produce harmonised estimates of migration flows at the European level by combining administrative data sources, surveys, and expert assessments. The QuantMig project (Aristotelous et al., 2022) builds on this approach by incorporating bilateral flow comparisons and adjustments for the duration of stay. Dańko et al. (2024) further enhance data integration methods by combining expert assessments, metadata, and model-based corrections, ultimately developing a country ranking system based on the level of emigration undercounting,

malja prema razini podcijenjenosti iseljavanja, pri čemu Hrvatsku svrstavaju među zemlje s najvišom razinom podcijenjenosti. Modeli za izračun migracijskih tokova kombinacijom podataka popisa stanovništva, anketa i poreza u SAD-u su primijenjeni prije više desetljeća (Willekens, 1994), dok se u Velikoj Britaniji primjenjuju napredne metode povezivanja zdravstvenog registra i popisa stanovništva (Raymer i sur., 2007; Raymer i sur., 2011). Međunarodna iskustva jasno pokazuju nužnost razvoja integriranih metodoloških pristupa u mjerenju migracija s ciljem poboljšanja kvalitete migracijske statistike i učinkovitijeg planiranja javnih politika.

Dosadašnja istraživanja potvrđuju postojanje značajnih problema u kvaliteti migracijskih podataka, osobito u podcjenjivanju stvarnih migracijskih tokova, no ona su uglavnom usmjerena na nacionalnu razinu, bez detaljnijeg prostornog pristupa. U ovom istraživanju provodi se detaljna prostorna analiza nepouzdanosti migracijskih podataka za cijelu Hrvatsku. Specifični metodološki okvir rada kombinira službene podatke s indirektnim (vitalno-statističkim) procjenama primjenom statističkih i prostornih analitičkih alata. Takav je pristup novitet te pruža originalne uvide koji mogu služiti kao temelj za unaprjeđenje kvalitete migracijskih podataka u Hrvatskoj, ali i kao metodološki primjer za slična istraživanja u drugim zemljama.

PODACI I METODE

Istraživanje je usmjereno na prostorni aspekt nepouzdanosti demografskih podataka. Stoga podaci pokrivaju 556 gradova i općina (lokalne razine) te 21 županiju (regionalne razine) Republike Hrvatske. Svi korišteni podaci prikupljeni su od Državnog zavoda za statistiku: broj stanovnika iz Popisa 2011. i Popisa 2021. godine (DZS, 2013; 2022), a doseljeno i odseljeno stanovništvo po godinama te podaci vitalne statistike od 2011. do 2021. godine iz publikacije *Gradovi i općine u statistici* (DZS, 2024). Kako bi se podaci migracija i vitalne statistike poklapali s vremenskim okvirom međupopisne promjene broja stanovnika, usklađeni su s kritičnim trenucima dvaju popisa – broj

placing Croatia among the countries with the highest undercount. Models for estimating migration flows by combining census data, surveys (CPS), and tax records (IRS) have been used in the United States for several decades (Willekens, 1994), while in the United Kingdom, advanced linkage methods between health registers and census data are employed (Raymer et al., 2007; Raymer et al., 2011). International experience clearly demonstrates the need for developing integrated methodological approaches to migration measurement in order to improve the quality of migration statistics and support more effective policy planning.

Previous research has confirmed the existence of significant issues in the quality of migration data, particularly the underestimation of actual migration flows. However, such studies have largely focused on the national level, with limited attention to detailed spatial perspectives. This study conducts an in-depth spatial analysis of the unreliability of migration data across the entire territory of Croatia. The specific methodological framework combines official data with indirect (vital-statistical) estimates, employing both statistical and spatial analytical tools. This approach is innovative and offers original insights that can serve as a basis for improving the quality of migration data in Croatia, while also providing a methodological example for similar research in other countries.

DATA AND METHODS

The research focuses on the spatial dimension of demographic data unreliability covering 556 cities and municipalities (local level) and 21 counties (regional level) in Croatia. All data were obtained from the Croatian Bureau of Statistics (CBS), including population counts from the 2011 and 2021 censuses (CBS, 2013; 2022), annual migration data, and vital statistics for the period 2011–2021, published in Towns and Municipalities in Statistics (CBS, 2024). To ensure temporal consistency between migration and vital statistics data and the intercensal change in population, the data were aligned with the reference dates of the two censuses – the number of in-migrants, out-migrants, births, and deaths was estimated for the

doseljenih, odseljenih, rođenih i umrlih procijenjen je za razdoblje od 31. ožujka 2011. do 31. kolovoza 2021. Također, kod nekoliko je gradova i općina provedeno korigiranje podataka kako bi teritorijalni obuhvat u proučavanom razdoblju bio usklađen. Pritom su korišteni tablogrami DZS-a, a podaci su prilagođeni najnovijoj administrativnoj podjeli.

Polazište istraživanja nepouzdanosti migracijskih podataka mogu biti apsolutne vrijednosti migracijskog salda dobivene iz dva različita izvora, no takva vrsta analize pruža samo početnu informativnu vrijednost. Relevantna usporedba migracijskog salda među prostornim jedinicama i detektiranje prostornih obrazaca mogući su korištenjem relativnih pokazatelja. Stoga temeljni dio istraživanja nepouzdanosti demografskih podataka u Hrvatskoj čine dva seta stope migracijskog salda dobivena iz različitih izvora.

Prosječna godišnja stopa migracijskog salda službenih podataka DZS-a (ms_{DZS}) temeljena je na neposrednom izračunu migracijske bilance:

$$ms_{DZS} = \frac{\frac{(I - E)}{10}}{\frac{P_{2011} + P_{2021}}{2}} * 1000 \quad (1)$$

gdje I predstavlja broj doseljenih, a E broj odseljenih između 31. ožujka 2011. i 31. kolovoza 2021.; P_{2011} broj stanovnika utvrđen Popisom 2011., a P_{2021} Popisom 2021. godine.

Prosječna godišnja stopa migracijskog salda dobivena vitalno-statističkom metodom (ms_{VSM}) temeljena je na razlici ukupne međupopisne promjene i prirodne promjene:

$$ms_{VSM} = \frac{\frac{(P_{2021} - P_{2011}) - (N - M)}{10}}{\frac{P_{2011} + P_{2021}}{2}} * 1000 \quad (2)$$

pri čemu je P_{2011} broj stanovnika utvrđen Popisom 2011., a P_{2021} Popisom 2021. godine; N predstavlja broj živorođenih, a M broj umrlih između 31. ožujka 2011. i 31. kolovoza 2021.

Nova varijabla, koja se predstavlja i s pomoću

period from 31 March 2011 to 31 August 2021. Additionally, data for several cities and municipalities were corrected to ensure consistency in territorial coverage throughout the study period. For this purpose, CBS settlement-level vital statistics were used, and the data were harmonised with the most recent administrative divisions.

A starting point for analysing the unreliability of migration data may be the absolute values of net migration derived from two different sources. However, this type of analysis offers only basic information value. A more relevant comparison of net migration across spatial units, and the identification of spatial patterns, is enabled using relative indicators. Therefore, the core part of the analysis of demographic data unreliability in Croatia is based on two sets of net migration rates derived from different sources.

The average annual net migration rate based on official CBS data (nmr_{CBS}) is calculated directly from the migration balance:

$$nmr_{CBS} = \frac{\frac{(I - E)}{10}}{\frac{P_{2011} + P_{2021}}{2}} * 1000 \quad (1)$$

where I denotes the number of immigrants and E the number of emigrants between 31 March 2011 and 31 August 2021; P_{2011} refers to the population in the 2011 Census, and P_{2021} to the population in the 2021 Census.

The average annual net migration rate calculated using the vital statistics method (nmr_{VSM}) is based on the difference between the total intercensal population change and natural change:

$$nmr_{VSM} = \frac{\frac{(P_{2021} - P_{2011}) - (N - M)}{10}}{\frac{P_{2011} + P_{2021}}{2}} * 1000 \quad (2)$$

where P_{2011} denotes the population recorded in the 2011 Census, and P_{2021} the population recorded in the 2021 Census; N refers to the number of live births and M to the number of deaths between 31 March 2011 and 31 August 2021.

koje se pokušava detektirati nepouzdanost demografskih podataka u Hrvatskoj, je razlika migracijskog salda (ms_{RAZ}) između službenih podataka DZS-a (ms_{DZS}) i podataka dobivenih vitalno-statističkom metodom (ms_{VSM}):

$$ms_{RAZ} = ms_{DZS} - ms_{VSM} \quad (3)$$

Prvom namjenom ovoga pokazatelja nameće se detektiranje nepouzdanosti migracijske statistike za pojedinu prostornu jedinicu. Na temelju mnogobrojnih istraživanja, kojima je potvrđena podcijenjenost iseljavanja iz Hrvatske u službenim podacima, kao dominantna pojava očekuje se povoljniji ms_{DZS} u odnosu na ms_{VSM}, tj. pozitivan ms_{RAZ}. Prostorna distribucija ms_{RAZ} trebala bi detektirati prostorne obrasce nepouzdanosti migracijskih podataka. Pritom je u cilju, osim pregleda varijabilnosti ms_{RAZ} u prostoru, identificiranje područja izrazito pozitivne ili potencijalne izrazito negativne razlike migracijskog salda. S obzirom na tri vrste demografskih podataka korištenih u izračunu i činjenicu da su podaci vitalne statistike u Hrvatskoj načelno pouzdani, pojavnost izrazito pozitivnih ili negativnih vrijednosti ms_{RAZ} ne bi samo upućivala na manjkavost migracijske statistike, već bi pobudila sumnju i na pouzdanost popisnih podataka za ta područja. Stoga je druga namjena ms_{RAZ} posredno otkrivanje područja slabije pouzdanosti podataka iz Popisa 2011. i/ili Popisa 2021. godine. U prostornoj analizi razlika migracijskih salda (ms_{RAZ}) pokazuje razlike između dviju različitih stopa, ali same vrijednosti nisu intuitivne te je granice pouzdanosti podataka teško odrediti. Stoga je u sljedećem koraku razlika migracijskog salda izražena u standardnim devijacijama, čime je omogućeno intuitivnije i statistički preciznije razumijevanje odstupanja.

Za nadopunu pokazateljima deskriptivne statistike i potvrdu dobivenih prostornih obrazaca nepouzdanosti demografskih podataka u Hrvatskoj primijenjena je prostorna statistika. Za eksplorativnu analizu i početne vizualizacije klastera korišten je softver GeoDa. Potvrda identificiranih obrazaca i izrada konačnih analiza provedena je u programu ArcMap 10.8.2, korištenjem alata Cluster and Outlier Analysis (Anselin Local Mo-

A new variable introduced in this study to detect the unreliability of demographic data in Croatia is the difference in net migration rates (nmr_{DIFF}) between the official CBS data (nmr_{CBS}) and the rate derived from the vital statistics method (nmr_{VSM}):

$$nmr_{DIFF} = nmr_{CBS} - nmr_{VSM} \quad (3)$$

The primary purpose of this indicator is to detect the unreliability of migration statistics at the level of individual spatial units. Based on numerous studies confirming the underestimation of emigration from Croatia in official statistics, it is expected that nmr_{CBS} will generally be more favourable than nmr_{VSM}, i.e., that nmr_{DIFF} will tend to be positive. The spatial distribution of nmr_{DIFF} should reveal spatial patterns in the unreliability of migration data. The aim, beyond observing the spatial variability of nmr_{DIFF}, is to identify areas with notably positive or potentially strongly negative differences in net migration rates. Given that the calculation involves three types of demographic data, and that vital statistics in Croatia are generally considered reliable, the occurrence of strongly positive or negative nmr_{DIFF} values may not only indicate limitations in migration statistics but may also raise concerns about the reliability of census data for those areas. Thus, the second purpose of nmr_{DIFF} is to indirectly identify areas where census data from 2011 and/or 2021 may be less reliable. In spatial analysis, the difference in net migration rates (nmr_{DIFF}) reflects discrepancies between two different rates, but the values themselves are not intuitive, and setting clear thresholds for data reliability is difficult. Therefore, in the next step, the net migration rate difference is expressed in standard deviations, allowing for a more intuitive and statistically precise understanding of the observed deviations.

In order to strengthen the descriptive statistical indicators and to validate the spatial patterns of demographic data unreliability in Croatia, spatial statistics were employed. GeoDa software was used for exploratory analysis and initial cluster visualizations. Confirmation of the identified patterns and the preparation of the final analyses were carried out in ArcMap 10.8.2, using the Cluster and Outlier Analysis (Anselin Local Moran's I) tool

ran's I) iz skupa Spatial Statistics Tools. Lokalni je Moranov indeks mjera za identifikaciju prostorne autokorelacije na lokalnoj razini. On za svaku jedinicu mjeri odnose sa susjedstvom i pokazuje postoje li grupiranja sličnih ili različitih vrijednosti u prostoru te identificira prostorne klastere i prostorne anomalije (Anselin, 1995). U ovom je radu korišten jer, uz izdvajanje prostornih klastera pozitivne i negativne razlike migracijskog salda, omogućuje identificiranje prostornih izuzetaka, tj. anomalija (*outlier*). Stoga bi trebao pružiti dodatno objašnjenje pojavnosti područja upitne pouzdanosti demografskih podataka. Prostorna autokorelacija na lokalnoj razini eliminirat će nasumično raštrkane jedinice i omogućiti distinkciju između specifičnih prostorno-lokacijskih faktora (primjerice obala) i sustavnih faktora nepouzdanosti podataka (primjerice urbanizacija). Veličina lokalnih jedinica u Hrvatskoj izrazito je varijabilna, a problem predstavljaju i otočne jedinice bez susjeda ili s malim brojem neposrednih susjeda. Stoga je pri definiranju susjedstva izazov u kompromisu između odabira prostorne udaljenosti susjedstva i odabira neposrednih ili najbližih susjeda. Na temelju više različito definiranih susjedstava i njima pripadajućih rezultata, najpogodnijim se pokazalo korištenje pet najbližih susjeda.

REZULTATI

Procjena (ne)pouzdanosti migracijskih podataka po županijama

Prema službenim podacima DZS-a, između 2011. i 2021. godine pozitivnu migracijsku bilancu zabilježili su samo Grad Zagreb, Istarska, Zadarska i Dubrovačko-neretvanska županija (Tab. 1.). Istovremeno, u Zagrebačkoj županiji tek je nešto više odseljenih u odnosu na broj doseljenih. Pet slavonskih županija i Sisačko-moslavačka županija ističu se najnegativnijom migracijskom bilancom. U promatranom razdoblju, prema podacima DZS-a, iz Hrvatske se iselilo oko 114 000 osoba više no što se doselilo u Hrvatsku. Nasuprot tomu, negativan migracijski saldo dobiven vitalno-statističkom metodom upućuje na bitno drukčiju vrijednost

from the Spatial Statistics Tools toolbox. The Local Moran's I index is a measure used to identify spatial autocorrelation at the local level. It evaluates the relationship between each spatial unit and its neighbours, detecting clusters of similar or dissimilar values and identifying both spatial clusters and spatial outliers (Anselin, 1995). It was used in this study not only to detect clusters of positive and negative differences in net migration rates, but also to identify spatial anomalies (*outliers*). As such, it provides further insight into the presence of areas with questionable reliability in demographic data. Local spatial autocorrelation allows for the elimination of randomly scattered units and helps distinguish between specific spatial-location factors (e.g., coastal areas) and systemic factors related to data unreliability (e.g., urbanisation). The size of local units in Croatia varies significantly, and a particular challenge lies in island units, which either have no neighbours or only a limited number of immediate neighbours. Thus, defining neighbourhoods involves a trade-off between distance-based and adjacency-based approaches. Based on testing multiple definitions and their corresponding outputs, the use of the five nearest neighbours proved to be the most suitable.

RESULTS

Assessing the (Un)reliability of Migration Data across Counties

According to official data from the Croatian Bureau of Statistics (CBS), between 2011 and 2021 a positive net migration balance was recorded only in the City of Zagreb, Istria County, Zadar County and Dubrovnik-Neretva County (Tab. 1). At the same time, Zagreb County recorded only a slightly higher number of emigrants than immigrants. The five Slavonian counties, along with Sisak-Moslavina County, stand out with the most negative migration balances. In the observed period, CBS data indicate that approximately 114,000 more people emigrated from Croatia than immigrated to it. In contrast, the net migration balance calculated using the vital statistics method suggests a markedly different figure (around -257,000), indicating a far more negative situation. The negative balance

(oko -257 000) i izrazito negativnije stanje. Negativna bilanca u službenim podacima više je no upola manja u odnosu na komparativnu. Vitalno-statističkom metodom dobivene su bitno negativnije vrijednosti i po županijama – prema tim podacima nijedna od njih nije zabilježila pozitivnu bilancu. Najočitija je neusklađenost u Gradu Zagrebu gdje je razlika između dvaju podataka oko 40 000 osoba. Izrazitom disproporcijom još se izdvajaju Splitsko-dalmatinska (oko 21 500), Istarska (oko 15 000) i Primorsko-goranska (oko 12 500). Anomaliju predstavlja Požeško-slavonska županija u kojoj službeni podaci pokazuju negativnije stanje u odnosu na one dobivene vitalno-statističkom metodom, no ta je razlika minimalna.

Relevantnu usporedbu intenziteta migracijske bilance po županijama daju prosječne godišnje stope migracijskog salda prema dvije metode i njihova razlika (Sl. 1). Promatrajući razliku između ms_{DZS} i ms_{VSM}, županije se mogu svrstati u tri kategorije. Prvu čine pet primorskih županija i Grad Zagreb kod kojih je razlika velika i osjetno veća u odnosu na vrijednost za Hrvatsku (3,5) te se kreće u rasponu od 7,4 do 4,5 promilnih bodova. U tim županijama migracijska bilanca prema službenim podacima je pozitivna ili vrlo blago negativna, dok je prema komparativnim podacima bilanca osjetno negativna. Unutar ove skupine ističe se Istarska županija s najvećom razlikom, dok se u ostalih pet bilježe podjednake vrijednosti. Drugu skupinu čine Zagrebačka županija, sve županije sjeverne Hrvatske te Osječko-baranjska i Brodsko-posavska županija. Njihova su oba migracijska salda negativna, a razlika između njih je razmjerno blaga do umjerena. Treću skupinu čine sve preostale županije. Kod njih je razlika između dviju stopa primjetljiva, ali neznatna. Najviša usklađenost dviju migracijskih stopa, a time i potencijalno najpouzdaniji podaci migracijske statistike prisutni su u spomenutoj Požeško-slavonskoj županiji. Prema rezultatima na županijskoj razini, relativno pouzdanim također se mogu smatrati podaci za Karlovačku, Šibensko-kninsku, Virovitičko-podravsku i Sisačko-moslavačku županiju čija je migracijska razlika unutar promilnog boda.

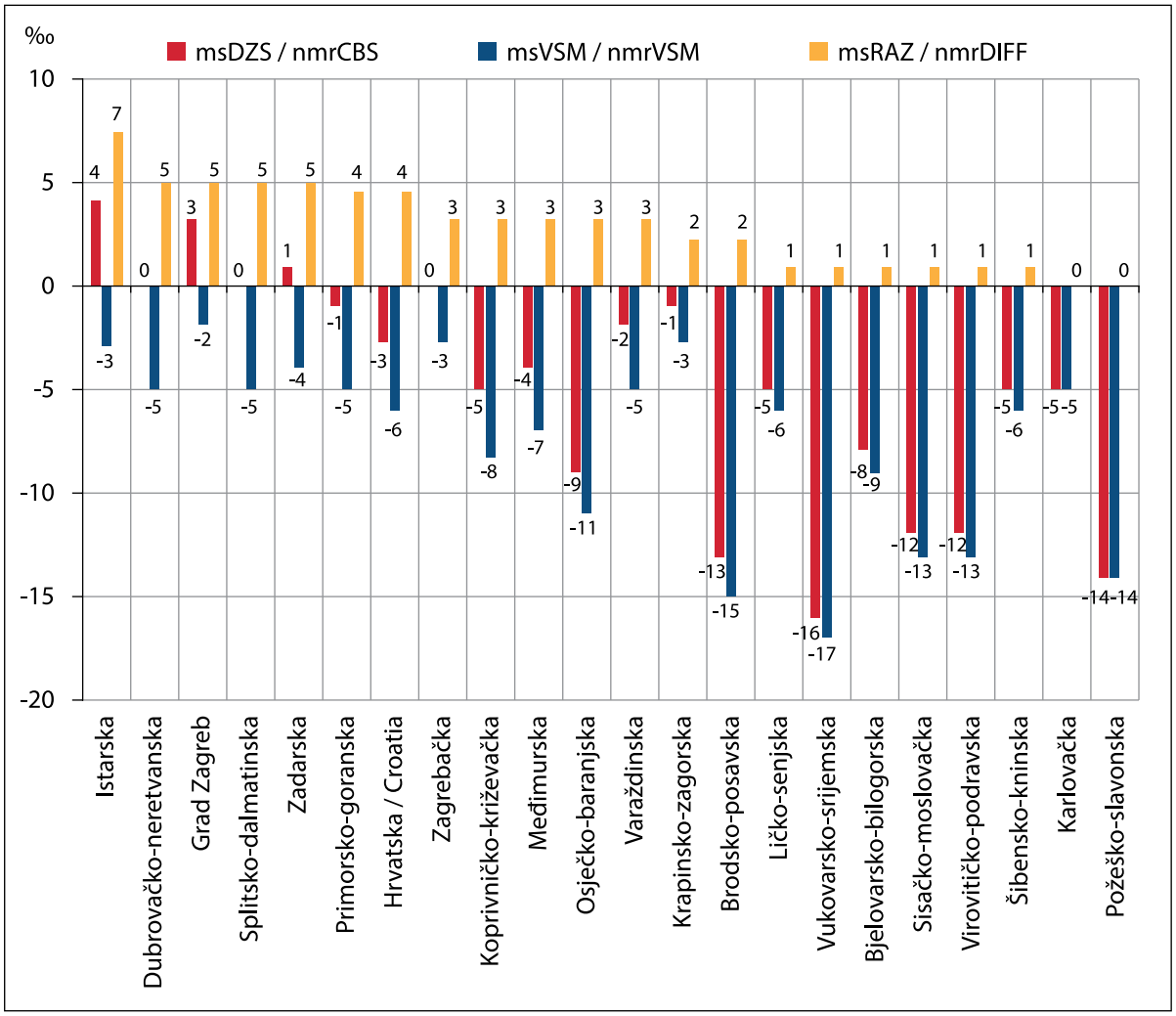
recorded in the official statistics is less than half of that obtained through the comparative method. The vital statistics method produced significantly more negative figures across counties as well. According to that method, none of the counties recorded a positive balance. The greatest discrepancy is found in the City of Zagreb, where the difference between the two data sources amounts to approximately 40,000 people. Other counties with notable disproportions include Split-Dalmatia (around 21,500), Istria (around 15,000), and Primorje-Gorski Kotar (around 12,500). An exception is Požega-Slavonia County, where the official data indicate a more negative balance than the vital statistics method, although the difference is minimal.

A meaningful comparison of migration balance intensity across counties is provided by the average annual net migration rates calculated using two methods and their difference (Fig. 1). Based on the difference between nmr_{CBS} and nmr_{VSM}, the counties can be grouped into three categories. The first group comprises five coastal counties and the City of Zagreb, where the difference is large and significantly above the national average (3.5), ranging from 7.4 to 4.5 per mille points. In these counties, the migration balance based on official data is either positive or only slightly negative, whereas the comparative method indicates a considerably negative balance. Within this group, Istria County stands out with the highest difference, while the other five record similar values. The second group includes Zagreb County, all counties in northern Croatia, as well as Osijek-Baranja and Brod-Posavina counties. In these counties, both migration balances are negative, and the difference between the two is relatively mild to moderate. The third group consists of all remaining counties. Here, the difference between the two rates is noticeable but minor. The highest alignment between the two migration rates – and thus the potentially most reliable migration data – is found in Požega-Slavonia County. According to the results at the county level, data for Karlovac, Šibenik-Knin, Virovitica-Podravina, and Sisak-Moslavina counties can also be considered relatively reliable, as their migration balance differences are within one per mille point.

Tablica 1. *Migracijska bilanca službenih podataka DZS-a i vitalno-statističke metode po županijama Hrvatske između 2011. i 2021. godine*
Table 1 *Migration balance according to official CBS data and vital-statistical method by counties of Croatia, 2011–2021*

Županija / *County*	Službeni podaci DZS-a (2011.-2021.) / *Official CBS data 2011-2021*			Vitalno-statistička metoda (2011.-2021.) / *Vital-statistic method 2011-2021*					Razlika migracijskog salda / *Migration balance difference*
	Ukupno doseljeni / *Total immigration*	Ukupno odseljeni / *Total emigration*	Migracijski saldo / *Net migration*	Broj stanovnika 2011. / *2011 Population*	Broj stanovnika 2021. / *2021 Population*	Ukupna promjena / *Total change*	Prirodna promjena / *Natural change*	Migracijski saldo / *Net migration*	
Grad Zagreb	172.591	147.946	24.646	790.017	767.131	-22.886	-7.510	-15.376	40.022
Istarska	65.588	56.605	8.983	208.055	195.237	-12.818	-6.841	-5.977	14.960
Zadarska	45.019	43.666	1.353	170.017	159.766	-10.251	-4.080	-6.171	7.525
Dubrovačko-neretvanska	35.400	35.027	373	122.568	115.564	-7.004	-1.043	-5.961	6.334
Zagrebačka	83.219	83.449	-230	317.606	299.985	-17.621	-7.449	-10.172	9.942
Krapinsko-zagorska	24.218	25.692	-1.474	132.892	120.702	-12.190	-8.018	-4.172	2.698
Splitsko-dalmatinska	107.280	109.286	-2.007	454.798	423.407	-31.391	-7.868	-23.523	21.516
Ličko-senjska	12.955	15.318	-2.363	50.927	42.748	-8.179	-5.172	-3.007	644
Primorsko-goranska	83.242	86.052	-2.810	296.195	265.419	-30.776	-15.420	-15.356	12.546
Varaždinska	32.523	36.381	-3.859	175.951	159.487	-16.464	-8.262	-8.202	4.343
Međimurska	23.795	28.527	-4.733	113.804	105.250	-8.554	-766	-7.788	3.055
Šibensko-kninska	26.050	31.191	-5.141	109.375	96.381	-12.994	-7.085	-5.909	769
Koprivničko-križevačka	19.697	24.915	-5.218	115.584	101.221	-14.363	-5.957	-8.406	3.188
Karlovačka	25.411	31.375	-5.964	128.899	112.195	-16.704	-10.175	-6.529	564
Virovitičko-podravska	14.595	23.722	-9.128	84.836	70.368	-14.468	-4.698	-9.770	642
Bjelovarsko-bilogorska	23.586	32.869	-9.283	119.764	101.879	-17.885	-7.410	-10.475	1.192
Požeško-slavonska	16.070	26.151	-10.081	78.034	64.084	-13.950	-4.074	-9.876	-205
Brodsko-posavska	25.809	44.159	-18.350	158.575	130.267	-28.308	-7.245	-21.063	2.713
Sisačko-moslavačka	32.964	52.224	-19.260	172.439	139.603	-32.836	-12.269	-20.567	1.307
Osječko-baranjska	56.158	80.224	-24.066	305.032	258.026	-47.006	-15.478	-31.528	7.462
Vukovarsko-srijemska	30.346	55.623	-25.277	179.521	143.113	-36.408	-9.082	-27.326	2.049
Hrvatska / *Croatia*	956.513	1.070.402	-113.889	4.284.889	3.871.833	-413.056	-155.902	-257.154	143.265

Izvor: *Izračun autora na temelju DZS-a (2013; 2022; 2024)* / Source: *Calculated by the authors according to CBS (2013; 2022; 2024)*



Slika 1. *Prosječna godišnja stopa migracijskog salda službenih podataka (ms_{DZS}) i vitalno-statističke metode (ms_{VSM}) te njihova razlika (ms_{RAZ})*

Figure 1 *Average annual migration rates from official CBS data (nmr_{CBS}) and the vital-statistical method (nmr_{VSM}), along with their difference (nmr_{DIFF})*

Izvor: *Izračun autora na temelju DZS-a (2013; 2022; 2024)* / Source: *Calculated by the authors according to CBS*

Procjena (ne)pouzdanosti migracijskih podataka na lokalnoj razini

Pokazatelji deskriptivne statistike za 556 jedinica lokalne samouprave upućuju na sustavnu razliku između službenih podataka (ms_{DZS}) i podataka dobivenih vitalno-statističkom metodom (ms_{VSM}) (Tab. 2.). Aritmetička sredina ms_{DZS} iznosi -5,4 promila (medijan -5,8), dok je prema ms_{VSM} niža i iznosi -7,6 promila (medijan -6,9). Rezultati potvrđuju da vitalno-statistička metoda bilježi negativniji migracijski saldo u odnosu na službene podatke. Raspon i varijabilnost u podacima blago su veći kod službenih podataka, a razlike minimalnih i maksimalnih vrijednosti između ms_{DZS} i ms_{VSM} izrazito su velike, što potvrđuje pomak cijeloga spektra između dviju metoda migracijskog salda.

Assessing the (Un)reliability of Migration Data at the Local Level

Descriptive statistics indicators for 556 local units indicate a systematic difference between official data (nmr_{CBS}) and data obtained through the vital-statistical method (nmr_{VSM}) (Table 2). The mean of nmr_{CBS} is -5.4 per mille (median -5.8), while the nmr_{VSM} reports a lower value at -7.6 per mille (median -6.9). The results confirm that the vital-statistical method records more negative migration balance compared to official data. The range and variability in the data are slightly higher for official data, and the differences between the minimum and maximum values of nmr_{CBS} and nmr_{VSM} are notably large, confirming a shift across the entire spectrum between the two migration balance methods. Therefore, the differences

Tablica 2. *Deskriptivna statistika prosječne godišnje stope migracijskog salda 2011. – 2021. za lokalne jedinice u Hrvatskoj*
Table 2 *Descriptive statistics for the average annual migration rates (2011–2021) across local units in Croatia*

Izvor / *Source*	**Sredina / *Mean***	**Medijan / *Median***	**Minimum / *Minimum***	**Maksimum / *Maximum***	**Raspon / *Range***	**Interkv. raspon / *IQ range***	**Standardna devijacija / *Standard deviation***
Službeni podaci DZS-a / *Official CBS data*	-5,4	-5,8	-39,6	43,2	82,8	14,0	11,4
Vitalno-statistička metoda / *Vital-statistic method*	-7,6	-6,9	-50,7	28,9	79,6	10,7	8,6
Razlika migracijskog salda / *Migration balance difference*	2,3	2,1	-27,2	32,8	60,0	5,4	6,0
Razlika migracijskog salda u SD /*Migration balance difference in SD*	0,4	0,3	-4,5	5,4	10,0	0,9	1,0

Izvor: *Izračun autora na temelju DZS-a (2013; 2022; 2024)* / Source: *Calculated by the authors according to CBS (2013; 2022; 2024)*

Razlike nisu ravnomjerno raspoređene, što upućuje na potrebu za daljnjom prostornom analizom.

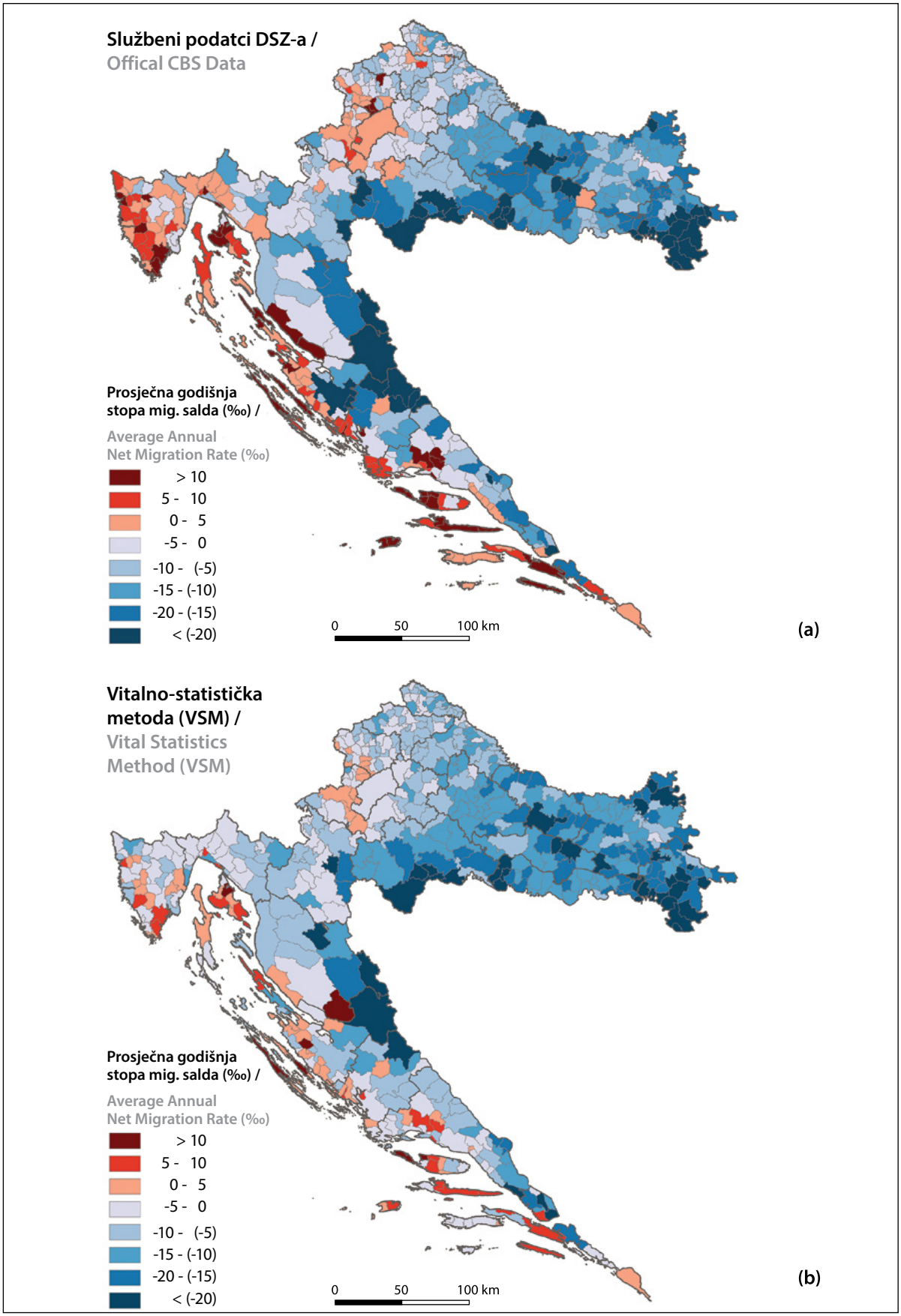
Prostorna distribucija prosječnih godišnjih stopa migracijskog salda po lokalnim jedinicama slijedi prethodno iznesene distribucije za županijsku razinu, no pruža temeljitiji uvid u prostorne obrasce, kao i specifičnosti unutar pojedine županije (Sl. 2.). Već prvim pogledom na obje karte stječe se dojam o osjetno povoljnijem stanju, ali i izraženijoj prostornoj varijaciji migracijskog salda pri službenim podacima (ms_{DZS}). Prema tim podacima je između 2011. i 2021. godine 29,3 % jedinica zabilježilo pozitivnu, a 70,7 % negativnu migracijsku bilancu. Prema komparativnim podacima (ms_{VSM}), pozitivan migracijski saldo imalo je 16,2 % jedinica, a 83,8 % njih imalo je migracijski gubitak. Dvije vizualno najuočljivije razlike odnose se na šire zagrebačko područje i gotovo cijelo priobalje. Grad Zagreb i dijelovi okolice prema službenim podacima bilježe pozitivnu migracijsku bilancu, što prema podacima vitalno-statističke metode nije slučaj. Iako znatan dio priobalja prema obje metode ostvaruje pozitivan migracijski saldo, prema službenim podacima pozitivne vrijednosti zahvaćaju puno širi prostor te su osjetno pozitivnije.

Značajan je podatak da kod čak 87 (15,6 %) jedinica migracijski saldo prema ms_{DZS} i ms_{VSM} imaju suprotan predznak. Samim time one se mogu smatrati područjima u čijoj je analizi migracijskih podataka nužan oprez. Kod 80 (14,4 %) slučajeva radi se o pozitivnom ms_{DZS} i negativnom ms_{VSM}. Gotovo tri četvrtine takvih jedinica smješteno je u priobalnom pojasu (Tab. A1. u dodacima). Pritom

are not evenly distributed, indicating the need for further spatial analysis.

The spatial distribution of the average annual migration balance rates by local units follows the previously described pattern at the county level but provides a more detailed insight into spatial trends and specificities within individual counties (Fig. 2). A first glance at both maps reveals a more favourable migration balance and a greater spatial variation in the case of official data (nmr_{CBS}). According to these data, between 2011 and 2021, 29.3% of units recorded a positive, while 70.7% recorded a negative migration balance. In comparison, the vital-statistical method data (nmr_{VSM}) shows only 16.2% of units with a positive migration balance, and 83.8% with a migration loss. The two most visually striking differences are observed in the wider Zagreb area and nearly the entire coastline. According to official data, Zagreb and surrounding areas record a positive migration balance, which is not the case according to vital-statistical data. Although a significant part of the coastline shows a positive migration balance in both methods, the official data indicates that positive values cover a much broader area and are notably higher.

A notable finding is that in as many as 87 units (15.6%), the net migration rates based on nmr_{CBS} and nmr_{VSM} have opposite signs. These units can therefore be considered areas where caution is necessary when interpreting migration data. In 80 cases (14.4%), this concerns a positive nmr_{CBS} and a negative nmr_{VSM}. Nearly three-quarters of these units are located along the coastal zone (see Appendix Table A1). Istria County stands out with the highest num-



Slika 2. *Prosječna godišnja stopa migracijskog salda 2011. – 2021. godine prema službenim podacima (a) i podacima vitalno-statističke metode (b)*

Figure 2 *Average Annual Net Migration Rate (2011–2021) according to official data (a) and the vital statistics method (b)*

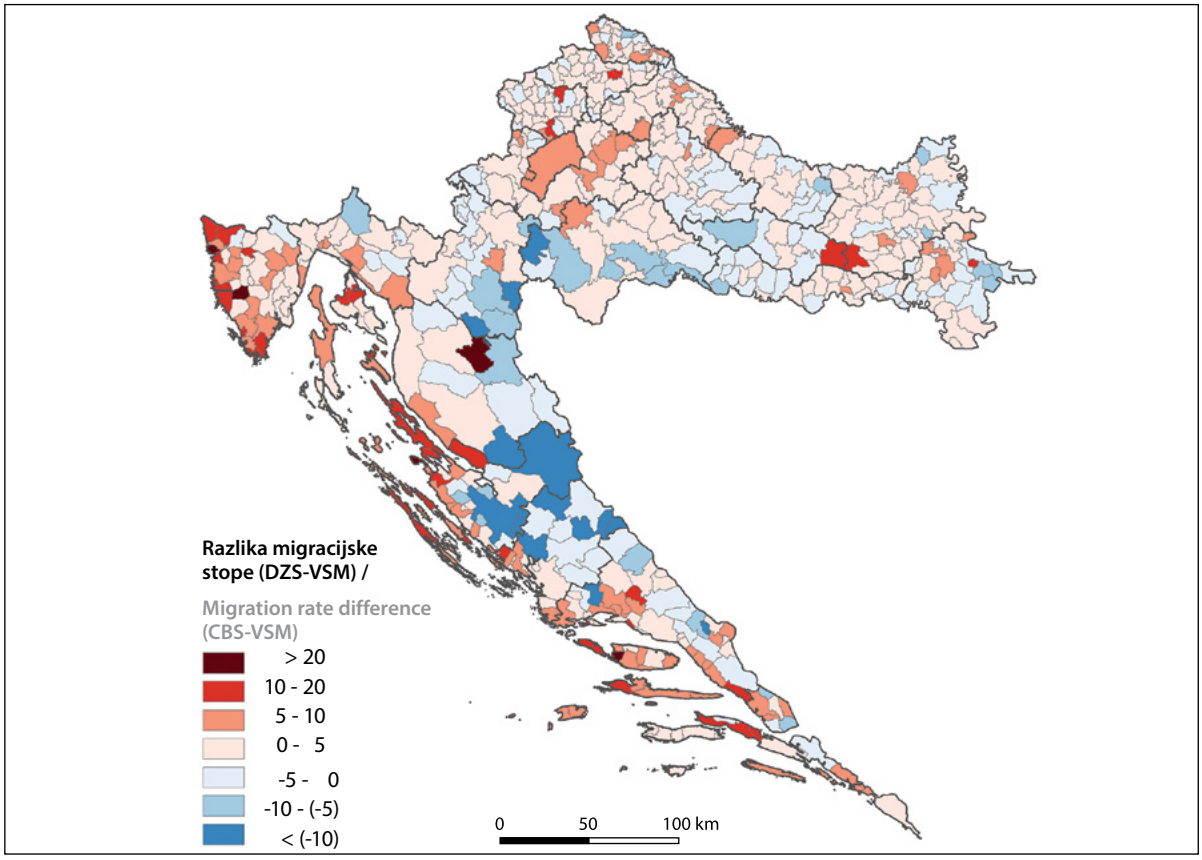
Izvor: *Izračun autora na temelju DZS-a (2013; 2022; 2024)* / Source: *Calculated by the authors according to CBS (2013; 2022; 2024)*

se najvećim brojem (19) ističe Istarska županija, gdje gotovo polovina svih gradova i općina bilježi suprotne predznake migracijskog salda prema dvije metode. U Dubrovačko-neretvanskoj županiji takvih je jedinica nešto više od trećine (8), u Primorsko-goranskoj nešto manje od trećine (11), u Splitsko-dalmatinskoj nešto više od petine (12). U Zadarskoj županiji pojavnost je nešto manja (6), a u Šibensko-kninskoj najmanja među primorskim županijama (2). U kontinentalnoj Hrvatskoj navedena je pojava rijetkost, a tu prednjače Zagrebačka i Krapinsko-zagorska županija s po šest takvih jedinica. Među ostalim područjima valja istaknuti gradove Varaždin, Čakovec i Dugu Resu. Sedam općina u Hrvatskoj (1,3 %) predstavlja drugu mogućnost s obrnutim predznakom migracijskog salda – imaju negativan ms_{DZS} i pozitivan ms_{VSM}. To su Jakovlje u Zagrebačkoj županiji, Kraljevec na Sutli i Zagorska Sela u Krapinsko-zagorskoj, Lovinac u Ličko-senjskoj, Jasenice i Polača u Zadarskoj te Lećevica u Splitsko-dalmatinskoj.

Prostorna slika razlike migracijskog salda (ms_{RAZ}) između službenih podataka (ms_{DZS}) i podataka vi-

ber of such cases (19), where nearly half of all cities and municipalities show opposing signs considering the two methods. In Dubrovnik-Neretva County, over a third of units (8) display this discrepancy, in Primorje-Gorski Kotar County under a third (11), and in Split-Dalmatia County slightly more than one-fifth (12). The occurrence is lower in Zadar County (6), and lowest among coastal areas in Šibenik-Knin County (2). In continental Croatia, this phenomenon is rare. However, Zagreb County and Krapina-Zagorje County stand out with six such units each. Other notable examples include the cities of Varaždin, Čakovec, and Duga Resa. Seven municipalities in Croatia (1.3%) represent the reverse pattern – a negative nmr_{CBS} and a positive nmr_{VSM}. These are Jakovlje in Zagreb County, Kraljevec na Sutli and Zagorska Sela in Krapina-Zagorje County, Lovinac in Lika-Senj County, Jasenice and Polača in Zadar County, and Lećevica in Split-Dalmatia County.

The spatial representation of the difference in net migration rates (nmr_{DIFF}) between the official data (nmr_{CBS}) and the vital statistics method (nmr_{VSM}) represents the focal point of this study. This variable is



Slika 3. *Razlika prosječne godišnje stope migracijskog salda DZS i VSM 2011. – 2021. godine*
Figure 3 *Difference in the average annual migration rate between CBS and VSM, 2011–2021*
Izvor: *Izračun autora na temelju DZS-a (2013; 2022; 2024)* / Source: *Calculated by the authors according to CBS (2013; 2022; 2024)*

talno-statističke metode (ms_{VSM}) središnji je dio ovoga rada. Varijabla je dobivena oduzimanjem dviju migracijskih stopa. Crvena na karti prikazuje područja s povoljnijom migracijskom stopom prema službenim podacima, dok plava označava područja s povoljnijom stopom prema podacima vitalno-statističke metode (Sl. 3.). Prostorni obrasci na podacima lokalne razine pretežito su sukladni iznesenim rezultatima na županijskoj razini i pokazateljima deskriptivne statistike, no upravo odudaranja od generalne pravilnosti čine ovaj dio analize vrjednijim i bogatijim. Na temelju općih i specifičnih rezultata moguće je izdvojiti tri međusobno prožimajuća nalaza.

Prema općim rezultatima migracijske bilance za Hrvatsku, službeni podaci (ms_{DZS}) prikazuju povoljnije stanje u odnosu na komparativne podatke (ms_{VSM}). Isti zaključak vrijedi za sve županije osim jedne. Na podacima lokalne razine to se može tvrditi za ukupno 393 (70,7 %) jedinica, kod kojih je razlika migracijskog salda pozitivna (nijanse crvene boje na karti). Kod 163 (29,3 %) jedinica razlika je negativna, što upućuje na povoljnije stanje prema podacima vitalno-statističke metode (plavo na karti). Stoga je prvi važniji nalaz detektiranje znatnog dijela teritorija koji odudara od općeg zaključka. Ta plavo označena područja zauzimaju više od trećine ukupne površine Hrvatske (37,9 %), ali na njihovu teritoriju živi tek 15 % ukupnog stanovništva. Činjenica da preostalih 85 % stanovništva živi na 62,1 % teritorija potvrđuje da se radi o gusto naseljenim područjima. Samim time, drugi važniji nalaz je da su pozitivna razlika migracijskog salda i povoljnije stanje prema službenim podacima češće prisutni u urbaniziranim područjima. Zaključak vrijedi za svih 20 najvećih gradova prema Popisu 2021. godine, čime se potvrđuje zakonitost. Treći važniji nalaz potvrda je ranije spomenutih rezultata – gotovo cijelo obalno područje bilježi izrazito pozitivniju migracijsku bilancu prema službenim podacima (ms_{DZS}). Pritom se ponovno potvrdila važnost analize na lokalnoj razini, napose u dalmatinskim županijama, u kojima je jasno vidljiva diferencijacija obale i zaleđa.

Na temelju kartografskog prikaza u nastavku je moguće iščitavati lokalne specifičnosti pojedinih područja, no uz oprez. Karta prikazuje razliku ms_{DZS} i ms_{VSM}, ali ne pruža informaciju o njihovim

calculated by subtracting the two migration rates. On the map, red indicates areas where the migration rate is more favourable according to official data, while blue indicates areas where the vital statistics method yields more favourable rates (Fig. 3). The spatial patterns observed at the local level largely align with the previously presented county-level results and descriptive statistics. However, it is the deviations from these general trends that specifically make this part of the analysis more insightful and meaningful. Based on both general and specific findings, three interrelated conclusions can be drawn.

According to overall net migration results for Croatia, the official data (nmr_{CBS}) present a more favourable situation compared to the comparative data (nmr_{VSM}). The same conclusion applies to all counties except one. At the local level, this pattern holds for a total of 393 units (70.7%) in which the net migration difference is positive (shades of red on the map). Conversely, 163 units (29.3%) show a negative difference, indicating a more favourable balance according to the vital statistics method (blue on the map). Thus, the first key finding is the identification of a substantial portion of the territory that deviates from the general trend. These blue-marked areas account for more than one-third of Croatia's total territory (37.9%), but only 15% of the total population resides there. The fact that the remaining 85% of the population lives on 62.1% of the territory confirms that these are densely populated areas. Accordingly, the second key finding is that a positive migration balance difference and a more favourable outcome according to official data are more frequently found in urban areas. This conclusion holds for all the 20 largest cities according to the 2021 Census, confirming the pattern. The third key finding confirms previously presented results – almost the entire coastal area records a significantly more positive migration balance in the official data (nmr_{CBS}). This once again highlights the importance of conducting analysis at the local level, especially in the Dalmatian counties, where a clear differentiation between the coastline and the hinterland is evident.

Cartographic representation allows for the identification of local specificities across individual areas, though caution is required in interpretation. The map illustrates the difference between nmr_{CBS} and nmr_{VSM}, but it does not indicate their respective signs. The

predznacima. Nijanse boja prikazuju intenzitet i smjer razlike, pa je moguće iščitavati razlike među jedinicama, no vrijednosti nisu intuitivne, stoga je teško procijeniti jesu li pojedine razlike značajne ili zanemarive. Kako bi se podacima dala statistički relevantnija forma i kako bi se omogućilo vjerodostojno izdvajanje područja upitne pouzdanosti demografske statistike, u sljedećem koraku razlike migracijskog salda iskazane su u standardnim devijacijama (Sl. 4.). Ova verzija karte predstavlja pročišćenu i optimiziranu varijantu promatrane varijable te je relevantnija za iščitavanje specifičnih nalaza. Jedna standardna devijacija u ovom kontekstu označava razliku od 6,03 promilnih bodova između ms_{DZS} i ms_{VSM}.

Prije kartografsko-statističke analize potrebno je istaknuti nekoliko napomena o interpretaciji podataka. Na prvi dojam karta je intuitivna za interpretaciju – nijanse crvene prikazuju povoljnije stanje prema službenim podacima, a nijanse plave povoljnije stanje prema komparativnim podacima. No iz podataka se ne može utvrditi jesu li razlike migracijskih salda posljedica nepouzdanosti migracijske statistike, popisne statistike ili oba izvora podataka. Takva paradoksalna situacija dijelom podsjeća na Schrödingerovu mačku. Crveno označena jedinica istovremeno može značiti nepouzdane podatke migracijske i popisne statistike, no tek uvidom u točne i stvarne podatke te jedinice možemo znati što je presudno. Uvid u takve podatke analogan je otvaranju kutije Schrödingerove mačke, a budući da točne i stvarne podatke nemamo, možemo se osloniti na konceptualni model s prikazom različitih mogućnosti stvarnih podataka (Sl. 4b). Ako su i popisni i migracijski podaci za određenu jedinicu točni, između migracijskog salda DZS-a i VSM-a ne bi trebalo biti značajne razlike. U slučaju da su popisni podaci uglavnom točni, a migracijski nisu, tada crvena označava precijenjen ms_{DZS} (premalo odjavljivanja prebivališta ili previše „fiktivnog" prijavljivanja), a plava podcijenjen ms_{DZS} (premalo prijavljivanja prebivališta ili previše odjavljivanja u odnosu na stvarno stanje). U slučaju da popisni podaci nisu posve točni, a migracijski podaci uglavnom jesu, tada crvena upućuje na premalo popisanih, a plava na potencijalno previše popisanih. Za razliku od Schrödingerove mačke, u ovom je slučaju moguća i treća mogućnost – da ni mi-

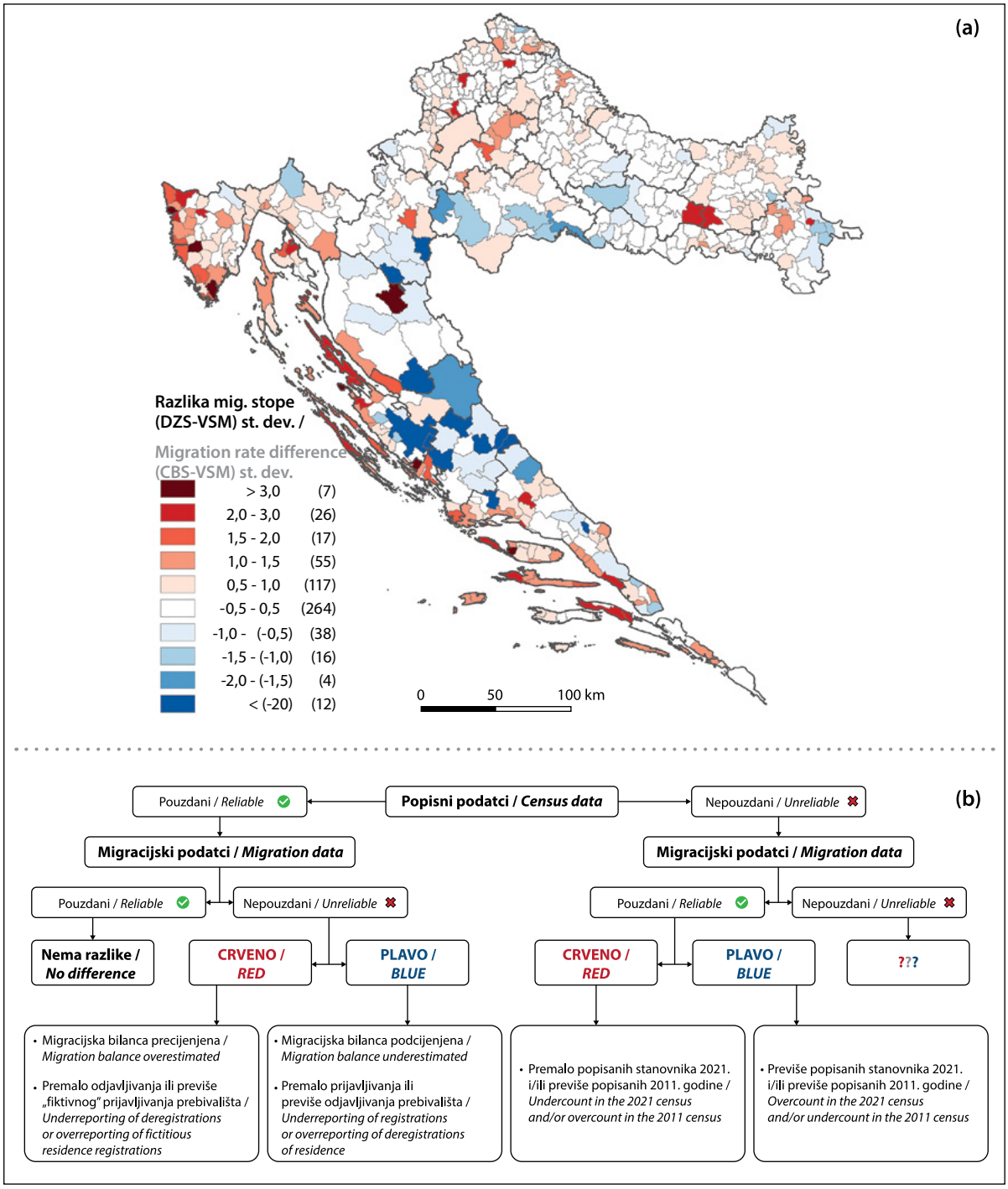
colour gradients show the intensity and direction of the difference, making it possible to compare units. However, the values are not intuitive, making it difficult to assess whether the differences are statistically significant or negligible. In order to provide the data with a greater statistical relevance and enable more credible identification of areas with questionable demographic data reliability, the next step expresses the net migration differences in standard deviations (Fig. 4). This version of the map represents a refined and optimised form of the observed variable and is more appropriate for interpreting specific findings. In this context, one standard deviation corresponds to a difference of 6.03 per mille points between nmr_{CBS} and nmr_{VSM}.

Before the cartographic-statistical analysis, several interpretative remarks must be highlighted. At first glance, the map appears intuitive to interpret – shades of red indicate a more favourable outcome according to official data, while shades of blue represent more favourable outcomes according to comparative data. However, the data alone do not allow us to determine whether the differences in net migration rates stem from the unreliability of migration statistics, census statistics, or both. This paradoxical situation in some ways resembles Schrödinger's cat. A red-marked unit could simultaneously indicate unreliable migration data, unreliable census data, or both. Only access to accurate and verifiable data for a given unit would reveal the dominant source of discrepancy – comparable to opening Schrödinger's box. Since such data are not available, we rely on a conceptual model that illustrates the range of possible actual scenarios (Fig. 4b). If both census and migration data are accurate for a given unit, there should be no significant difference between the net migration rate from CBS and that derived from the vital-statistical method. If the census data are generally reliable but the migration data are not, then a red unit indicates an overestimated nmr_{CBS} (due to underreporting of emigration or overreporting through 'fictitious' registrations), while a blue unit signals an underestimated nmr_{CBS} (due to underreporting of immigration or excessive deregistrations compared to actual population movement). If census data are less reliable and migration data are more accurate, red may indicate undercounting in the census, while blue suggests potential overcounting. Unlike Schrödinger's cat, however, a third sce-

gracijska ni popisna statistika za neku jedinicu nisu posve pouzdane. Crvena za takvu jedinicu može biti pokazatelj dominantnije pojavnosti (premalo odjavljivanja/previše „fiktivnih" prijava ili premalo popisanih), a u slučaju suprotnih predznaka može označavati zbroj obje mogućnosti. Suprotna analogija vrijedi za plavu.

nario is possible here: both sources may be flawed. In such cases, red may reflect the dominance of one type of error (e.g., underreporting of emigration or undercounting in the census), whereas opposing errors could result in red or blue depending on their combination and magnitude.

Local units where the differences between the two



Slika 4. *(a) Razlika migracijske stope DZS-a i VSM-a 2011. – 2021. godine u standardnim devijacijama; (b) Tumačenje razlika migracijske stope DZS i VSM*

Figure 4 *(a) Difference in migration rates between CBS and VSM from 2011 to 2021, expressed in standard deviations; (b) Interpretation of migration rate differences between CBS and VSM*

Izvor: *Izračun autora na temelju DZS-a (2013; 2022; 2024)* / Source: *Calculated by the authors according to CBS (2013; 2022; 2024)*

Lokalne jedinice čije su razlike dviju promatranih migracijskih stopa manje od pola standardne devijacije, bilo u pozitivnom ili negativnom smjeru, izdvojene su kao zasebna kategorija i označene bijelom bojom. Radi se o gotovo polovini ukupnog broja jedinica, a u njima živi otprilike trećina ukupnog stanovništva (Tab. 3.). Iako na tom prostoru ukupna apsolutna razlika dvaju migracijskih salda iznosi oko 16 000, relativna je razlika ispod 15 %. U kontekstu usklađenosti dvaju setova podataka, ti se gradovi i općine mogu smatrati područjima najpouzdanije migracijske statistike u hrvatskim okvirima. Veći gradovi unutar ove kategorije su Velika Gorica, Karlovac, Šibenik, Sisak, Samobor, Bjelovar, Koprivnica, Požega, Petrinja, Kutina i Virovitica. Unutar kategorije je i 13 jedinica[2] sa suprotnim predznacima dvaju migracijskih salda. One su ranije istaknute kao neka od područja u analizi kojih je nužan oprez, no standardna razlika je mala, što upućuje na zaključak da su njihovi podaci relativno pouzdani, a suprotni predznaci dobiveni su zbog malih vrijednosti blizu nule.

Oko petine ukupnog broja gradova i općina bilježi pozitivnu razliku migracijskih salda razine između pola i jedne standardne devijacije (Tab. 3.). U tim područjima živi gotovo polovina ukupnog stanovništva, a zbog njegova izrazitog pondera i Hrvatska u cjelini pripada ovoj kategoriji. Razlika migracijskih bilanci u apsolutnom iznosu (oko 86 000) daleko nadmašuje sve ostale kategorije, što se može pripisati činjenici da u ovu skupinu spadaju najveći gradovi. Pritom gotovo polovina otpada na Grad Zagreb (40 022), a velike razlike bilježe i drugi najveći gradovi: Split (6 248), Rijeka (4. 658), Osijek (3 470), Pula (3 256), Slavonski Brod (2 343), Varaždin (2 201). Od ostalih većih gradova valjda izdvojiti Čakovec (913), Zaprešić (780), Đakovo (1 050) i Sinj (835). Unatoč velikim apsolutnim razlikama, relativne su razlike prosječne razine unutar okvira Hrvatske. Zbog toga razlike migracijskih stopa ispod jedne standardne devijacije ne upućuju nužno na izrazitu nepouzdanost podataka, već na sustavnu razliku između dviju stopa. Izuzetak su gradovi i općine suprotnih predznaka.

[2] msDZS > 0 i msVSM < 0: Korčula, Smokvica, Buzet, Veliki Bukovec, Karojba, Krapinske Toplice, Jelenje, Brela, Barban, Marija Bistrica; msDZS <0 i msVSM > 0: Jakovlje, Jasenice, Kraljevec na Sutli.

observed migration rates fall within half a standard deviation, either positive or negative, were classified as a separate category and marked in white. These account for nearly half of all units, encompassing approximately one-third of the national population (Table 3). Although the total absolute difference in migration balances across these areas amounts to around 16,000, the relative difference is below 15%. In terms of consistency between the two data sets, these towns and municipalities may be regarded as the areas with the most reliable migration statistics within the Croatian context. Larger urban centres in this category include Velika Gorica, Karlovac, Šibenik, Sisak, Samobor, Bjelovar, Koprivnica, Požega, Petrinja, Kutina, and Virovitica. The category also includes 13 units[2] with opposing signs of migration balance. Although these were previously highlighted as the areas requiring caution in data interpretation, the small standard deviation suggests that their data are relatively reliable, and the conflicting signs likely result from small values close to zero.

Approximately one fifth of all towns and municipalities exhibit a positive difference in migration balance between half and one standard deviation (Table 3). Almost half of the Croatian population lives in these areas, and due to this significant demographic weight, the country as a whole fall into this category. The absolute difference in migration balance (approximately 86,000) by far exceeds that of all other categories, largely due to the inclusion of the country's largest cities. Nearly half of this figure pertains to the City of Zagreb (40,022), while other major cities also record substantial differences: Split (6,248), Rijeka (4,658), Osijek (3,470), Pula (3,256), Slavonski Brod (2,343), and Varaždin (2,201). Among other notable towns are Čakovec (913), Zaprešić (780), Đakovo (1,050), and Sinj (835). Despite the large absolute differences, the relative differences are of average magnitude within the national context. Therefore, differences in migration rates below one standard deviation do not necessarily indicate significant data unreliability but rather reflect a systematic discrepancy between the two rates. Exceptions include cities and towns with opposite signs for nmr_{CBS} and

[2] nmbCBS>0 and nmbVSM <0: Korčula, Smokvica, Buzet, Veliki Bukovec, Karojba, Krapinske Toplice, Jelenje, Brela, Barban, Marija Bistrica; msDZS<0 and msVSM >0: Jakovlje, Jasenice, Kraljevec na Sutli.

Tablica 3. *Demografski i migracijski pokazatelji po razinama odstupanja između DZS-a i VSM-a*
Table 3 *Demographic and migration indicators by deviation levels between CBS and VSM*

Standardne devijacije / *Standard deviations*	**Broj JLS / *Number of local units***	**Udio JLS (%) / *Share of units (%)***	**Broj stanovnika 2021. / *2021 Population***	**Udio uk. stan. (%) / *Share of total pop. (%)***	**Ukupno doseljeni / *Total imigration***	**Ukupno odseljeni / *Total emigration***	**Migracijski saldo (DZS) / *Net migration (CBS)***	**Migracijski saldo (VSM) / *Net migration (VSM)***	**Apsolutna razlika / *Absolute difference***	**Relativna razlika / *Relative difference***
> 3	7	1,3	15.709	0,4	9.464	6.174	3.291	-694	3.985	121,1
2 - 3	26	4,7	68.034	1,8	28.340	19.742	8.598	-1.506	10.104	117,5
1,5 - 2	17	3,1	75.349	1,9	31.281	25.321	5.959	-2.080	8.039	134,9
1 - 1,5	55	9,9	426.237	11,0	130.466	122.410	8.056	-23.811	31,866	133,8
0,5 - 1	117	21,0	1.836.149	47,4	430.209	441.202	-10.993	-97.256	86.263	88,7
-0,5 - 0,5	264	47,5	1.272.055	32,9	278.860	373.234	-94.374	-110.756	16.382	14,8
-1 - (-0,5)	38	6,8	108.985	2,8	28.496	47.553	-19.057	-13.918	5.140	27,0
-1,5 - (-1)	16	2,9	39.336	1,0	9.988	17.724	-7.735	-4.556	3.180	41,1
-2 - (-1,5)	4	0,7	9.886	0,3	2.526	5.521	-2.995	-1.830	1.165	38,9
< -2	12	2,2	20.093	0,5	6.884	11.522	-4.638	-1.465	3.173	68,4
Uk. / *Total*	556	100,0	3.871.833	100,0	956.513	1.070.402	-113.889	-257.870	169.296	65,7

Napomena: *relativna razlika dobivena je omjerom apsolutne razlike i apsolutnog iznosa većega od dvaju migracijskih salda*
Izvor: *Izračun autora na temelju DZS-a (2013; 2022; 2024)* / Source: *Calculated by the authors according to CBS (2013; 2022; 2024)*

znaka ms_{DZS} i ms_{VSM} poput Zagreba, Pule, Varaždina, Čakovca i Dugog Sela (Tab. A1. u dodacima) – analiza njihovih podataka zahtijeva povećan oprez.

Jedinice s pozitivnim razlikama migracijskih stopa između jedne i dvije standardne devijacije dio su normalne distribucije, ali ukupni apsolutni iznosi migracijskog salda DZS-a i VSM-a suprotnog su predznaka, stoga je pri analizi njihovih podataka također nužan oprez. Relativne razlike dvaju migracijskih pokazatelja upravo su u ove dvije kategorije najveće s iznosima iznad 130 %. U jedinicama kategorije 1 do 1,5 standardne devijacije živi nešto manje od pola milijuna stanovnika, a uglavnom se prostiru priobalnim pojasom. Najveći gradovi u kategoriji su Zadar, Dubrovnik, Kaštela, Vinkovci, Solin i Poreč. Među njima jedino Vinkovci bilježe jednak predznak za obje stope. Kategorija s jedinicama 1,5 do 2 standardne devijacije populacijski je manja, ali označava viši stupanj odstupanja dviju migracijskih stopa. Od većih gradova tu se ističu Rovinj i Umag, a jedine općine u kontinentalnom dijelu su Krnjak i Rugvica.

Odstupanje između dvije i tri standardne devijacije može upućivati na potencijalne metodološke specifičnosti pojedine jedinice. Podatke za tu skupinu potrebno je uvijek interpretirati s dodatnim oprezom. Radi se najvećim dijelom o priobalnim jedinicama s manjim brojem stanovnika, a uvjerljivo najveća među njima je Općina Podstrana. Skupini pripada i nekoliko jedinica koje predstavljaju izuzetke u kontinentalnom dijelu zemlje: Donja Stubica, Jalžabet, Lobor, Negoslavci i Levanjska Varoš. Jedinice s odstupanjem većim od tri standardne devijacije su statistički izuzeci te zahtijevaju velik oprez, detaljnu provjeru i dodatna objašnjenja. Najvećim vrijednostima izdvajaju se Vir (5,44 st. dev.), Vrhovine (5,26) i Milna (4,54), a u kategoriji su još Novigrad, Kanfanar, Ližnjan i Pirovac.

Plavo obojena područja odlikuju se povoljnijim stanjem prema podacima vitalno-statističke metode, a njihova je pojavnost bitno rjeđa. Budući da se radi o prostorima koji odudaraju od generalne pravilnosti, u analizi njihovih podataka važno je imati na umu eventualnu strukturu podataka koja je dovela do inverzije. Najintenzivnija pojavnost takvih područja je u sjevernom dijelu Dalmatinske zagore, dijelovima Like, Korduna, Banovine, zapadne Slavonije, uz pojedina rubna područja u

nmr_{VSM}, such as Zagreb, Pula, Varaždin, Čakovec, and Dugo Selo (Table A1 in the Appendix), whose data warrant greater interpretive caution.

Units with positive differences in migration rates between one and two standard deviations fall within the range of normal distribution; however, the total absolute migration balances from CBS and VSM show opposing signs, which calls for caution in data interpretation. The relative differences between the two migration indicators are highest within these two categories, exceeding 130%. Nearly half a million people reside in units within the 1 to 1.5 standard deviation category, which are mostly located along the coastal belt. The largest cities in this category include Zadar, Dubrovnik, Kaštela, Vinkovci, Solin, and Poreč. Among them, only Vinkovci shows matching signs for both rates. The 1.5 to 2 standard deviation category is smaller in terms of population but indicates a greater level of divergence between the two migration rates. Larger cities in this group include Rovinj and Umag, while the only municipalities from the continental part of the country are Krnjak and Rugvica.

Deviation between two and three standard deviations may point to potential methodological peculiarities specific to individual units. Data for this group should always be interpreted with additional caution. Most of these units are coastal and have relatively small populations, with the Municipality of Podstrana standing out as the largest. The group also includes a few exceptions located in the continental part of the country: Donja Stubica, Jalžabet, Lobor, Negoslavci, and Levanjska Varoš. Units with deviations greater than three standard deviations are statistical outliers and require exceptional caution, thorough verification, and further explanation. The most notable cases include Vir (5.44 s.d.), Vrhovine (5.26), and Milna (4.54), while Novigrad, Kanfanar, Ližnjan, and Pirovac are also part of this category.

Areas shaded in blue reflect more favourable conditions according to the vital statistics method data, although their occurrence is considerably rarer. Since these areas deviate from the general pattern, it is important to consider the possible data structure that may have led to this inversion when interpreting their figures. The most notable presence of such areas is in the northern part of the Dalmatian hinterland, parts of Lika, Kordun, Banovina, western Slavonia, and

različitim dijelovima zemlje. Jedinice s negativnom razlikom migracijskih salda između pola i jedne standardne devijacije uvjetno se mogu smatrati relativno pouzdanima za analize. U toj su skupini gradovi Vukovar, Knin, Drniš, Vrgorac, Slunj. Sljedeću skupinu (-2 do -1 standardne devijacije) čine područja s izraženijom sumnjom u pouzdanost podataka. Njihova apsolutna i relativna odstupanja manja su u odnosu na skupinu pozitivne razlike od 1 do 2 standardne devijacije, no povećan oprez je nužan. Među ostalima, u ovoj su skupini gradovi Glina, Pakrac i Čabar. Konačno, gradovi i općine s negativnim odstupanjima višim od dvije standardne devijacije također se mogu smatrati područjima upitne pouzdanosti demografske statistike. U toj su skupini gradovi Benkovac i Skradin, a s najvećim vrijednostima ističu se Ervenik (-4,5), Lokvičići (-3,4), Biskupija (-2,7), Civljane (-2,7) i Lišane Ostrovičke (-2,6). Općine Lovinac i Lećevica specifične su po suprotnim predznacima dvaju migracijskih salda, a popis kategorije zaključuju Cetingrad, Kijevo i Saborsko.

Prostorna autokorelacija (ne)pouzdanosti migracijskih podataka

Predočena karta razlika migracijskih salda u standardnim devijacijama može poslužiti kao ključni okvir za izdvajanje područja slabije pouzdanosti demografske statistike u Hrvatskoj. Sljedeći korak u istraživanju predstavlja prostorna autokorelacija tih razlika, koja omogućuje bolje razumijevanje prostornih obrazaca nepouzdanosti tih podataka. Lokalni Moranov indeks pružit će informaciju o tome koje su jedinice, identificirane kao područja slabije pouzdanosti podataka, okružene istim takvim jedinicama, a koje od njih nisu. Identificirat će se samo područja u kojima je nepouzdanost podataka u nekoj mjeri prostorno uvjetovana, dok će ostale jedinice ostati neoznačene. Susjedstvom pojedinog grada ili općine definirano je pet prostorno najbližih jedinica. Važno je napomenuti da bi drukčijim definiranjem susjedstva rezultati bili neznatno drukčiji. Proširivanjem susjedstva broj jedinica identificiranih kao klasteri pozitivne ili negativne razlike blago bi se povećao, dok bi se smanjivanjem susjedstva broj blago smanjio. Tako definirano susjedstvo predstavlja kompromisnu

in some peripheral zones across the country. Units with a negative difference in migration rates between half and one standard deviation can be conditionally considered relatively reliable for analysis. This group includes the towns of Vukovar, Knin, Drniš, Vrgorac, and Slunj. The next group (-2 to -1 standard deviations) includes areas where the reliability of data is more questionable. Although their absolute and relative deviations are smaller compared to the positive 1 to 2 standard deviation group, increased caution is still required. Among others, this group includes Glina, Pakrac, and Čabar. Finally, towns and municipalities with negative deviations exceeding two standard deviations are also considered areas of questionable demographic data reliability. These include the towns of Benkovac and Skradin, with the highest deviations recorded in Ervenik (-4.5), Lokvičići (-3.4), Biskupija (-2.7), Civljane (-2.7), and Lišane Ostrovičke (-2.6). The municipalities of Lovinac and Lećevica are notable for having opposite signs in the two migration indicators, and the category is completed by Cetingrad, Kijevo, and Saborsko.

Spatial autocorrelation of (un)reliability in migration data

The presented map of net migration differences expressed in standard deviations provides a key framework for identifying areas of lower reliability in demographic statistics across Croatia. The next step in the analysis involves exploring the spatial autocorrelation of these differences, which allows for a deeper understanding of the spatial patterns of data unreliability. The Local Moran's I index indicates which units, identified as areas of lower data reliability, are surrounded by similarly classified units, and which are not. Only areas where data unreliability is at least partially spatially conditioned are identified, while other units remain unmarked. The neighbourhood of each town or municipality is defined as the five nearest spatial units. It is important to note that using a different definition of neighbourhood would have slightly altered the results. Expanding the neighbourhood would have marginally increased the number of units identified as clusters of positive or negative differences, while reducing it would have led to a slight decrease. This definition of neighbourhood

vrijednost, a cilj nije točno klasificirati svaku pojedinu jedinicu, već pružiti okvir identificiranjem područja Hrvatske u kojima se takvi klasteri pojavljuju.

Jedinice identificirane kao klasteri pozitivne ili negativne razlike migracijskog salda u najvećoj se mjeri poklapaju s navedenim područjima upitne pouzdanosti demografskih podataka (Sl. 5.). Time je potvrđena uspješnost definiranih uvjeta za kvantificiranje nepouzdanosti. Na prvi pogled dobiva se dojam kako su uglavnom identificirane jedinice pozitivne ili negativne razlike migracijskih salda veće od jedne standardne devijacije, no ima izuzetaka. Neke od izdvojenih jedinica ranije su označene kao područja relativno pouzdanih podataka, a neke jedinice s razlikom iznad tri standardne devijacije tu uopće nisu označene. Stoga je važno pravilno interpretirati kartu i identificirane klastere, ali i napomenuti da ovaj dio analize služi samo kao dopuna ranijim rezultatima i to u smislu prostornih obrazaca pojavnosti nepouzdanih podataka.

Klasteri pozitivne razlike (*high-high*) obuhvaćaju jedinice čija je razlika migracijskog salda, ali i razlika migracijskog salda pet najbližih susjeda, statistički značajno pozitivna (veći ms_{DZS} u odnosu na ms_{VSM}). Drugim riječima, ako je jedinica označena crvenom, to znači da i ona i pet najbližih susjeda vjerojatno pate od slabije pouzdanosti demografskih podataka. U odnosu na sva crveno označena područja na karti razlika migracijskog salda u standardnim devijacijama (Sl. 4a), tu je identificiran samo veći dio priobalnih područja. Nepouzdanost podataka, u smjeru povoljnijeg stanja prema službenim podacima, stoga je prostorno uvjetovana samo u priobalnom pojasu. Za sve takve jedinice u kontinentalnoj Hrvatskoj razlozi su sustavni (stupanj urbanizacije, veća mobilnost stanovništva, rad na određeno i sl.) ili specifični za pojedinu lokalnu jedinicu.

Klasteri negativne razlike (*low-low*) označavaju jedinice čija je razlika migracijskog salda, kao i razlika migracijskog salda njihova susjedstva, statistički značajno negativna (veći ms_{VSM} u odnosu na ms_{DZS}). Plava boja označava područja u kojima je migracijski saldo u službenim podacima podcijenjen i/ili postoji sumnja u pouzdanost popisnih podataka. Identificirana područja

represents a compromise, as the goal is not to classify every individual unit with precision, but to provide a framework for identifying areas in Croatia where such spatial clusters emerge.

The units identified as clusters of positive or negative differences in net migration rates largely correspond to the previously outlined areas of questionable demographic data reliability (Fig. 5). This confirms the effectiveness of the previously established criteria for quantifying unreliability. At first glance, it appears that most of the identified units with positive or negative net migration differences exceed one standard deviation, but there are exceptions. Some of the highlighted units had previously been classified as relatively reliable, while others with differences exceeding three standard deviations are not marked here at all. Therefore, it is important to interpret the map and the identified clusters carefully, and to note that this part of the analysis serves only as a complement to earlier findings, specifically in terms of the spatial patterns of demographic data unreliability.

High-high clusters include units for which both the difference in net migration rate and the average difference of their five nearest neighbours are statistically significantly positive (i.e., nmr_{CBS} is greater than nmr_{VSM}). In other words, if a unit is marked in red, this indicates that both it and its five closest neighbours are likely suffering from lower reliability of demographic data. Compared to the red areas marked red on the map showing net migration differences in standard deviations (Fig. 4a), only a larger portion of the coastal area is identified here. Thus, data unreliability, manifested as more favourable outcomes in the official statistics, is spatially conditioned only along the coastal strip. For all such units in continental Croatia, the causes of unreliability are either structural (such as urbanisation levels, higher population mobility, temporary labour migration, etc.) or specific to the individual local unit.

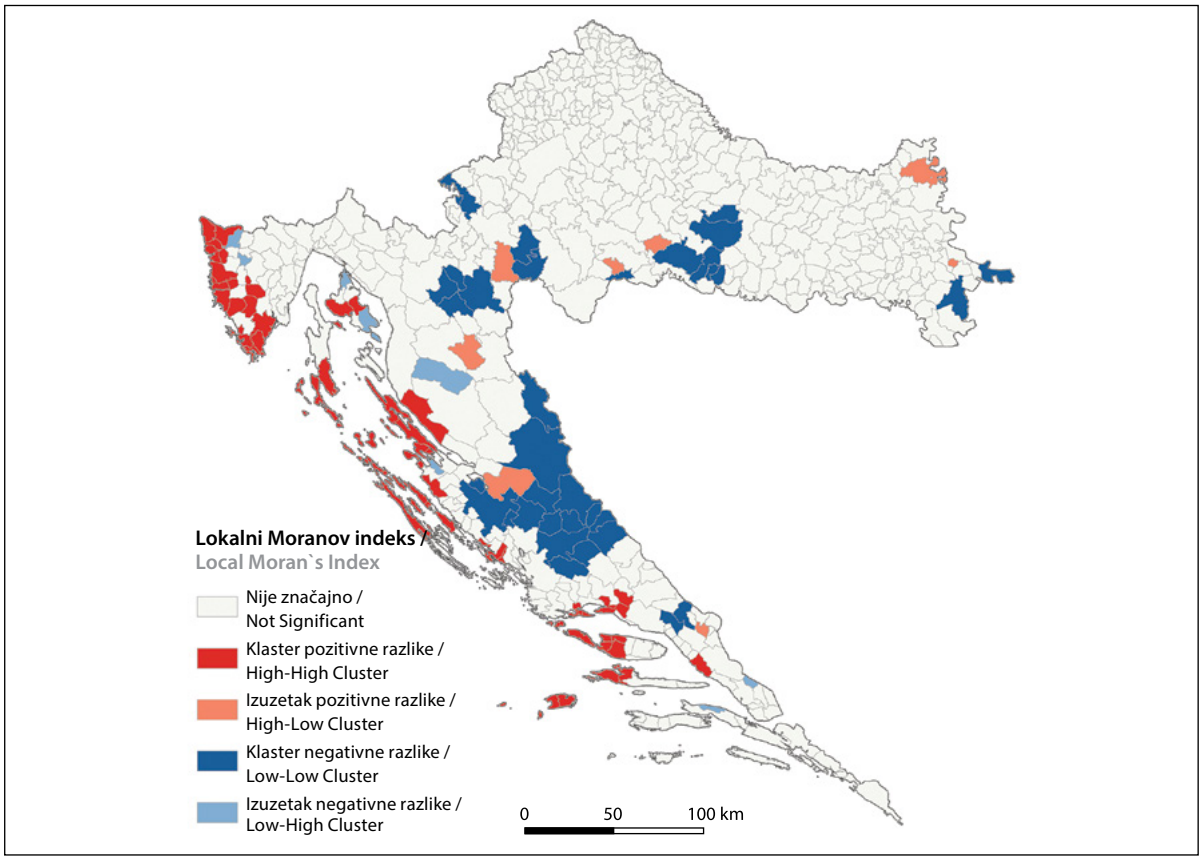
Low-low clusters refer to units for which both the difference in net migration rate and the difference in their surrounding units are statistically significantly negative (i.e., nmr_{VSM} is greater than nmr_{CBS}). Blue areas, therefore, indicate regions where the official migration balance is likely underestimated and/or where the reliability of census data is questionable. The identified areas largely correspond to

najvećim se dijelom poklapaju s ranije predočenim rezultatima. Razinu pouzdanosti za pojedini grad ili općinu uputno je iščitavati iz karte sa standardnim devijacijama, dok ovaj prikaz pruža informacije o izdvojenim većim klasterima. Prostorno je najveći klaster u sjevernom dijelu Dalmatinske zagore i južne Like, slijede kordunsko-banovinski i zapadnoslavonski klasteri i još nekoliko manjih klastera u različitim dijelovima zemlje.

Izuzeci pozitivne razlike (*high-low outlier*) predstavljaju svojevrsne anomalije u prostoru. To su jedinice pozitivne razlike migracijskog salda dominantno okružene jedinicama negativne razlike (Kneževi Vinogradi, Negoslavci, Lipovljani, Majur, Vojnić, Vrhovine, Obrovac i Podbalje). Suprotno njima, izuzeci negativne razlike (*low-high outlier*) označavaju jedinice negativne razlike migracijskog salda okružene susjedstvom pozitivne razlike (Grožnjan, Karojba, Omišalj, Baška, Perušić, Vrsi, Pojezerje i Trpanj). Sve izdvojene klastere, a osobito manje, nužno je promatrati zajedno s okruženjem, a ne kao zasebne jedinice.

the previously presented results. While the reliability level for a specific town or municipality is best interpreted using the map based on standard deviations, this map highlights larger clusters. Spatially, the largest cluster appears in the northern part of the Dalmatian hinterland and southern Lika, followed by clusters in the Kordun–Banovina region, western Slavonia, and several smaller clusters scattered across the country.

High-low outliers represent spatial anomalies – units with a significantly positive net migration difference that are predominantly surrounded by units with negative differences (e.g., Kneževi Vinogradi, Negoslavci, Lipovljani, Majur, Vojnić, Vrhovine, Obrovac, and Podbablje). Conversely, low-high outliers denote units with a negative net migration difference that are surrounded by neighbours showing positive differences (e.g., Grožnjan, Karojba, Omišalj, Baška, Perušić, Vrsi, Pojezerje, and Trpanj). All identified clusters – especially the smaller ones – should be interpreted in conjunction with their spatial context rather than as isolated units.



Slika 5. *Lokalni Moranov indeks prostorne autokorelacije razlike između DZS-a i VSM-a*
Figure 5 *Local Moran's I of spatial autocorrelation for CBS–VSM migration rate differences*
Izvor: *Izračun autora na temelju DZS-a (2013; 2022; 2024)* / Source: *Calculated by the authors according to CBS (2013; 2022; 2024)*

RASPRAVA

Domaća i međunarodna istraživanja migracijskih tokova slažu se u potvrdi podcijenjenosti iseljavanja iz Hrvatske nakon pristupanja Europskoj uniji (Akrap i sur., 2017; Balija, 2020; Dańko i sur., 2024; Komušanac, 2023; Pokos, 2017; Pokos & Turk, 2022a; Strmota, 2020). Ovaj rad analizu (ne)pouzdanosti migracijskih podataka spušta najprije na regionalnu (županijsku) razinu, a zatim i na lokalnu. U skladu s istraživanjima nacionalne razine, u svakoj županiji, osim jedne, migracijski saldo službenih podataka povoljniji je u odnosu na migracijski saldo komparativne vitalno-statističke metode, stoga je potvrđena precijenjenost migracijske bilance. Požeško-slavonska županija, kao izuzetak, županija je s najusklađenijim, a time i najpouzdanijim podacima regionalne razine. Ipak, unutar nje postoje područja upitne pouzdanosti podataka za koja službeni podaci precjenjuju i područja za koja podaci podcjenjuju migracijski saldo, stoga se razlike međusobno poništavaju. Taj primjer pokazuje važnost i opravdanost istraživanja na lokalnoj razini, a na temelju cjelovite analize jasno je da relativno zadovoljavajuće razlike migracijskog salda i pouzdanosti podataka županijske razine ne jamče jednako pouzdane podatke za sva područja unutar županije. Takvi obrasci u skladu su s upozorenjima o učinku prostorne skale i zoniranja (MAUP) u analizi migracija, prema kojima migracijski pokazatelji na grubim regionalnim razinama ne odražavaju nužno stvarnu razinu mobilnosti, već mogu predstavljati artefakt prostorne agregacije i prikrivati znatne unutarnje razlike (Chatagnier & Stillwell, 2021; Stillwell i sur., 2018).

Rezultati na lokalnoj razini potvrđuju da je u razdoblju 2011.–2021. u Hrvatskoj povoljnija migracijska bilanca prema službenim podacima dominantna pojava (70,7 % jedinica). Međutim, intenzitet nepouzdanosti podataka znatno varira u prostoru, dok 29,3 % jedinica bilježi povoljniji saldo prema vitalno-statističkoj metodi, čime odudara od temeljne zakonitosti. Budući da metodološki okvir uključuje kombinaciju direktnih administrativnih migracijskih podataka i indirektnih podataka na temelju popisa

DISCUSSION

National and international studies on migration flows consistently confirm the underestimation of emigration from Croatia following its accession to the European Union (Akrap et al., 2017; Balija, 2020; Dańko et al., 2024; Komušanac, 2023; Pokos, 2017; Pokos & Turk, 2022a; Strmota, 2020). This study brings the analysis of migration data (un)reliability down to the regional (county) level, and then further to the local level. Consistently with findings at the national level, in all but one county, the net migration rate derived from official data is more favourable than that obtained using the comparative vital-statistical method, thus confirming an overestimation of the migration balance. Požega-Slavonia County, as the exception, demonstrates the highest consistency between the two measures and therefore shows the most reliable data at the regional level. However, even within this county, there are areas with questionable data reliability, some where the official data overestimate and other where they underestimate the migration balance, resulting in the differences effectively offsetting each other out. This illustrative example highlights the importance and validity of research at the local level. A comprehensive analysis clearly shows that relatively acceptable differences in net migration rates and data reliability at the county level do not guarantee equally reliable data across all areas within a county. These patterns are consistent with warnings about the effects of spatial scale and zonation (MAUP) in migration analysis, which suggest that migration indicators at coarse regional levels do not necessarily reflect actual levels of mobility, but may instead represent artefacts of spatial aggregation and conceal substantial internal differences (Stillwell et al., 2018; Chatagnier & Stillwell, 2021).

The results at the local level confirm that, during the 2011–2021 period, a more favourable migration balance according to official data was the dominant pattern in Croatia, present in 70.7% of all units. However, the intensity of data unreliability varies significantly across space, with the remaining 29.3% of units showing a more favourable balance according to the vital-statistical method – deviating from the general trend. As the methodological framework combines direct administrative migration data with indirect census-based estimates, the observed dif-

stanovništva, dobivena razlika, kao promatrana varijabla, istovremeno mjeri nepouzdanost migracijske i popisne statistike. Pozitivna razlika između službenih i komparativnih podataka sustavna je pojava zbog metodoloških razloga dvaju izvora (Ahmad Yar & Bircan, 2023). Pojavnost pozitivne razlike za pojedini grad ili općinu ne mora se automatski tumačiti kao znak nepouzdanosti podataka. Štoviše, za nešto manje od polovine svih jedinica može se dati zadovoljavajuća ocjena pouzdanosti podataka jer su razlike migracijskih salda minimalne, manje od pola standardne devijacije. Oprez u demografskoj analizi nužan je za četvrtinu gradova i općina Hrvatske s razlikama većim od jedne standardne devijacije. Dodaju li se tome i sve jedinice čije su razlike migracijskih salda DZS-a i VSM-a manje od zadane granice, ali su suprotnih predznaka, tada ukupni udio područja slabije pouzdanosti demografskih podataka seže do gotovo trećine. Obalni pojas ističe se najvećom pozitivnom razlikom, a time i najslabijom pouzdanošću podataka, a nešto slabiju, ali i dalje prisutnu nepouzdanost bilježe gradovi, što je u skladu s postavljenom hipotezom istraživanja.

Glavni rezultati u skladu su s nalazima prethodnih istraživanja usporedbe migracijskih podataka iz dvaju izvora i kvalitete statistike, koji upozoravaju da pouzdanost migracijskih podataka nije prostorno homogena, već varira ovisno o tipu prostora, prostornoj razini i izvoru podataka (Chatagnier & Stillwell, 2021; Lomax, 2022; Stillwell i sur., 2018). Veće pogreške i slabija pouzdanost primjećuju se u populacijama s većim udjelom mladih, studenata i mobilnih skupina, u malim i slabo naseljenim prostorima te u područjima s većom fluktuacijom stanovništva (Alessandrini i sur., 2020; Baker i sur., 2013; Calhoun i sur., 2021; Foley i sur., 2023). Kao glavna odredišta migracija unutar Hrvatske profilirali su se Grad Zagreb s okolicom i priobalje (Grdović Gnip, 2023; Klempić Bogadi & Lajić, 2014; Strmota & Ivanda, 2022), a upravo u tim područjima uočena je slabija pouzdanost podataka. Zbog iseljeničkog vala nakon pristupanja Europskoj uniji u promatranom je razdoblju većina većih gradova zabilježila negativnu migracijsku bilancu, što je istovremeno praćeno

ference, as a core variable, simultaneously reflects the (un)reliability of both migration and census statistics. A positive difference between official and comparative data is a systematic occurrence, largely attributable to methodological discrepancies between the two data sources (Ahmad Yar & Bircan, 2023). Therefore, the presence of a positive difference for a particular town or municipality should not automatically be interpreted as a sign of data unreliability. In fact, for just under half of all units, the differences in net migration rates are minimal, below half a standard deviation, warranting a satisfactory assessment of data reliability. Caution in demographic analysis is required for a quarter of Croatian cities and municipalities with differences exceeding one standard deviation. If one also includes all units where the difference between the CBS and VSM migration balances falls within the defined threshold but the two have opposite signs, the total share of areas with potentially unreliable demographic data rises to nearly one-third. The coastal zone stands out with the highest positive differences – and consequently, the weakest data reliability – while cities also show notable, though somewhat lower, unreliability, consistent with the research hypothesis.

The main findings are consistent with previous studies comparing migration data from different sources and assessing data quality, which indicate that the reliability of migration statistics is not spatially homogeneous but varies according to the type of area, spatial scale, and data source (Stillwell et al., 2018; Chatagnier & Stillwell, 2021; Lomax, 2022). Larger errors and lower reliability are observed in populations with a higher share of young people, students, and highly mobile groups, in small and sparsely populated areas as well as in areas characterised by pronounced population fluctuation (Alessandrini et al., 2020; Baker et al., 2013; Calhoun et al., 2021; Foley et al., 2023). The City of Zagreb and the coastal region have emerged as the main internal migration destinations in Croatia (Grdović Gnip, 2023; Klempić Bogadi & Lajić, 2014; Strmota & Ivanda, 2022), and it is precisely in these areas that lower data reliability was observed. Due to the wave of emigration following Croatia's accession to the European Union, most major cities recorded a negative migration balance during the observed period, which was simultaneously accompanied by in-

slabijim odjavljivanjem. Istovremeno, gradovi, kao središta funkcije rada i obrazovanja, neprestano generiraju povećanu migracijsku aktivnost koja dovodi do velikog broja nedefiniranih i vremenski neodređenih migracija. Uz kriterij trajanja boravka (Dańko i sur., 2024; Raymer i sur., 2013), za kvalitetu migracijskih podataka važni su pravni okvir, učinkovitost administracije i ponašanje stanovništva (Ahmad Yar & Bircan, 2023; Pavić & Ivanović, 2019). Stoga se nepouzdanost migracijskih podataka za gradove u Hrvatskoj može tumačiti kombinacijom velikog broja nedefiniranih migracija upitnog trajanja i ponašanjem stanovništva u vidu izostanka evidentiranja preseljenja, dok metodološke razlike administrativnih i popisnih podataka dodatno povećavaju razlike između migracijskih salda DZS-a i VSM-a. Grad Zagreb napose se ističe zbog suprotnih predznaka migracijskih stopa, a rezultati, među ostalim, upućuju na premalo popisanih stanovnika 2021. godine.

Pozitivna migracijska bilanca u priobalju najvećim je dijelom potaknuta turizmom (Opačić, 2009), no takva silna migracijska aktivnost može biti stvarna i fiktivna (Lajić & Mišetić, 2013). Mnogi vlasnici kuća za odmor, u novije doba sve više i strani državljani, doseljavaju se u svoje nekretnine ili se samo fiktivno prijavljuju s namjerom izbjegavanja poreza na nekretnine (Pokos & Turk, 2022b). Nadalje, djelatnost turizma generira i veći broj radnih mjesta, no pretežito sezonskog tipa (Strmota & Ivanda, 2022). Stoga se nepouzdanost podataka u priobalju može pripisati velikom broju nedefiniranih migracija i ponašanju stanovništva i to dvosmjerno: s jedne strane administrativno prijavljivanje precjenjuje stvarno stanje, dok je s druge strane taj „višak“ stanovništva podcijenjen u popisnim podacima, čime se razlike migracijskih salda dvosmjerno povećavaju. Metodološki okvir korišten u ovom istraživanju djelovao je kao „povećalo“ koje je preciznije otkrilo nesklad u podacima iz dvaju izvora. Popis stanovništva poslužio je kao korektiv administrativnim podacima, no velik broj nedefiniranih migracija i izrazita sezonalnost migracijskih kretanja u priobalju otežavaju precizno određivanje broja stanovnika.

Identificiranje jedinica negativne razlike migracijskih salda, kao područja s povoljnijim

sufficient deregistration practices. At the same time, cities, as centres of employment and education, continually generate increased migration activity, often resulting in many undefined and temporally ambiguous migration events. In addition to the residence duration criterion (Dańko et al., 2024; Raymer et al., 2013), the reliability of migration data also depends on the legal framework, administrative efficiency, and population behaviour (Ahmad Yar & Bircan, 2023; Pavić & Ivanović, 2019). Therefore, the unreliability of migration data for Croatian cities can be interpreted as a result of numerous undefined migrations of uncertain duration and the population's failure to report changes of residence, while methodological discrepancies between administrative and census data further amplify differences between the CBS and VSM migration balances. The City of Zagreb stands out in particular due to the opposite signs of migration rates, and the results suggest, among other things, that in the 2021 census the actual population was likely undercounted.

A positive migration balance along the Adriatic coast is largely driven by tourism (Opačić, 2009). However, such intense migration activity may be both genuine and fictitious (Lajić & Mišetić, 2013). Many owners of holiday homes, including an increasing number of foreign nationals, either move into their properties or register residency there solely to avoid property taxes (Pokos & Turk, 2022b). Furthermore, tourism creates a significant number of jobs, although these are predominantly seasonal in nature (Strmota & Ivanda, 2022). As a result, the unreliability of data in coastal areas can be attributed to a large volume of undefined migrations and the behaviour of the population in two distinct ways: on the one hand, official registrations may overestimate the actual resident population, while on the other, this 'excess' population tends to be undercounted in census data, thereby amplifying discrepancies in migration balances in both directions. The methodological framework applied in this research acted as a 'magnifying glass,' revealing data inconsistencies between the two sources with greater precision. Although the population census served as a corrective to administrative records, the high number of undefined migrations and pronounced seasonality of population movement in coastal areas complicate the accurate determination of population size.

stanjem migracijske bilance prema vitalno-statističkoj metodi, važan je nalaz jer odudara od općih obrazaca, no istovremeno je najizazovnije za interpretaciju. Inverzan odnos migracijske bilance službenih i komparativnih podataka načelno bi trebao biti posljedica kumulacije više različitih pogrešaka ili odstupanja. Primjenom prostorne autokorelacije prikazana je prostorna ovisnost ove pojave: većina identificiranih jedinica grupirana je u područjima s relativno visokim udjelom srpskog stanovništva. Neke od tih općina među vodećima su u zemlji po intenzitetu recentnih iseljavanja, no pritom se značajan dio iseljavanja zapravo odnosi na brisanje iz evidencije prebivališta za stanovnike koji već dulje vrijeme ne žive u Hrvatskoj (Pokos & Turk, 2022b). Shodno tomu, moglo bi se zaključiti da službeni podaci podcjenjuju migracijsku bilancu i da je stvarno stanje nešto povoljnije, no to vrijedi za pojedini grad ili općinu samo u slučaju pouzdanosti popisnih podataka (Sl. 4b). S obzirom na neobične obrasce međupopisne promjene u nekima od promatranih jedinica, određena sumnja u pouzdanost popisnih podataka zasigurno postoji, što posljedično narušava pouzdanost rezultata vitalno-statističke metode (Winkler & Curtis, 2023). Slabija pouzdanost podataka iz obaju korištenih izvora uvelike otežava procjenu stvarnih migracijskih tokova, a negativna razlika dvaju migracijskih salda može odražavati zbroj više malih pogrešaka. U tim područjima konkretne vrijednosti bilance teško je procijeniti – točnost može ovisiti o kombinaciji intenziteta administrativnih odstupanja (u smjeru podcjenjivanja), nepouzdanosti podataka Popisa 2011. i nepouzdanosti podataka Popisa 2021. godine.

Metodološki okvir primijenjen u istraživanju omogućio je kvantifikaciju nepouzdanosti migracijskih podataka lokalne razine na temelju dvaju izvora podataka te je primjenjiv i u drugim zemljama. Ograničavajući je faktor korištenje neto migracije koja ima određenih manjkavosti (Rogers, 1990), ali nudi praktičnu i jednostavnu mjeru u uvjetima nedostupnosti podataka (Smith & Swanson, 1998), stoga je bila jedini način za direktnu usporedbu. Razlike migracijskih salda u standardnim devijacijama omogućile su objektivno defi-

Identifying units with a negative difference in migration balances, as areas with a more favourable migration balance according to the vital-statistical method, represents an important finding as it deviates from general patterns, but at the same time, it is the most challenging to interpret. An inverse relationship between the official and comparative migration balance should generally be the result of the accumulation of various types of errors or discrepancies. By applying spatial autocorrelation, the spatial dependence of this phenomenon was revealed: most of the identified units are grouped in areas with a relatively high share of the Serbian population. Some of these municipalities rank among the leading ones in the country in terms of the intensity of recent emigration, yet a significant portion of this emigration refers to the deletion from the residence register of people who have not lived in Croatia for an extended period (Pokos & Turk, 2022b). Accordingly, it could be concluded that official data underestimate the migration balance and that the real situation is somewhat more favourable, but this only applies to a given town or municipality if the census data is reliable (Fig. 4b). Considering unusual patterns of inter-census change in some of the observed units, a certain degree of doubt regarding the reliability of census data undoubtedly exists, which consequently undermines the reliability of the vital-statistical method results (Winkler & Curtis, 2023). Lower reliability of data from both sources used significantly complicates the assessment of actual migration flows, and the negative difference between the two migration balances may reflect the sum of several small errors. In such areas, it is difficult to assess concrete balance values – accuracy may depend on a combination of the intensity of administrative discrepancies (in the direction of underestimation), unreliability of 2011 census data, and unreliability of 2021 census data.

The methodological framework used in this study enabled the quantification of the unreliability of local-level migration data based on two data sources and is applicable in other countries as well. A limiting factor is the use of net migration, which has certain shortcomings (Rogers, 1990), but offers a practical and simple measure in situations where data are unavailable (Smith & Swanson, 1998), and was therefore the only way to enable direct comparison. Differences in migration balances expressed in standard devia-

niranje granica pouzdanosti, odnosno usklađenosti podataka. Premda istraživanje polazi od potvrđene nepouzdanosti službenih podataka (Akrap i sur., 2017; Balija, 2020; Komušanac, 2023; Pokos, 2017; Pokos & Turk, 2022a; Strmota, 2020; Strmota & Ivanda, 2022), dok podaci vitalno-statističke metode služe kao korektiv, treba imati na umu da razlike između njih nisu jednostrane i ne mogu se automatski pripisivati netočnosti službenih podataka. Naprotiv, radi se o dvama metodološki i konceptualno različitim pristupima mjerenju migracija koji imaju specifične prednosti i nedostatke.

Složenost i dvosmislenost interpretacije razlika između migracijske bilance DZS-a i VSM-a može se slikovito ilustrirati konceptom Schrödingerove mačke. Dok se ne otvori „kutija" i detaljno ne analiziraju razlozi nastale razlike za određenu jedinicu, ne može se pouzdano interpretirati značenje crveno i plavo označenih područja na Slici 4a. Pozitivna razlika (crveno) može značiti nedovoljno odjavljivanje ili previše „fiktivnog" popisivanja, ali također može upućivati na premalo popisanih stanovnika 2021. Međutim, moguće je istovremeno postojanje oba problema, što situaciju čini još složenijom, a dodatnu zamršenost uvodi pojavnost suprotnih predznaka dviju stopa migracijskog salda. Značajna razlika između dvaju setova podataka nedvojbeno je pokazatelj nepouzdanosti, no nije odmah jasno koji je dominantan razlog, pa su prije dodatne analize oba moguća. Pri interpretaciji za pojedini grad ili općinu potrebno je zapitati se je li plauzibilniji neto migracijski saldo DZS-a ili VSM-a. Ako se za crveno označenu jedinicu vjeruje kako je točniji podatak službene migracijske bilance, odstupanje se pripisuje slabijoj pouzdanosti popisnih podataka – to podrazumijeva premalo popisanih, odnosno podcijenjen broj stanovnika. Ako pak je za istu jedinicu vjerojatnija pouzdanost podatka vitalno-statističke metode, do odstupanja je došlo zbog premalo odjavljivanja prebivališta ili previše „fiktivnog" prijavljivanja. No kod velikog broja slučajeva očekuje se istovremeno postojanje obaju razloga. Pritom se, ovisno o predznacima sastavnica ukupne promjene, razlike migracijskih salda poništavaju ili zbrajaju, a smjer određuje dominan-

tions allowed for the objective definition of reliability thresholds, i.e., data consistency. Although the study starts from the confirmed unreliability of official data (Akrap et al., 2017; Balija, 2020; Komušanac, 2023; Pokos, 2017; Pokos & Turk, 2022a; Strmota, 2020; Strmota & Ivanda, 2022), and data from the vital-statistical method served as a corrective, it should be noted that differences between them are not one-sided and cannot automatically be attributed to the inaccuracy of official data. On the contrary, these are two methodologically and conceptually distinct approaches to measuring migration, each with its own specific advantages and limitations.

The complexity and ambiguity in interpreting the differences between the migration balance reported by the official (CBS) and comparative (VSM) data can be illustratively explained using the concept of Schrödinger's cat. Until the 'box' is opened and the reasons for the observed discrepancy in each unit are thoroughly analysed, it is not possible to provide a reliable interpretation of the meaning of the red and blue areas shown in Figure 4a. A positive difference (red) may indicate insufficient deregistration or excessive 'fictitious' enumeration, but it may also point to an undercount of residents in the 2021 census. However, it is also possible for both problems to coexist simultaneously, which further complicates the situation, especially when the two migration balance rates have opposite signs. A significant discrepancy between the two datasets is undoubtedly a sign of unreliability, but the dominant reason is not immediately clear, meaning that both explanations remain valid until further analysis is conducted. When interpreting data for a specific city or municipality, one must ask which migration balance – CBS or VSM – is more plausible. If, for a red-labelled unit, the official migration balance is considered more accurate, the discrepancy can be attributed to census undercounting, i.e., an underestimated population count. On the other hand, if the VSM data is considered more reliable for the same unit, then the discrepancy is likely due to insufficient deregistration of residency or excessive fictitious registrations. In many cases, both reasons are expected to be simultaneously present. Depending on the signs of the components of total population change, the differences in migration balances may either cancel each other out or accumulate, with the dominant reason determining the over-

tan razlog. Nepouzdanost migracijske statistike često se svaljuje na DZS, premda podatke prikuplja MUP, no zanemaruje se važnost ponašanja stanovništva (Ahmad Yar & Bircan, 2023). U toj situaciji odgovornost DZS-a zapravo je evidentnija u popisnoj statistici. Ipak, teško je reći treba li biti kritičniji prema migracijskim ili popisnim podacima – odgovor svakako nije jednoznačan i ovisi o prostornoj jedinici.

Komparativna perspektiva pokazuje da se Hrvatska uklapa u skupinu zemalja Europske unije bez uspostavljenog registra stanovništva, koje obilježavaju izraženi problemi podcjenjivanja migracija, a osobito emigracije (Dańko i sur., 2024; de Beer i sur., 2010; Raymer i sur., 2013; Wiśniowski, 2021). Slični obrasci uočeni su i u novijim članicama iz Srednje i Istočne Europe, poput Poljske, Bugarske, Rumunjske i Slovačke, gdje je najveći intenzitet podcjenjivanja migracija zabilježen u razdoblju nakon pristupanja Europskoj uniji. Nasuprot tome, zemlje s dugotrajno razvijenim registrima, poput nordijskih zemalja, Nizozemske i Belgije, bilježe stabilnije podatke. Ipak, razlike u kvaliteti migracijske statistike ne proizlaze samo iz metodološkog aspekta, nego su povezane s administrativnom učinkovitošću i ponašanjem stanovništva. Stoga ograničenja hrvatske migracijske statistike treba promatrati kao dio šireg strukturnog problema mjerenja migracija, a ne kao nacionalnu iznimku. U zemljama s razvijenijim sustavima statistike uspostavljeni su i mehanizmi razmjene migrantskih podataka (Dańko i sur., 2024). Proširivanje takve prakse na ostale zemlje jedan je od načina poboljšanja kvalitete migracijske statistike.

ZAKLJUČAK

Istraživanje je pokazalo da kvaliteta demografske statistike u Hrvatskoj, osobito migracijskih podataka, znatno varira u prostoru. Precijenjenost migracijske bilance u službenim podacima, kao ranije potvrđen fenomen na nacionalnoj razini, izražena je na županijskoj razini, a dominantna je pojava u prostoru i na lokalnoj razini, no različitog intenziteta. Za gotovo polovinu

all direction. The unreliability of migration statistics is often blamed on the CBS, even though the data is collected by the Ministry of the Interior, and the importance of population behaviour is frequently overlooked (Ahmad Yar & Bircan, 2023). In this context, the CBS's responsibility is more evident in the census data. Still, it is difficult to say whether one should be more critical of migration or census data. The answer is certainly not straightforward and depends on the specific spatial unit.

The comparative perspective indicates that Croatia belongs to the group of European Union countries without an established population register, which are characterised by pronounced problems of migration undercounting, particularly with respect to emigration (de Beer et al., 2010; Dańko et al., 2024; Raymer et al., 2013; Wiśniowski, 2021). Similar patterns have been observed in other recent EU Member States in Central and Eastern Europe, such as Poland, Bulgaria, Romania and Slovakia, where the highest intensity of migration underestimation was recorded in the period following accession to the European Union. In contrast, countries with long-established population registers, such as the Nordic countries, the Netherlands and Belgium, report more stable migration statistics. However, differences in the quality of migration statistics do not stem solely from methodological factors, but are also related to administrative efficiency and population behaviour. Consequently, the limitations of Croatian migration statistics should be understood as part of a broader structural challenge in the measurement of migration rather than as a national peculiarity. In countries with more advanced statistical systems, mechanisms for the exchange of migration data were established (Dańko et al., 2024), and the extension of such practices to other countries represents a possible approach for improving the quality of migration statistics.

CONCLUSION

The study has shown that the quality of demographic statistics in Croatia, particularly migration data, varies significantly across regions. The overestimation of migration balance in official statistics, a previously confirmed phenomenon at the national level, is also evident at the county level and is a

svih lokalnih jedinica podaci su zadovoljavajuće pouzdanosti, dok se za četvrtinu do trećinu jedinica pouzdanost podataka smatra upitnom. Pritom se posebno ističu priobalje i veliki gradovi u kojima je pouzdanost slabija zbog intenzivne migracijske aktivnosti, velikog broja nedefiniranih migracija te neusklađenosti između prijavljenog i stvarnog stanja, pri čemu važnu ulogu ima ponašanje stanovništva. Dio jedinica slabije pouzdanosti podataka odudara od uobičajenih obrazaca, pa nepouzdanost ide u smjeru podcijenjenosti službenih migracijskih podataka. Taj fenomen upućuje na potencijalne probleme popisne statistike, a u nekim je slučajevima teško utvrditi je li veći problem u migracijskoj ili popisnoj statistici.

Metodološki okvir korišten u istraživanju pokazao se učinkovitim za otkrivanjem prostornih obrazaca nepouzdanosti podataka, a temelji se na analizi razlike migracijskih podataka iz dvaju izvora: službene statistike i vitalno-statističkih podataka. Razlike dviju migracijskih stopa iskazane su u standardnim devijacijama, a za potvrdu prostornih obrazaca korištena je prostorna statistika u vidu lokalnog Moranova indeksa. U budućoj demografskoj analizi jedinica s razlikom iznad jedne standardne devijacije poziva se na oprez, dok se u analizi jedinica s razlikom iznad dvije standardne devijacije sugerira paralelno korištenje migracijskih podataka iz obaju izvora. Rezultati mogu biti od koristi akademskoj zajednici, istraživačima, donositeljima demografskih politika, lokalnim vlastima i relevantnim institucijama. Uz odgovarajuće dodatne analize, domaćim istraživačima rezultati mogu poslužiti kao posredna metoda za preciznije identificiranje glavnog razloga nepouzdanosti podataka. Slijedom toga može se zaključiti je li broj stanovnika u nekoj jedinici podcijenjen ili precijenjen. Institucijama rezultati mogu pomoći pri poboljšanju prikupljanja i eventualnoj korekciji podataka za područja slabije pouzdanosti. Predstavljenu metodologiju može se primijeniti i na druge demografske pokazatelje, čime se proširuje njezina analitička i praktična vrijednost.

U budućim istraživanjima važan bi doprinos moglo pružiti istraživanje odrednica nepouzdanosti migracijskih podataka. Neke od socioekodominant spatial feature at the local level, albeit with varying intensity. For nearly half of all local units, the data is of satisfactory reliability, while for one quarter to one third of units, the data's reliability is deemed questionable. Coastal areas and large cities are particularly notable, as data reliability tends to be lower there due to intense migration activity, a high prevalence of undefined migration movements, and significant discrepancies between registered and actual residency – all of which are strongly shaped by individual behavioural patterns. Some of the units with lower data reliability deviate from usual patterns, and in these cases, the unreliability tends to reflect an underestimation of official migration figures. This phenomenon points to potential issues in census statistics, and in some cases, it is difficult to determine whether the greater problem lies with migration statistics or census data.

The methodological framework used in this study proved effective in detecting spatial patterns of data unreliability. It is based on the analysis of differences in migration data from two sources: official statistics and vital-statistical data. Differences between the two migration rates were expressed in standard deviations, and spatial statistics, specifically the Local Moran's I index, were used to confirm spatial patterns. In future demographic analyses, caution is advised when interpreting data for units with differences exceeding one standard deviation, while for units with differences greater than two standard deviations, it is recommended to use migration data from both sources in parallel. The results may be useful to the academic community, researchers, demographic policy-makers, local authorities, and relevant institutions. With appropriate follow-up analyses, these findings can serve domestic researchers as an indirect method for more accurately identifying the main causes of data unreliability. This, in turn, can help determine whether the population count in each unit is underestimated or overestimated. For institutions, the results may support improvements in data collection and possible corrections in areas with lower data reliability. The presented methodological approach can be applied to other demographic indicators, which broadens its analytical and practical relevance.

In future research, an important contribution would come from examining the determinants of migration data unreliability. In future research, an im-

nomskih varijabli koje bi dodatno mogle objasniti prostorne obrasce nepouzdanosti podataka obuhvaćaju tržište rada (npr. stopa zaposlenosti, ponuda poslova), stambenu mobilnost i stanovanje u najmu, intenzitet turizma i sezonalnosti, udio studentske populacije te dobnu strukturu područja. Te varijable potencijalno utječu na učestalost kratkotrajnih, privremenih i neregistriranih migracija, što može povećati razlike između administrativnih i popisnih izvora. Izazov predstavlja i izračun korekcijskih indeksa kojima bi se podaci očistili od metodološkog viška ili manjka broja stanovnika. Nadalje, u Hrvatskoj bi 2026. godine trebao zaživjeti registar stanovništva, stoga se u budućnosti očekuje bitno viša kvaliteta demografskih podataka. No budući da probleme s migracijskom statistikom imaju i razvijenije zemlje, samo uvođenje registra neće riješiti sve probleme nepouzdanosti podataka. Područja slabije pouzdanosti vjerojatno će i u budućnosti patiti od sličnih problema. Stoga bi uz uvođenje registra trebalo razvijati integrirane modele koji upotrebljavaju više različitih izvora podataka kako bi se povećala ukupna pouzdanost migracijske statistike. Uz kontinuiranu integraciju i usklađivanje različitih izvora osigurat će se preciznije informacije za donošenje i provedbu politika demografske revitalizacije.

Autorski doprinosi:

T.B.: istraživanje literature, konceptualizacija istraživanja, metodologija, programska obrada, vizualizacija, pisanje – priprema izvornog rada, pisanje – završna verzija.

R.M.: konceptualizacija istraživanja, metodologija, pisanje – završna verzija, validacija i nadzor.

Izjava o dostupnosti podataka: Podaci su dostupni na zahtjev autorima.

Sukob interesa: Autori izjavljuju da nema sukoba interesa.

portant contribution could be made by examining the determinants of migration data unreliability. Some of the socio-economic variables that could further explain the spatial patterns of data unreliability include labour market characteristics (e.g., employment rates and job availability), residential mobility and rental housing, tourism intensity and seasonality, the share of the student population, and the age structure of areas. These factors may influence the prevalence of short-term, temporary, and unregistered migrations, thereby increasing discrepancies between administrative and census data sources. A further challenge lies in calculating correction indices that would adjust the data by eliminating methodological overestimation or underestimation of the population. Furthermore, Croatia is expected to implement a population register in 2026, which should significantly improve the quality of demographic data. However, given that even more developed countries face issues with migration statistics, the introduction of a register alone will not resolve all data reliability problems. Areas with lower reliability are likely to continue experiencing similar issues. Therefore, alongside the establishment of the register, integrated models that draw on multiple data sources should be developed to enhance the overall reliability of migration statistics. Continuous integration and harmonization of various data sources will ensure more accurate information for the formulation and implementation of demographic revitalization policies.

Author Contributions:

T.B.: literature review, conceptualization, methodology, software, visualization, writing – original draft preparation, writing – review and editing.

R.M.: conceptualization, methodology, writing – review and editing, validation, supervision.

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Conflicts of Interest: The authors declare no conflict of interest.

DODATAK A / APPENDIX A

Tablica A1. *Popis jedinica lokalne samouprave s pozitivnom migracijskom bilancom prema službenim podacima, a negativnom prema vitalno-statističkoj metodi*
Table A1 *List of local units with a positive migration balance according to official data, and a negative balance according to the vital-statistical method*

Županija / *County*	**Broj JLS / *Number of units***	**%**	**Popis JLS / *List of units***
Zagrebačka	6	17,6	Brdovec, Dugo Selo, Kravarsko, Luka, Marija Gorica, Pušća
Krapinsko-zagorska	6	18,8	Desinić, Donja Stubica, Krapinske Toplice, Lobor, Marija Bistrica, Veliko Trgovišće
Sisačko-moslavačka	1	5,3	Lekenik
Karlovačka	2	9,1	Draganić, Duga Resa
Varaždinska	4	14,3	Cestica, Jalžabet, Varaždin, Veliki Bukovec
Koprivničko-križevačka	0	0,0	
Bjelovarsko-bilogorska	0	0,0	
Primorsko-goranska	11	30,6	Bakar, Crikvenica, Čavle, Jelenje, Kastav, Klana, Lopar, Mali Lošinj, Matulji, Novi Vinodolski, Rab
Ličko-senjska	0	0,0	
Virovitičko-podravska	0	0,0	
Požeško-slavonska	1	10,0	Čaglin
Brodsko-posavska	0	0,0	
Zadarska	6	17,6	Bibinje, Pag, Povljana, Starigrad, Sveti Filip i Jakov, Zadar
Osječko-baranjska	0	0,0	
Šibensko-kninska	2	10,0	Pirovac, Rogoznica
Vukovarsko-srijemska	0	0,0	
Splitsko-dalmatinska	12	21,8	Baška Voda, Brela, Hvar, Kaštela, Makarska, Marina, Milna, Okrug, Podgora, Selca, Solin, Tučepi
Istarska	19	46,3	Barban, Brtonigla, Buje, Buzet, Fažana, Gračišće, Karojba, Lupoglav, Motovun, Novigrad, Poreč, Pula, Rovinj, Sveti Petar u Šumi, Umag, Višnjan, Vodnjan, Vrsar, Žminj
Dubrovačko-neretvanska	8	36,4	Blato, Dubrovnik, Korčula, Lastovo, Orebić, Smokvica, Vela Luka, Župa dubrovačka
Međimurska	1	4,0	Čakovec
Grad Zagreb	1	100,0	Zagreb
Ukupno / Total	80	14,4	

Izvor: *Izračun autora na temelju DZS-a (2013; 2022; 2024)* / Source: *Calculated by the authors according to CBS (2013; 2022; 2024)*

Tablica A2. *Popis jedinica lokalne samouprave prema razlikama migracijskog salda službenih podataka i vitalno-statističke metode izraženih u standardnim devijacijama*
Table A2 *List of local units by differences in migration balance between official data and the vital-statistical method, expressed in standard deviations*

St. dev	Popis gradova i općina / *List of towns and municipalities*
> 3	Vir, Vrhovine, Milna, **Novigrad – Cittanova**, Kanfanar, Ližnjan, Pirovac.
2 – 3	Podstrana, Levanjska Varoš, Lobor, Motovun – Montana, Jalžabet, Okrug, **Pag**, Kukljica, Šolta, Gradac, Tar-Vabriga, Čaglin, Kolan, Lopar, **Donja Stubica**, Dobrinj, **Novalja**, **Buje – Buie**, Orebić, Povljana, Dicmo, Negoslavci, Janjina, **Hvar**, **Nin**, Sali.
1,5 – 2	Malinska-Dubašnica, Vrsar – Orsera, Fažana – Fasana, Preko, **Umag – Umago,** Starigrad, Funtana – Fontane, Tkon, Medulin, **Rovinj – Rovigno, Vodnjan – Dignano**, Rogoznica, Sućuraj, Pašman, Krnjak, Rugvica, **Vodice.**
1 – 1,5	Jelsa, **Cres**, Višnjan – Visignano, **Kastav**, **Vis**, **Rab**, Podgora, Brckovljani, Koprivnički Bregi, Stubičke Toplice, Marina, Karlobag, Brtonigla – Verteneglio, **Novi Vinodolski**, Marčana, Borovo, **Kaštela**, Baška Voda, **Solin**, Selca, Vižinada – Visinada, **Poreč – Parento**, **Makarska**, Mljet, **Opuzen**, Pribislavec, **Imotski**, Tučepi, Tisno, Privlaka (Zadarska), **Dubrovnik**, Bibinje **Metković**, Murter-Kornati, Kravarsko, **Vrbovec**, **Prelog**, **Vinkovci**, Ražanac, Sutivan, Viškovo, Andrijaševci, **Kraljevica**, **Zadar**, Gradec, **Komiža**, Peteranec, Bol, Gornja Vrba, Markušica, Mošćenička Draga, Cerovlje, Stupnik, Nedelišće, **Stari Grad**.
0,5 – 1	Sukošan, **Pula – Pola**, Nerežišća, Kotoriba, **Bakar**, Kloštar Podravski, Jagodnjak, Gorjani, Pitomača, **Biograd na Moru**, Lekenik, Dubravica, Podbablje, Svetvinčenat, **Ploče**, Župa dubrovačka, **Crikvenica**, Štrigova, Pušća, Dugopolje, Gračišće, Lupoglav, **Zagreb**, Klis, Sveti Ivan Žabno, Severin, Postira, Velika Pisanica, Pučišća, Zmijavci, Sveti Lovreč, Bukovlje, Kaštelir-Labinci – Castelliere-Santa Domenica, Primošten, **Varaždin**, Brod Moravice, Darda, Sveti Filip i Jakov, Kostrena, **Lepoglava**, Majur, Bale – Valle, **Krk**, Sveta Marija, **Križevci**, Dvor, **Delnice**, Sveti Petar u Šumi, Klinča Sela, Petrijanec, Preseka, Farkaševac, Blato, **Obrovac**, Vođinci, **Slavonski Brod**, Tribunj, Čavle, **Dugo Selo**, **Mali Lošinj**, Strizivojna, Jarmina, Donji Kraljevec, **Đakovo**, Viškovci, Semeljci, Kali, **Našice**, Lastovo, Lumbarda, Klana, **Popovača**, **Rijeka**, Veliko Trgovišće, **Supetar**, Draganić, Velika Trnovitica, Breznički Hum, Seget, Vrbnik, Desinić, **Split**, Trpinja, Novi Golubovec, Vojnić, **Belišće**, Brdovec, **Ivanić-Grad**, **Trogir**, **Sveta Nedelja (Zagrebačka),** Žminj, Vela Luka, **Sinj**, Marija Gorica, Sveta Nedelja (Istarska), Bošnjaci, Matulji, **Osijek**, Sveti Križ Začretje, Velika Ludina, **Čakovec**, Oprisavci, Luka, Goričan, Otok (Splitsko-dalmatinska), Raša, **Opatija**, Kneževi Vinogradi, **Zaprešić**, Virje, Runovići, **Duga Resa**, Cestica, Lipovljani, Oprtalj – Portole, **Valpovo**, Viljevo.
-0,5 – 0,5	**Korčula**, Tinjan, **Koprivnica**, **Otočac**, Selnica, Orle, Bedenica, Smokvica, **Sisak**, Kula Norinska, **Omiš**, Novigrad Podravski, Sokolovac, **Velika Gorica**, **Labin**, **Bjelovar**, Lovran, Krapinske Toplice, Vidovec, Ston, Jelenje, Orehovica, **Buzet**, Špišić Bukovica, Mali Bukovec, Vinica, Mala Subotica, Privlaka (Vukovarsko-srijemska), Pakoštane, Rasinja, **Ivanec**, Drenovci, Petrovsko, Šenkovec, Velika, Gundinci, **Samobor**, Marijanci, Zrinski Topolovac, Satnica Đakovačka, Čepin, Podcrkavlje, Primorski Dolac, **Đurđevac**, Kloštar Ivanić, **Kutina**, Veliki Bukovec, **Donji Miholjac**, Davor, Sveti Ilija, **Jastrebarsko**, Petrijevci, **Šibenik**, Ivankovo, Ivanska, Klakar, Posedarje, Đelekovec, Đurđenovac, Koška, Omišalj, Brela, **Oroslavje**, **Čazma**, Baška, **Krapina**, **Hrvatska Kostajnica**, Magadenovac, Oriovac, **Sveti Ivan Zelina**, Zadvarje, Nuštar, Martijanec, Strahoninec, Sveti Petar Orehovec, Karojba, **Požega**, Trnava, Marija Bistrica, Antunovac, Rakovec, Lokve, Galovac, **Karlovac**, Konjščina, Vratišinec, Punat, Novo Virje, **Slatina**, Bizovac, **Nova Gradiška**, Muć, Rešetari, Lukač, Feričanci, Berek, Voćin, Kalinovac, **Pazin**, Pićan, Gunja, **Varaždinske Toplice**, **Vrbovsko**, Vrpolje, Maruševec, Barban, **Ogulin**, Tuhelj, Molve, Donji Andrijevci, Dubrava, **Klanjec**, Čađavica, Križ, Budinščina, Ferdinandovac, Koprivnički Ivanec, Nova Rača, Šodolovci, Gola, Bilice, Vrsi, Bedekovčina, Kršan, **Zabok**, **Daruvar**, Trnovec Bartolovečki, **Senj**, Punitovci, Cerna, Dugi Rat, Končanica, Beretinec, Suhopolje, **Ludbreg**, Erdut, Garčin, Klenovnik, Donja Motičina, **Gospić**, Brodski Stupnik, Jesenje, Vrbanja, Škabrnja, Ravna Gora, Đurmanec, Gornji Kneginec, **Virovitica**, **Mursko Središće**, Sibinj, **Petrinja**, Bosiljevo, **Beli Manastir**, Donji Vidovec, Drenje, **Županja**, Visoko, Proložac, Hum na Sutli, Zlatar-Bistrica, Konavle, Pisarovina, Rovišće, Gornji Mihaljevec, Vinodolska općina, Jakšić, Mihovljan, Kapela, **Novi Marof**, Hercegovac, Gornja Rijeka, Fužine, Drnje, **Ozalj**, Donja Dubrava, Pokupsko, Bebrina, Gornja Stubica, Sračinec, **Novska**, Breznica, **Ilok**, **Garešnica**, **Trilj**, Kumrovec, Grožnjan – Grisignana, Sveti Martin na Muri, Žakanje, Promina, Veliko Trojstvo, Martinska Ves, Sveti Juraj na Bregu, Nova Bukovica, **Pleternica**, Podgorač, **Zlatar**, Stari Mikanovci, Šandrovac, Sveti Đurđ, Šestanovac, Podravske Sesvete, **Pregrada**, Krašić, Jakovlje, Domašinec, Štefanje, Radoboj, Velika Kopanica, Josipdol, Bistra, **Otok (Vukovarsko-srijemska),** Zdenci, Stari Jankovci, Jasenice, Dubrovačko primorje, Vuka, Belica, Hrašćina, Mače, Štitar, Bilje, Skrad, Kalnik, Netretić, **Kutjevo**, Trpanj, Zagvozd, Sopje, Udbina, Babina Greda, Poličnik, Nova Kapela, Staro Petrovo Selo, **Orahovica**, Bogdanovci, Dežanovac, Barilović, **Grubišno Polje**, Slavonski Šamac, Mrkopalj, Veliki Grđevac, Vrbje, Stankovci, Generalski Stol, Mikleuš, Kaptol, Čeminac, Hlebine, Gornji Bogićevci, Okučani, Gradište, Čačinci, Ljubešćica, Vladislavci, Donja Voća, Gradina, Donji Lapac, Prgomet, Bednja, Kraljevec na Sutli, Podravska Moslavina, Topusko, Petlovac, **Lipik**.

St. dev	Popis gradova i općina / *List of towns and municipalities*
-1 – (-0,5)	Dragalić, Perušić, Đulovac, Ružić, **Vrlika**, Slivno, Cernik, Draž, Kistanje, Legrad, Brinje, **Knin**, **Drniš**, Nijemci, Plaški, Brestovac, Kamanje, Unešić, Sirač, **Vrgorac**, **Vukovar**, Cista Provo, Tounj, Ribnik, Sikirevci, Žumberak, Lanišće, Zagorska Sela, Tordinci, Lovreć, Lasinja, Novigrad, Crnac, Popovac, Rakovica, Donji Kukuruzari, **Slunj**, Plitvička Jezera
-1,5 – (-1)	**Čabar**, Ernestinovo, Hrvatska Dubica, Podturen, Zemunik Donji, Stara Gradiška, **Pakrac**, Dekanovec, Zažablje, Sunja, **Glina**, Tovarnik, Tompojevci, Pojezerje, Polača, Lovas.
-2 – (-1,5)	Jasenovac, Hrvace, Gračac, Gvozd.
< -2	Cetingrad, **Benkovac**, Lećevica, **Skradin**, Kijevo, Saborsko, Lovinac, Lišane Ostrovičke, Civljane, Biskupija, Lokvičići, Ervenik.

Napomena: *Unutar svakog razreda jedinice su poredane silazno prema razlici migracijskog salda; gradovi su označeni podebljano* / *Within each class, units are listed in descending order according to the difference in migration balance; cities are shown in bold*

Izvor: *Izračun autora na temelju DZS-a (2013; 2022; 2024)* / Source: *Calculated by the authors according to CBS (2013; 2022; 2024)*

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KRONIKA
ODJELA ZA GEOGRAFIJU SVEUČILIŠTA U ZADRU
2024./2025.

ODVIJANJE NASTAVE U AKADEMSKOJ GODINI 2024./2025.

U trideset prvoj akademskoj godini ostvarivanja dvopredmetnoga studija geografije u kombinaciji s drugim predmetom (povijest, sociologija, strani jezik, etnologija i antropologija, filozofija i dr.) od osnivanja akademske godine 1994./1995. te u devetnaestoj godini ostvarivanja jednopredmetnoga studija primijenjene geografije od akademske godine 2005./2006. Odjel za geografiju Sveučilišta u Zadru uspješno je proveo planirani program rada na prijediplomskoj i diplomskoj razini studija.

Na Odjelu za geografiju bila su zaposlena dvadeset dva stalna djelatnika u različitim znanstveno-nastavnim zvanjima: jedanaest redovitih profesora, četiri izvanredna profesora, četiri docenta, jedan viši asistent i dva asistenta. Odjel je imao dva vanjska suradnika, izv. prof. dr. Krešimira Žganeca i Stjepana Gverića, prof. geog. Suradnik na HRZZ projektima pri Odjelu za geografiju bio je Lovre Panđa, mag. geogr.

Pročelnik Odjela za geografiju Sveučilišta u Zadru i član Senata Sveučilišta u Zadru bio je izv. prof. dr. sc. Ante Blaće, a zamjenica pročelnika prof. dr. sc. Ana Pejdo.

Prof. dr. sc. Josip Faričić od akademske godine 2023./2024. obnaša funkciju rektora Sveučilišta u Zadru, a prof. dr. sc. Lena Mirošević funkciju prorektorice za organizaciju, ljudske potencijale i izdavaštvo.

U uredu Odjela za geografiju djeluje tajništvo Odjela za geografiju. Tajnica je Ana Ažić-Potočnjak, dipl. tur. kom.

Nastavni plan i program prijediplomskog i diplomskog studija ostvaren je prema sljedećem rasporedu:

Predmet	Broj sati tjedno (ukupno)	Znanstveno--nastavni stupanj	Nastavnici i suradnici u nastavi
A) PRIJEDIPLOMSKI STUDIJ			
1. godina studija, 1. semestar – jednopredmetni studij primijenjene geografije			
Uvod u geografiju	3P+1V (60)	izv. prof.	dr. sc. A. Blaće
Matematička geografija	2P+1V (45)	doc.	dr. sc. T. Marelić
Osnove geologije I.	3P+1V (60)	red. prof.	dr. sc. M. Surić
Hidrogeografija I.	2P+1V (45)	red. prof.	dr. sc. D. Perica
Geoinformatika	1P+2V (45)	doc.	dr. sc. T. Marelić
Uvod u znanstveno-istraživački rad	2P (30)	doc.	dr. sc. T. Marelić
Multimedijska geografija	1P+2V (45)	doc.	dr. sc. F. Domazetović
1. GODINA STUDIJA, 2. SEMESTAR – JEDNOPREDMETNI STUDIJ PRIMIJENJENE GEOGRAFIJE			
Kartografija I.	2P+1S (45)	doc.	dr. sc. T. Marelić
Osnove geologije II.	3P+1V (60)	red. prof.	dr. sc. M. Surić
Hidrogeografija II.	2P+1V (45)	red. prof.	dr. sc. D. Perica
Grafičke metode u geografiji	3V (45)	doc.	dr. sc. B. Vukosav
Kvantitativne metode u geografiji I.	2P+2V (60)	izv. prof.	dr. sc. S. Šiljeg
Biogeografija s ekologijom	2P+1V (45)	izv. prof.	dr. sc. K. Žganec
Uvod u ekonomsku geografiju	2P+1S (45)	red. prof.	dr. sc. Ž. Šiljković

Predmet	Broj sati tjedno (ukupno)	Znanstveno--nastavni stupanj	Nastavnici i suradnici u nastavi
Terenska nastava I.	30 sati semestralno	red. prof. doc. red. prof. viši asist.	dr. sc. M. Surić dr. sc. T. Marelić dr. sc. R. Lončarić dr. sc. J. Sutlović
1. GODINA STUDIJA, 1. SEMESTAR – DVOPREDMETNI NASTAVNIČKI STUDIJ GEOGRAFIJE			
Uvod u geografiju	3P (45)	izv. prof.	dr. sc. A. Blaće
Matematička geografija	2P+1V (45)	doc.	dr. sc. T. Marelić
Osnove geologije I.	3P+1V (60)	red. prof.	dr. sc. M. Surić
Hidrogeografija I.	2P (30)	red. prof.	dr. sc. D. Perica
Uvod u znanstveno-istraživački rad	2P (30)	doc.	dr. sc. T. Marelić
1. GODINA STUDIJA, 2. SEMESTAR – DVOPREDMETNI NASTAVNIČKI STUDIJ GEOGRAFIJE			
Kartografija I.	2P (30)	doc.	dr. sc. T. Marelić
Osnove geologije II.	3P+1V (60)	red. prof.	dr. sc. M. Surić
Hidrogeografija II.	2P (30)	red. prof.	dr. sc. D. Perica
Grafičke metode u geografiji	2V (30)	doc.	dr. sc. B. Vukosav
Kvantitativne metode u geografiji I.	2P+2V (60)	izv. prof.	dr. sc. S. Šiljeg
Uvod u ekonomsku geografiju	2P (30)	red. prof.	dr. sc. Ž. Šiljković
Terenska nastava I.	30 sati	red. prof. doc. red. prof. viši asist.	dr. sc. M. Surić dr. sc. T. Marelić dr. sc. R. Lončarić dr. sc. J. Sutlović
2. GODINA STUDIJA, 3. SEMESTAR – JEDNOPREDMETNI STUDIJ PRIMIJENJENE GEOGRAFIJE			
Klimatologija I.	2P+1V (45)	red. prof. izv. prof.	dr. sc. R. Lončarić dr. sc. D. Radoš
Kartografija II.	2P+1V (45)	doc.	dr. sc. T. Marelić
Demografija I.	2P+1S+1V (60)	red. prof. izv. prof.	dr. sc. V. Graovac Matassi dr. sc. S. Šiljeg
Geomorfologija I.	2P+1V (45)	izv. prof.	dr. sc. M. Mamut
Kvantitativne metode u geografiji II.	2P+2V (60)	izv. prof.	dr. sc. A. Blaće
Regionalna geografija Australije, Oceanije i Antarktike	2P+1S (45)	red. prof.	dr. sc. A. Čuka
Regionalna geografija Azije s Rusijom	2P+1S (45)	izv. prof.	dr. sc. D. Radoš
Regionalna geografija Angloamerike	2P+1S (45)	red. prof. asistent	dr. sc. Ž. Šiljković M. S. Čagalj, mag. geogr.
2. GODINA STUDIJA, 4. SEMESTAR – JEDNOPREDMETNI STUDIJ PRIMIJENJENE GEOGRAFIJE			
Klimatologija II.	2P+1V (45)	red. prof. izv. prof.	dr. sc. R. Lončarić dr. sc. D. Radoš
Demografija II.	2P+1S+1V (60)	red. prof. izv. prof.	dr. sc. V. Graovac Matassi dr. sc. S. Šiljeg
Geomorfologija II.	2P+1V (45)	izv. prof.	dr. sc. M. Mamut
Agrarna i ruralna geografija	2P+1V (45)	red. prof.	dr. sc. A. Čuka
Geografski informacijski sustavi I.	1P+2V (45)	red. prof. doc.	dr. sc. A. Šiljeg dr. sc. F. Domazetović
Industrijska geografija	2P+1S (45)	red. prof.	dr. sc. Ž. Šiljković
Terenska nastava II.	40 sati	doc. asistent	dr. sc. B. Vukosav M. S. Čagalj, mag. geogr.

Predmet	Broj sati tjedno (ukupno)	Znanstveno--nastavni stupanj	Nastavnici i suradnici u nastavi
Regionalna geografija Afrike	2P+1S (45)	red. prof.	dr. sc. R. Lončarić
Geografija religija	1P+2S (45)	red. prof. asistent	dr. sc. J. Faričić M. S. Čagalj, mag. geogr.
2. GODINA STUDIJA, 3. SEMESTAR – DVOPREDMETNI NASTAVNIČKI STUDIJ GEOGRAFIJE			
Klimatologija I.	2P (30)	red. prof.	dr. sc. R. Lončarić
Kartografija II.	2P+1V (45)	doc.	dr. sc. T. Marelić
Demografija I.	2P+1V (45)	red. prof.	dr. sc. V. Graovac Matassi
Geomorfologija I.	2P (30)	izv. prof.	dr. sc. M. Mamut
Regionalna geografija Australije, Oceanije i Antarktike	2P (30)	red. prof.	dr. sc. A. Čuka
Regionalna geografija Azije s Rusijom	2P (30)	izv. prof.	dr. sc. D. Radoš
Kvantitativne metode u geografiji II.	2P+1V (45)	izv. prof.	dr. sc. A. Blaće
Regionalna geografija Angloamerike	2P (30)	red. prof.	dr. sc. Ž. Šiljković
2. GODINA STUDIJA, 4. SEMESTAR – DVOPREDMETNI NASTAVNIČKI STUDIJ GEOGRAFIJE			
Klimatologija II.	2P (30)	red. prof.	dr. sc. R. Lončarić
Demografija II.	2P+1V (45)	red. prof.	dr. sc. V. Graovac Matassi
Geomorfologija II.	2P (30)	izv. prof.	dr. sc. M. Mamut
Regionalna geografija Afrike	2P (30)	red. prof.	dr. sc. R. Lončarić
Terenska nastava II.	40 sati	doc. asistent	dr. sc. B. Vukosav M. S. Čagalj, mag. geogr.
Agrarna i ruralna geografija	2P (30)	red. prof.	dr. sc. A. Čuka
Geografski informacijski sustavi I.	1P+2V (45)	izv. prof.	dr. sc. D. Radoš
Industrijska geografija	2P (30)	red. prof.	dr. sc. Ž. Šiljković
Geografija religija	1P+1S (30)	red. prof. asistent	dr. sc. J. Faričić M. S. Čagalj, mag. geogr.
3. GODINA STUDIJA, 5. SEMESTAR – JEDNOPREDMETNI STUDIJ PRIMIJENJENE GEOGRAFIJE			
Uvod u političku geografiju	2P+1S (45)	doc.	dr. sc. B. Vukosav
Urbana geografija I.	2P+1S (45)	izv. prof.	dr. sc. S. Šiljeg
Regionalna geografija Hrvatske I.	2P+1S (45)	izv. prof.	dr. sc. D. Radoš
Regionalna geografija Latinske Amerike	2P+1S (45)	red. prof.	dr. sc. Ž. Šiljković
Regionalna geografija Europe	2P+1S (45)	doc.	dr. sc. B. Vukosav
Turistička geografija	2P+1S (45)	red. prof.	dr. sc. A. Čuka
Historijska geografija	2P+1S (45)	red. prof. asistent	dr. sc. L. Mirošević T. Turić, mag. geogr.
Hrvatsko iseljeništvo	2P+1S (45)	red. prof.	dr. sc. A. Čuka
Pedogeografija	1P+2V (45)	red. prof.	dr. sc. D. Perica
Geografski informacijski sustavi II.	2P+2V (60)	doc.	dr. sc. I. Marić
3. GODINA STUDIJA, 6. SEMESTAR – JEDNOPREDMETNI STUDIJ PRIMIJENJENE GEOGRAFIJE			
Prometna geografija	2P+1S (45)	red. prof. viši asist.	dr. sc. A. Pejdo dr. sc. J. Sutlović
Urbana geografija II.	2P+1S (45)	red. prof. asistent	dr. sc. L. Mirošević T. Turić, mag. geogr.
Pomorska geografija	2P+1S (45)	red. prof. doc.	dr. sc. R. Lončarić dr. sc. T. Marelić
Regionalna geografija Hrvatske II.	2P+1S (45)	doc.	dr. sc. B. Vukosav

Predmet		Broj sati tjedno (ukupno)	Znanstveno--nastavni stupanj	Nastavnici i suradnici u nastavi
Svjetski geopolitički sustavi		2P+1S (45)	doc. izv. prof.	dr. sc. B. Vukosav dr. sc. A. Blaće
Geografija prirodnih prijetnji		2P+1S (45)	red. prof.	dr. sc. N. Lončar
Medicinska geografija		1P+2S (45)	red. prof.	dr. sc. N. Lončar
Kartografija i vizualizacija		1P+2V (45)	doc.	dr. sc. F. Domazetović
Terenska nastava III.		40 sati	red. prof. red. prof.	dr. sc. D. Perica dr. sc. Ž. Šiljković
3. GODINA STUDIJA, 5. SEMESTAR – DVOPREDMETNI NASTAVNIČKI STUDIJ GEOGRAFIJE				
Uvod u političku geografiju		2P (30)	doc.	dr. sc. B. Vukosav
Urbana geografija I.		2P (30)	izv. prof.	dr. sc. S. Šiljeg
Regionalna geografija Hrvatske I.		2P (30)	izv. prof.	dr. sc. D. Radoš
Regionalna geografija Latinske Amerike		2P (30)	red. prof.	dr. sc. Ž. Šiljković
Regionalna geografija Europe		2P (30)	doc.	dr. sc. B. Vukosav
Turistička geografija		2P (30)	red. prof.	dr. sc. A. Čuka
Historijska geografija		2P (30)	red. prof.	dr. sc. L. Mirošević
Hrvatsko iseljeništvo		2P (30)	red. prof.	dr. sc. A. Čuka
3. GODINA STUDIJA, 6. SEMESTAR – DVOPREDMETNI NASTAVNIČKI STUDIJ GEOGRAFIJE				
Prometna geografija		2P (30)	red. prof.	dr. sc. A. Pejdo
Urbana geografija II.		2P (30)	red. prof.	dr. sc. L. Mirošević
Regionalna geografija Hrvatske II.		2P (30)	doc.	dr. sc. B. Vukosav
Svjetski geopolitički sustavi		2P (30)	doc.	dr. sc. B. Vukosav
Pomorska geografija		2P (30)	red. prof.	dr. sc. R. Lončarić
Geografija prirodnih prijetnji		2P (30)	red. prof.	dr. sc. N. Lončar
Medicinska geografija		1P+2S (30)	red. prof.	dr. sc. N. Lončar
Kartografija i vizualizacija		1P+2V (45)	doc.	dr. sc. F. Domazetović
Terenska nastava III.		40 sati	red. prof. red. prof.	dr. sc. D. Perica dr. sc. Ž. Šiljković
B) DIPLOMSKI STUDIJ				
1. GODINA STUDIJA, 1. SEMESTAR – JEDNOPREDMETNI STUDIJ PRIMIJENJENE GEOGRAFIJE				
Geografsko modeliranje prostora	Modeliranje prostornih podataka u GIS-u I.	2P+2V (60)	red. prof.	dr. sc. A. Šiljeg
	Geografska analiza krajolika	1P+2V (45)	izv. prof.	dr. sc. A. Blaće
	Geografski aspekti upravljanja obalnim područjima	2P+1S (45)	red. prof. doc.	dr. sc. V. Graovac Matassi dr. sc. I. Marić
	Osnove oceanologije	2P+1V (45)	red. prof.	dr. sc. M. Surić
	Metodologija znanstveno-istraživačkog rada u geografiji I.	2P (30)	red. prof.	dr. sc. V. Graovac Matassi
	Turistički prostorni resursi Hrvatske	2P+1S (45)	red. prof.	dr. sc. A. Pejdo
	Metodika nastave geografije I.	2P+1V (45)	red. prof.	dr. sc. A. Pejdo
	Geoekologija	2P+1V (45)	izv. prof.	dr. sc. M. Mamut
	Geografija hrvatskih otoka	1P+2S (45)	red. prof.	dr. sc. A. Čuka
	Geoprostorne tehnologije u upravljanju okolišem	1P+1S+1V (45)	doc.	dr. sc. I. Marić

Predmet		Broj sati tjedno (ukupno)	Znanstveno--nastavni stupanj	Nastavnici i suradnici u nastavi
Geografski aspekti upravljanja obalnim područjima	Geografski aspekti upravljanja obalnim područjima	2P+1S (45)	red. prof. doc.	dr. sc. V. Graovac Matassi dr. sc. I. Marić
	Geografija hrvatskih otoka	1P+2S (45)	red. prof.	dr. sc. A. Čuka
	Geoekologija	2P+1V (45)	izv. prof.	dr. sc. M. Mamut
	Osnove oceanologije	2P+1V (45)	red. prof.	dr. sc. M. Surić
	Metodologija znanstveno-istraživačkog rada u geografiji I.	2P (30)	red. prof.	dr. sc. V. Graovac Matassi
	Turistički prostorni resursi Hrvatske	2P+1S (45)	red. prof.	dr. sc. A. Pejdo
	Geografska analiza krajolika	1P+2V (45)	izv. prof.	dr. sc. A. Blaće
	Modeliranje prostornih podataka u GIS-u I.	2P+2V (60)	red. prof.	dr. sc. A. Šiljeg
	Metodika nastave geografije I.	2P+1V (45)	red. prof.	dr. sc. A. Pejdo
	Geoprostorne tehnologije u upravljanju okolišem	1P+1S+1V (45)	doc.	dr. sc. I. Marić
1. GODINA STUDIJA, 2. SEMESTAR – JEDNOPREDMETNI STUDIJ PRIMIJENJENE GEOGRAFIJE				
Geografsko modeliranje prostora	Geografski aspekti regionalizacije i prostornog planiranja	2P+1S (45)	doc. asistent	dr. sc. I. Marić S. Gverić, prof.
	Prostorne analize u GIS-u	2P+1S+2V (75)	red. prof.	dr. sc. A. Šiljeg
	Daljinska istraživanja	2P+2V (60)	doc.	dr. sc. I. Marić
	Metodologija znanstveno-istraživačkog rada u geografiji II.	2S (30)	red. prof. viši asist.	dr. sc. V. Graovac Matassi dr. sc. J. Sutlović
	Geografija krša	2P+1V (45)	red. prof.	dr. sc. D. Perica
	Geografija Jadrana	2P+1S (45)	red. prof.	dr. sc. R. Lončarić
	Demografski prostorni resursi	2P+1V (45)	red. prof.	dr. sc. V. Graovac Matassi
	Metodika nastave geografije II.	2P+1V (45)	red. prof.	dr. sc. A. Pejdo
	Terenska nastava	40 sati	red. prof. doc.	dr. sc. A. Šiljeg dr. sc. I. Marić
Geografski aspekti upravljanja obalnim područjima	Geografija Jadrana	2P+1S (45)	red. prof.	dr. sc. R. Lončarić
	Geografski aspekti regionalizacije i prostornog planiranja	2P+1S (45)	doc. asistent	dr. sc. I. Marić S. Gverić, prof.
	Geografija krša	2P+1V (45)	red. prof.	dr. sc. D. Perica
	Metodologija znanstveno-istraživačkog rada u geografiji II.	2S (30)	red. prof.	dr. sc. V. Graovac Matassi
	Daljinska istraživanja	2P+2V (60)	doc.	dr. sc. I. Marić
	Prostorne analize u GIS-u	2P+1S+2V (75)	red. prof.	dr. sc. A. Šiljeg
	Demografski prostorni resursi	2P+1V (45)	red. prof.	dr. sc. V. Graovac Matassi
	Metodika nastave geografije II.	2P+1V (45)	red. prof.	dr. sc. A. Pejdo
	Terenska nastava	40 sati	doc. red. prof.	dr. sc. F. Domazetović dr. sc. N. Lončar
1. GODINA STUDIJA, 1. SEMESTAR – DVOPREDMETNI NASTAVNIČKI STUDIJ GEOGRAFIJE				
Metodika nastave geografije I.		2P+1V (45)	red. prof.	dr. sc. A. Pejdo
Metodologija znanstveno-istraživačkog rada u geografiji I.		2P (30)	red. prof.	dr. sc. V. Graovac Matassi
Geoekologija		2P (30)	izv. prof.	dr. sc. M. Mamut
Geografski aspekti upravljanja obalnim područjima		2P (30)	red. prof.	dr. sc. V. Graovac Matassi
Turistički prostorni resursi Hrvatske		2P (30)	izv. prof.	dr. sc. J. Brkić-Vejmelka
Geografija hrvatskih otoka		1P+1S (30)	red. prof.	dr. sc. A. Čuka

Predmet		Broj sati tjedno (ukupno)	Znanstveno--nastavni stupanj	Nastavnici i suradnici u nastavi
Modeliranje prostornih podataka u GIS-u I.		1P+2V (45)	red. prof.	dr. sc. A. Šiljeg
Geografska analiza krajolika		1P+1V (30)	izv. prof.	dr. sc. A. Blaće
Osnove oceanologije		2P+1V (45)	red. prof.	dr. sc. M. Surić
1. GODINA STUDIJA, 2. SEMESTAR – DVOPREDMETNI NASTAVNIČKI STUDIJ GEOGRAFIJE				
Metodika nastave geografije II.		2P+1V (45)	red. prof.	dr. sc. A. Pejdo
Metodologija znanstveno-istraživačkog rada u geografiji II.		2S (30)	red. prof.	dr. sc. V. Graovac Matassi
Geografija Jadrana		2P (30)	red. prof.	dr. sc. R. Lončarić
Geografski aspekti regionalizacije i prostornog planiranja		2P (30)	doc. asistent	dr. sc. I. Marić S. Gverić, prof.
Geografija krša		2P (30)	red. prof.	dr. sc. D. Perica
Prostorne analize u GIS-u		1P+2V (45)	red. prof.	dr. sc. A. Šiljeg
Daljinska istraživanja		1P+2V (45)	doc.	dr. sc. I. Marić
Demografski prostorni resursi		2P (30)	red. prof.	dr. sc. V. Graovac Matassi
Terenska nastava		40 sati	doc. red. prof.	dr. sc. F. Domazetović dr. sc. N. Lončar
2. GODINA STUDIJA, 3. SEMESTAR – JEDNOPREDMETNI STUDIJ PRIMIJENJENE GEOGRAFIJE				
Geografsko modeliranje prostora	Prirodno-geografski aspekti promjena u okolišu	2P+1S+1V (60)	red. prof.	dr. sc. N. Lončar
	Modeliranje prostornih podataka u GIS-u II.	2P+2V (60)	red. prof. izv. prof.	dr. sc. A. Šiljeg dr. sc. S. Šiljeg
	Stručna praksa	3V (45)	izv. prof.	dr. sc. S. Šiljeg
	Diplomski seminar	2S (30)	izv. prof. izv. prof.	dr. sc. A. Blaće dr. sc. S. Šiljeg
	Upravljanje prostorom i smanjenje rizika od katastrofa	2P+2S (60)	red. prof.	dr. sc. N. Lončar
	Primijenjena geoekologija	2P+1V (45)	izv. prof.	dr. sc. M. Mamut
	Metodika nastave geografije III.	3V (45)	red. prof.	dr. sc. A. Pejdo
	Geografske izvannastavne i izvanškolske aktivnosti	1P+2S (45)	red. prof.	dr. sc. A. Pejdo
	Geografski pristup vrednovanju kulturne baštine	1P+2S (45)	red. prof. doc. asistent	dr. sc. L. Mirošević dr. sc. F. Domazetović T. Turić, mag. geogr.
Geografski aspekti upravljanja obalnim područjima	Primijenjena geoekologija	2P+1V (45)	izv. prof.	dr. sc. M. Mamut
	Geografski pristup vrednovanju kulturne baštine	1P+2S (45)	izv. prof. doc. asistent	dr. sc. L. Mirošević dr. sc. F. Domazetović T. Turić, mag. geogr.
	Prirodno-geografski aspekti promjena u okolišu	2P+1S+1V (60)	red. prof.	dr. sc. N. Lončar Baričević
	Modeliranje prostornih podataka u GIS-u II.	2P+2V (60)	red. prof. izv. prof.	dr. sc. A. Šiljeg dr. sc. S. Šiljeg
	Stručna praksa	3V (45)	izv. prof.	dr. sc. S. Šiljeg
	Diplomski seminar	2S (30)	red. prof. izv. prof.	dr. sc. A. Blaće dr. sc. S. Šiljeg
	Upravljanje prostorom i smanjenje rizika od katastrofa	2P+2S (60)	red. prof.	dr. sc. N. Lončar Baričević
	Metodika nastave geografije III.	3V (45)	red. prof.	dr. sc. A. Pejdo
	Geografske izvannastavne i izvanškolske aktivnosti	1P+2S (45)	red. prof.	dr. sc. A. Pejdo

Predmet		Broj sati tjedno (ukupno)	Znanstveno-nastavni stupanj	Nastavnici i suradnici u nastavi
2. GODINA STUDIJA, 4. SEMESTAR – JEDNOPREDMETNI STUDIJ PRIMIJENJENE GEOGRAFIJE				
Geografsko modeliranje prostora	Diplomski rad	10V (150)		Mentor
Geografski aspekti upravljanja obalnim područjima	Diplomski rad	10V (150)		Mentor
2. GODINA STUDIJA, 3. SEMESTAR – DVOPREDMETNI NASTAVNIČKI STUDIJ GEOGRAFIJE				
Metodika nastave geografije III.		3V (45)	red. prof.	dr. sc. A. Pejdo
Geografske izvannastavne i izvanškolske aktivnosti		1P+2S (45)	red. prof.	dr. sc. A. Pejdo
Diplomski seminar		2S (30)	izv. prof. izv. prof.	dr. sc. A. Blaće dr. sc. S. Šiljeg
Prirodno-geografski aspekti promjena u okolišu		2P (30)	red. prof.	dr. sc. N. Lončar
Upravljanje prostorom i smanjenje rizika od katastrofa		2P (30)	red. prof.	dr. sc. N. Lončar
Primijenjena geoekologija		2P (30)	izv. prof.	dr. sc. M. Mamut
Geografski pristup vrednovanju kulturne baštine		1P+1S (30)	red. prof. doc. asistent	dr. sc. L. Mirošević dr. sc. F. Domazetović T. Turić, mag. geogr.
Modeliranje prostornih podataka u GIS-u II.		1P+2V (30)	red. prof. izv. prof.	dr. sc. A. Šiljeg dr. sc. S. Šiljeg
2. GODINA STUDIJA, 4. SEMESTAR – DVOPREDMETNI NASTAVNIČKI STUDIJ GEOGRAFIJE				
Diplomski rad		5V (75)		Mentor

POPIS I OPIS KONFERENCIJA, ZNANSTVENIH SKUPOVA, RADIONICA, OKRUGLIH STOLOVA, LJETNIH ŠKOLA, JAVNIH PREDAVANJA I PROJEKATA U ORGANIZACIJI ODJELA

Organizacija znanstveno-popularnih predavanja

Hrvatsko geografsko društvo – Zadar je u suradnji s Odjelom za geografiju tijekom akademske godine 2024./2025. organiziralo niz znanstveno-popularnih predavanja o geografskim i geografiji srodnim temama s vrlo dobrom posjećenosti nastavnika, studenata, učenika i zainteresiranih građana. Predavanja su bila otvorena za javnost te su medijski popraćena. Predavanje u listopadu *Zadarska arheološka baština – prijedlog valorizacije održivosti rimskog katastra* održala je izv. prof. dr. sc. Josipa Baraka s Odjela za arheologiju Sveučilišta u Zadru. U studenom predavanje *Povratak na mjesec* održao je Goran Hudec. Predavanje je organizirano u suorganizaciji s Hrvatskim astronautičkim i raketnim savezom i Astronomskim astronautičkim društvom Zadar. U sklopu obilježavanja Dana Grada Zadra predavanja su održali izv. prof. dr. sc. Silvija Šiljeg (*Kvaliteta života u gradu Zadru*) i Mislav Čagalj, mag. geog. (*Magistrala cesta koja je povezala Zadar s ostatkom svijeta*) s Odjela za geografiju. U prosincu predavanje *The Watermills of Dalmatia in Historical Cartography* održao je Ludovico Maurina, student četvrte godine Doktorskog studija geografije na Sveučilištu u Padovi, Odjel za geografiju, povijest i antiku. U siječnju 2025. predavanje *Demografsko starenje u Hrvatskoj: hoće li stariji ostati sami i nezaštićeni?* održala je prof. dr. sc. Sanja Klempić Bogadi. U ožujku je prof. dr. sc. Željka Šiljković održala putopisno predavanje *Afganistan – groblje carstava*.

18. seminar Josipa Roglića

Na Odjelu za geografiju 27. lipnja 2025. održan je 18. seminar Josipa Roglića *Izazovi i perspektive suvremenog poučavanja Geografije* (Sl. 1.). Glavni ciljevi seminara bili su: identificirati mogućnosti prilagodbe

kurikuluma Geografije potrebama 21. stoljeća, istaknuti važnost Geografije kao predmeta koji potiče razumijevanje globalnih procesa i lokalnih izazova, predložiti načine za jačanje njezine uloge u obrazovnom sustavu te primijeniti moderne digitalne alate (GIS, ChatGPT i druge aplikacije) za unapređenje nastave i motivaciju učenika.

Na seminaru su održana ova predavanja:

- Gordana Kovačević Poznanović, prof. geografije, OŠ Eugena Kvaternika, Rakovica: Iskustva OŠ Eugena Kvaternika, Rakovica u provedbi eksperimentalnog programa Osnovna škola kao cjelodnevna škola: uravnotežen, pravedan, učinkovit i održiv sustav odgoja i obrazovanja, s osvrtom na nastavu geografije.
- Ivica Borić, prof. geografije, Srednja strukovna škola bana Josipa Jelačića Sinj: Položaj Geografije u strukovnom obrazovanju
- dr. sc. Biljana Vranković, Nacionalni centar za vanjsko vrednovanje obrazovanja: Rezultati nacionalnih ispita iz Geografije s naglaskom na geografske vještine
- izv. prof. dr. sc. Željka Tomasović, Odjel za informacijske znanosti i tehnologije Sveučilišta u Zadru: Poučavanje u doba umjetne inteligencije: nastava 21. stoljeća
- izv. prof. dr. sc. Denis Radoš, Odjel za geografiju Sveučilišta u Zadru: Web alati za izradu geografskih karata
- izv. prof. dr. sc. Ružica Vuk, Geografski odsjek Prirodoslovno-matematičkog fakulteta Sveučilišta u Zagrebu: Novi pristupi vrednovanju geografskih vještina
- prof. dr. sc. Maša Surić, Odjel za geografiju Sveučilišta u Zadru: Jesmo li u antropocenu?
- Renata Cvetkoski, prof. geografije, Anita Šimac, prof. matematike, OŠ Petar Preradović Zadar: Igrifikacija u službi znanja: geografija i matematika u međupredmetnoj suradnji

Slika 1. *18. seminar Josipa Roglića* Izazovi i perspektive suvremenog poučavanja Geografije

Noć geografije 2025.

Članovi Hrvatskog geografskog društva – Zadar u suradnji s nastavnicima osnovnih i srednjih škola u Zadarskoj županiji, nastavnicima na Odjelu za geografiju i Odjelu za ekologiju, agronomiju i akvakulturu Sveučilišta u Zadru, Centrom za projekte, znanost i transfer tehnologija, članovima Automodelarskog klu-

ba, Aerokluba Zadar, Loptice Zadar, EGEA-e Zadar, Službe civilne zaštite Zadar i Zajednice tehničke kulture Zadarske županije zajednički su obilježili Noć geografije (GeoNight) koja se održala 4. travnja 2025. (Sl. 2.). Te godine bilo je planirano oko 270 aktivnosti širom svijeta. Noć geografije organizirao je EUGEO (European Geographical Organisation) u suradnji s geografskim društvima država Europe.

U četvrtak, 3. travnja, udruga studenata geografije EGEA Zadar pozvala je sudionike na GeoQuiz, uzbudljivo i dinamično natjecanje za sve ljubitelje geografije. U petak, 4. travnja, sudionici su se družili na Novom kampusu na Odjelu za geografiju gdje ih je dočekao niz zanimljivih aktivnosti. Dvije aktivnosti bavile su se temom mikroplastike – globalnog problema s lokalnim posljedicama. Profesorica geografije Zrinka Klarin i profesorica biologije Anita Mustać iz Osnovne škole Šime Budinića istražile su prisutnost mikroplastike u uzorcima pijeska i mora prikupljenima s gradske plaže. Cilj istraživanja bio je analizirati prisutnost mikroplastike s pomoću digitalnog mikroskopa. Učenici su mikroskopirali uzorke mora i pijeska te crtežom prikazivali čestice vidljive mikroskopom. Prof. geografije Marijana Škunca-Vrkić iz Medicinske škole Ante Kuzmanića Zadar demonstrirala je proces filtriranja vode iz stroja za pranje rublja. Na radionici sudionici su učili kako identificirati mikroplastiku te prepoznati važnost smanjenja njezine prekomjerne uporabe u svakodnevnom životu.

Slika 2. *Noć geografije 2025.*

Slika 3. *Radionica* Orijentacija u prostoru – od kuće do vrtića *u sklopu Noći geografije 2025.*

Tijekom Noći geografije organizirana je izložba učeničkih radova pod nazivom Svijet u našim rukama – ekološki modeli planeta. Radovi su nastali na nastavi geografije pod vodstvom profesorice geografije Renate Cvetkoski iz OŠ Petra Preradovića. U suradnji s profesoricom matematike Anitom Šimac, Renata Cvetkoski sudjelovala je u izvođenju još jedne aktivnosti: Učimo kroz igru – otkrijmo Europu. Aktivnost je bila osmišljena kako bi sudionicima omogućila stjecanje novih znanja o Europi na zabavan i interaktivan način. Igrajući se, učenici su rješavali matematičke zadatke povezane s geografijom. Aktivnost je bila prilagođena svim uzrastima radi spajanja zabave i edukacije te poticanja interesa za geografiju i matematiku kroz igru.

Profesorica geografije Manuela Margetić Longin iz OŠ Smiljevac vodila je aktivnost Klime na Zemlji. Putem zabavnih i interaktivnih zadataka učenici su proširivali svoje znanje o tipovima klima na Zemlji i njihovoj rasprostranjenosti. Doc. dr. sc. Ivana Zubak Čizmek s Odjela za ekologiju, agronomiju i akvakulturu Sveučilišta u Zadru vodila je interaktivnu radionicu pod nazivom Klimatski kolaž tijekom koje su manje skupine učenika u grupnom radu i diskusijom spoznavale uzroke i posljedice klimatskih promjena. Prof. dr. sc. Ana Pejdo i izv. prof. dr. sc. Jadranka Brkić-Vejmelka sa studentima prve godine diplomskog sveučilišnog studija Geografije organizirale su niz igara na temu geografije i geografiji srodnih znanosti kojima su potaknule učenike na razmišljanje o važnosti geografije u obrazovanju. Prof. dr. sc. Anica Čuka sudionicima je otkrila niz zanimljivosti o geografiji svjetskih i posebno hrvatskih otoka.

Tijekom Noći geografije Služba civilne zaštite Zadar provela je edukaciju građana o sustavu civilne zaštite. Sudionicima su predstavili sustav civilne zaštite u Republici Hrvatskoj te zaštitu i spašavanje od prirodnih nesreća poput poplava, požara, potresa i jakog vjetra, ali i od civilizacijskih nesreća poput radiološke opasnosti, industrijskih nesreća, prijevoza opasnih tvari i ratnog djelovanja. Predstavili su i primjere sličnih događaja u Zadarskoj županiji u posljednjem desetljeću.

U sklopu djelovanja Zajednice tehničke kulture Zadarske županije na Noći geografije sudjelovala je profesorica biologije Biljana Agić s radionicom o izradi geobotaničke karte. Sudionici su istraživali kartice i fotografije o staništima hrvatskih endema te označavali lokacije digitalnim alatima. Profesor matematike Emir Agić i Malik Agić predstavili su sudionicima zanimljivu zbirku minerala.

Automodelarski klub Zadar posjetiteljima je predstavio automodelarstvo kao dio tehničke kulture i sporta te prezentirao automodele skale 1:8 GT elektro, jedan off-road i jedan on-road bespilotni automobil. Aeroklub Zadar prezentirao je virtualno letenje s pomoću 2D simulatora letenja. Sudionici su imali priliku

okušati se u virtualnom letenju uz pomoć 2D simulatora uz instruktora virtualnog letenja i stvarnog pilota te steći osnovno teorijsko znanje iz područja aeronautike.

Prof. dr. sc. Lena Mirošević, Tea Turić, mag. geog., i izv. prof. dr. sc. Ante Blaće organizirali su radionicu Orijentacija u prostoru – od kuće do vrtića. Nakon što su djeca naučila kako se orijentirati u prostoru, uslijedilo je zanimljivo orijentacijsko kretanje pod vodstvom DŠR Loptica (Sl. 3.).

Dani geografije

U organizaciji Studentske udruge EGEA Zadar i Odjela za geografiju održani su Dani geografije (Sl. 4.). Tema Između valova i politika: otoci kao strateške točke bila je usmjerena na otoke kao prostorne, političke i kulturne entitete koji su tijekom povijesti i u suvremenosti imali ključno značenje u različitim geografskim kontekstima. U uvodnom predavanju Prilike i izazovi u implementaciji mjera održivog razvoja otoka prof. dr. sc. Anica Čuka istaknula je kako su otoci specifičan prostor kojemu je trebalo pristupati s velikom pažnjom. U nastavku programa studenti su slušali izlaganja dr. sc. Julijana Sutlovića, prof. dr. sc. Kristijana Jurana, izv. prof. dr. sc. Denisa Radoša i prof. dr. sc. Nikole Vuletića o povijesnim migracijama, percepciji jadranskih otoka na starim kartama, jezičnim raznolikostima otoka te suvremenim teritorijalnim prijeporima. Sljedeći dan studenti su sudjelovali u zabavnim i edukativnim aktivnostima poput Scavenger Hunta

Slika 4. *Dani geografije 2025.*

te Geokviza. Organiziran je i stručni terenski izlet na relaciji Manastir Krupa – izvor Krupe – Karišnica uz vodstvo prof. dr. sc. Roberta Lončarića. Manifestacija je završena u subotu uz Island Party u Studentskom klubu Bože Lerotića.

Siverić nekad i danas – u povodu 150. obljetnice posjeta cara Franje Josipa I. rudniku ugljena Siverić

U povodu 150. obljetnice povijesnog posjeta cara Franje Josipa I. rudniku ugljena u Siveriću u organizaciji Sveučilišta u Zadru i suorganizaciji Instituta Ruđera Boškovića, Fakulteta agrobiotehničkih znanosti Osijek, Veleučilišta u Šibeniku, Pučkog otvorenog učilišta Drniš, Turističke zajednice grada Drniša, Mjesnog odbora Siverić, Kulturne organizacije NIIT i Kulturno-društvene udruge RIBASO u Drnišu je od 5. do 7. lipnja 2025. održan znanstveno-stručni skup Siverić nekad i danas – u povodu 150. obljetnice posjeta cara Franje Josipa I. rudniku ugljena Siverić (Sl. 5.).

Slika 5. *Znanstveno-stručni skup Siverić nekad i danas – u povodu 150. obljetnice posjeta cara Franje Josipa I. rudniku ugljena Siverić*

Cilj skupa bio je sagledati bogatu povijest i značaj Siverića kao nekadašnjeg rudarskog i industrijskog središta te ponuditi smjernice za buduću kulturno-gospodarsku revitalizaciju. U dva dana izlaganja predstavljeno je četrdeset radova koji su obuhvatili širok spektar tema – od geografije, geologije, rudarstva i industrijskog razvoja, preko povijesti i kulture, do demografije, arhitekture i obrazovanja. Završnog dana skupa organiziran je stručni izlet na Visovac i Roški slap.

Razvoj Siverića usko je vezan za eksploataciju ugljena, a njegovo rudarsko značenje tijekom Austro-Ugarske Monarhije bilo je ravno onome u Labinu. Mjesto je 1875. godine posjetio i car Franjo Josip I., čime je Siverić ušao u povijesne zapise kao važno rudarsko središte. Ubrzo nakon toga izgrađena je željeznička pruga prema Šibeniku i Splitu, a 1909. uvedena je električna energija putem hidrocentrale na Roškom slapu. Siverić je imao razvijenu infrastrukturu, školu, kulturne i stambene objekte, a vrhunac doseže u poratnim godinama kada je u rudniku radilo više od dvije tisuće ljudi. No, zatvaranjem rudnika 1970-ih, gospodarstvo je zamrlo, a stanovništvo se počelo iseljavati.

Skup je okupio mnogobrojne ugledne znanstvenike i stručnjake iz različitih područja. Na skupu su bili veleposlanik Japana u Hrvatskoj Wada Mitsuhiro, rektor Sveučilišta u Zadru prof. dr. sc. Josip Faričić, dekan Veleučilišta Šibenik Ljubo Runjić, predstavnici Instituta Ruđera Boškovića, fakulteta Agrobiotehničkih znanosti Osijek te mnogi drugi uzvanici, predavači i gosti. U ime Grada Drniša i gradonačelnika Tomislava Dželalije okupljene je pozdravila pročelnica Marija Lovrić. Dekan Ljubo Runjić istaknuo je kako je tema skupa pogled u prošlost, ali s ciljem da shvatimo budućnost i da je kreiramo jer povijest je učiteljica života.

Ideja o organizaciji skupa potekla je od prof. Snježane Mrđen, rođene Siverćanke, predsjednice Mjesnog odbora Siverić i dugogodišnje profesorice na Odjelu za geografiju, istaknuo je rektor Sveučilišta u Zadru prof. dr. sc. Josip Faričić.

Međunarodna znanstvena konferencija Geography in its complexity

Međunarodna znanstvena konferencija *Geography in its complexity* u čast rada prof. Veljka Rogića (1925. – 2017.) u povodu 100. godišnjice njegova rođenja održana je u Krasnu 18. i 19. rujna 2025. u organizaciji Geografskog odsjeka Prirodoslovno-matematičkog fakulteta Sveučilišta u Zagrebu i Hrvatskoga geografskog društva. Suorganizatori skupa bili su: Hrvatsko geografsko društvo Zadar, Odjel za geografiju Sveučilišta u Zadru, Komisija Međunarodne geografske unije C24.34 Marginalization, Globalization and Regional and Local Response, Nacionalni park Paklenica, Park Prirode Velebit, Nacionalni park Sjeverni Velebit i Gradski muzej Senj – Senjsko muzejsko društvo.

Konferencija Geography in its complexity održana je u povodu 100. obljetnice rođenja prof. Veljka Rogića te je odala počast njegovu radu i iznimnom doprinosu modernoj hrvatskoj geografiji. Održavanje konferencije inicirala je prof. dr. sc. Borna Fuerst-Bjeliš. Podržao ju je prof. dr. sc. Dražen Perica te su svojim zalaganjem i radom dali veliki doprinos njezinu održavanju.

Svečano otvaranje započelo je 18. rujna u 9 sati, a skup su pozdravili Irena Glavičić Sertić, ravnateljica Nacionalnog parka Sjeverni Velebit, domaćina konferencije; izv. prof. dr. sc. Ivan Čanjevac, pročelnik Geografskog odsjeka Prirodoslovno-matematičkog fakulteta Sveučilišta u Zagrebu; doc. dr. sc. Mladen Maradin, predsjednik Hrvatskoga geografskog društva; prof. dr. sc. Damir Magaš, u ime Odjela za geografiju Sveučilišta u Zadru i Hrvatskoga geografskog društva – Zadar; prof. dr. sc. Walter Leimgruber, u ime Komisije Međunarodne geografske unije Marginality, Globalization and Regional and Local Response. Nakon pozdravnih govora plenarna izlaganja o životu i radu prof. Rogića imali su prof. dr. sc. Borna Fuerst-Bjeliš (Shaping Modern Croatian Geography: The Work and Legacy of Prof. Veljko Rogić) i prof. dr. sc. Dražen Perica (The Contribution of Prof. Rogić to the Understanding of the Natural Features of Velebit).

U rad skupa bilo je uključeno više od stotinjak sudionika iz 12 zemalja, a međunarodni znanstveni odbor konferencije, koji su činili znanstvenici iz osam zemalja, prihvatio je 36 podnesaka. Radni dio konferencije odvijao se 18. rujna, dvije paralelne sekcije tijekom kojih su održana ukupno 32 predavanja i prezentirana četiri posterska podneska. Drugoga dana konferencije, 19. rujna, održan je terenski dio na području Na-

cionalnog parka Sjeverni Velebit pod vodstvom prof. dr. sc. Dražena Perice koji je ukazao na prirodnogeografske i društvenogeografske specifičnosti na području sjevernog Velebita, a posjećeni su ovi lokaliteti: meteorološka postaja Zavižan, Velebitski botanički vrt, Veliki Lom, Štirovača, Mirevo i drugi.

21st international conference Geoinformation and Cartography

Od 18. do 20. rujna 2025. na Sveučilištu u Zadru odvijala se međunarodna znanstvena konferencija o geoinformacijama i kartografiji u zajedničkoj organizaciji Hrvatskoga kartografskog društva, Sveučilišta u Zadru i Hrvatskoga geografskog društva – Zadar (Sl. 6.). Okupila je brojne stručnjake iz različitih zemalja s ukupno 33 izlaganja, a pokrovitelj je bilo Međunarodno kartografsko društvo (International Cartographic Association; ICA). Prvog dana održano je 18 izlaganja i pozvano predavanje profesorice Liqiu Meng s Tehničkog sveučilišta u Münchenu. Predstavljena je i znanstvena monografija iz povijesti kartografije Early Modern Nautical Charts of the Adriatic Sea (Ranonovovjekovne pomorske karte Jadranskog mora) u međunarodnom izdanju kuće Palgrave Macmillan čiji su urednici Josip Faričić i Tome Marelić sa Sveučilišta u Zadru. Konferenciju je tematski popratila i međunarodna izložba starih pomorskih karata naslova More koje ujedinjuje: pomorske karte koje su oblikovale sliku Jadrana od 16. do 19. stoljeća u organizaciji Sveučilišta u Zadru, Sveučilišta u Trstu i talijanskog društva kolekcionara starih karata Roberto Almagia. Drugi dan konferencije obilježilo je 15 izlaganja, pozvano predavanje profesora Georga Gartnera s Tehničkog Sveučilišta u Beču, trenutačnog predsjednika Međunarodnog kartografskog društva, te sastanak Komisije za kartografske projekcije pri Međunarodnom kartografskom društvu. Trećega dana sudionici su posjetili Park prirode Vransko jezero i okolna područja.

Slika 6. *Sudionici 21st* International Conference Geoinformation and Cartography

POPIS I OPIS KONCERATA, IZLOŽBI, PREDSTAVLJANJA KNJIGA I ČASOPISA I SLIČNIH DOGAĐANJA U ORGANIZACIJI ODJELA

Predstavljanje dviju knjiga iz edicije Velika geograf ija Hrvatske

U okviru obilježavanja Dana Sveučilišta u Zadru – Dies academicus 2025. predstavljene su dvije knjige iz edicije Velika geografija Hrvatske, urednika Damira Magaša: Stanovništvo i naselja (demogeografska obilježja) Hrvatske i Geografska obilježja gospodarstva (ekonomska geografija) Hrvatske. Riječ je o petoj i šestoj do

sada objavljenoj knjizi, od sedam koliko će ih činiti ovu sveobuhvatnu sintezu o geoprostornim obilježjima Hrvatske u izdanju Sveučilišta u Zadru i Školske knjige. U ranije objavljenim izdanjima obrađeni su geografski položaj, granice i političko-geografska obilježja Hrvatske, fizička geografija Hrvatske (prirodno-geografska osnova razvoja), povijesno-geografske odrednice razvoja Hrvatske i druge teme. Predstavljene knjige posebno su važne u kontekstu budućnosti, jer obrađuju demografiju kao ključni čimbenik postojanja jednog naroda i gospodarstvo, koje bi onima koji budu živjeli na ovom prostoru trebalo omogućiti kvalitetan život i zadržati ih od odlaska u inozemstvo.

Teme obrađene u knjigama predstavile su suautorice prof. dr. sc. Vera Graovac Matassi i izv. prof. dr. sc. Jadranka Brkić-Vejmelka. Najnovija istraživanja pokazuju kako je Hrvatska u ozbiljnom problemu s depopulacijom, o čemu svjedoči i broj stanovnika s posljednjeg popisa, značajno manji od očekivana 4 milijuna. Trend je nastavljen i nakon popisa pa je 2023. bila godina s najmanje živorođene djece otkada se vodi statistika – rođeno ih je oko 32 tisuće, naspram 95 tisuća sa sredine prošlog stoljeća. Drugi problem je migracija koja u Hrvatskoj nije novost, ali ju je nekada nadoknađivao broj rođene djece. Vrhunac iseljavanja bio je 2017. godine, dok su 2022. i 2023. nakon dugo godina donijele pozitivan migracijski saldo. Zanimljivo je da Hrvatska uz manji broj stanovnika ima veći broj obitelji, jer je članova u jednoj obitelji manje nego ranije, u prosjeku manje od troje. Urednik Velike geografije Hrvatske, profesor emeritus Damir Magaš, nekadašnji rektor Sveučilišta u Zadru, najavio je izlazak i posljednje knjige, koja će, prema njegovu mišljenju, biti najzahtjevnija do sada. Riječ je o regionalizaciji, regijama i regionalizmima Hrvatske.

Posjet Odjelu za geografiju učenika OŠ Blatine-Škrape u sklopu projekta Aspiracije djevojaka k obrazovnim i profesionalnim putevima u STEM području – Steam

U sklopu izvannastavnih aktivnosti za učenice i učenike petih i šestih razreda koje se provode kao dio projekta STeam feeme junior, profesor geografije Frane Čerina, s kolegicama Anitom Belak Bumbak, učiteljicom razredne nastave, i Brunom Cvjetković, mag. edu. biologije i kemije iz OŠ Blatine-Škrape, posjetili su Odjel za geografiju.

Na Odjelu su ih dočekali i održali im predavanja prof. dr. sc Vera Graovac Matassi, prof. dr. sc. Robert Lončarić, doc. dr. sc. Fran Domazetović i doc. dr. sc. Ivan Marić. Cilj projekta je potaknuti učenice da se u većem broju zainteresiraju za STEM područje. Tim projektom učenici dobivaju dodatna znanja i vještine iz STEM područja, a nastavnici mogućnost profesionalnog razvoja (Sl. 7.).

Slika 7. *Učenici OŠ Blatine-Škrape u posjetu Odjelu za geografiju*

Promocija prvostupnika geografije

U petak, 12. prosinca 2025., u Svečanoj dvorani Sveučilišta u Zadru održane su dvije svečane promocije prvostupnika različitih struka. U sklopu toga događaja promovirano je 22 prvostupnika koji su završili jednopredmetni prijediplomski studij primijenjene geografije i dvopredmetni prijediplomski studij geografije (Sl. 8.).

Slika 8. *Promocija prvostupnika 12. prosinca 2025.*

Dvije svečane promocije prvostupnika različitih struka okupile su studente, nastavnike, obitelji i prijatelje na svečanom obilježavanju njihovih akademskih postignuća. Promocije su započele u prijepodnevnim satima i obuhvatile dodjelu diploma studentima koji su uspješno završili prijediplomske studijske programe te stekli akademski stupanj prvostupnika. Svečanosti su prisustvovali profesori suradnici Sveučilišta, članovi obitelji i prijatelji koji su se u svojim obraćanjima čestitali novim prvostupnicima na uloženom trudu i uspjehu tijekom studija. Ovaj tradicionalni događaj važan je dio akademskog kalendara Sveučilišta u Zadru i potvrđuje njegovu predanost kvalitetnom obrazovanju i promociji mladih stručnjaka.

Gostujuća predavanja održana akademske godine 2024./2025. na Odjelu

Tablica 1. *Gostujući nastavnici na Odjelu za geografiju*

Prezime i ime gostujućeg nastavnika	Matično sveučilište	Država	Datum održanog predavanja	Naslov održanog predavanja	Sastavnica	Koordinator aktivnosti
Fátima Velez de Castro	Department of Geography and Tourism, Faculty of Arts and Humanities University of Coimbra	Portugal	8. travnja 2025.	Initial training of Geography Teacher in Portugal: an overview	Odjel za geografiju	prof. dr. sc. Ana Pejdo
Fátima Velez de Castro	Department of Geography and Tourism, Faculty of Arts and Humanities University of Coimbra	Portugal	9. travnja 2025.	The approach to Hazards in Geography curriculum: position and possibilities	Odjel za geografiju	prof. dr. sc. Ana Pejdo, prof. dr. sc. Nina Lončar

Slika 9. *Studijski boravak Fátime Velez de Castro na Odjelu za geografiju*

STUDIJSKA PUTOVANJA I TERENSKE NASTAVE TE SUDJELOVANJA STUDENATA U ISTRAŽIVANJIMA, PROJEKTIMA I SL.

Studijski boravak u Rumunjskoj

Od 18. do 25. svibnja 2025. prof. dr. sc. Maša Surić i prof. dr. sc. Robert Lončarić boravili su na studijskom putovanju u Rumunjskoj (Sl. 10.). Boravak je organiziran s prof. Bodganom Onacom s kojim naši djelatnici imaju dugogodišnju znanstveno-istraživačku suradnju. Tijekom boravka posjetili su Institut za speleologiju Emil Racoviță u Cluj-Napoci, jednu od najproduktivnijih i najcjenjenijih takvih institucija u Europi i svijetu te Sveučilište Babeș-Bolyai, najveće (o. 56 000 studenata) i najpoznatije sveučilište u Rumunjskoj zahvaljujući kojem je Cluj-Napoca grad s jakim studentskim pečatom. Na Institutu Emil Racoviță održan je radni sastanak s dr. Aurelom Perșoiuom s kojim naši djelatnici imaju dugogodišnju suradnju u prikupljanju uzoraka kišnice za analizu stabilnih izotopa kisika i vodika. Na sastanku su podijeljena iskustva u metodologiji prikupljanja uzoraka kišnice te je posjećen i laboratorij za analizu uzoraka. Terenski dio boravka odvijao se na području sjeverozapadne Rumunjske, pretežito u gorju Apuseni, i bio usmjeren na posjet tamošnjim špiljama uz naglasak na upoznavanje s posebnostima speleogeneze i morfologije špilja te na znanstvenim istraživanjima koja su se provodila ili se još uvijek

Slika 10. *Prof. dr. sc. Maša Surić i prof. dr. sc. Robert Lončarić na terenu u Rumunjskoj s prof. Bodganom Onacom*

provode u špiljama. Posjećen je niz speleoloških objekata, među kojima se ističu Peștera Urșilor (Medvjeđa špilja), najposjećenija turistička špilja u Rumunjskoj poznata po iznimnim paleontološkim nalazima, te špilja Scărișoara, također turistička špilja velikim dijelom ispunjena ledom te je zbog toga važna kao izvor paleoklimatoloških zapisa. Posjećen je i rudnik kamene soli u gradu Turda, dvorac Korvin u Hunedoari, jedan od najvećih dvoraca u Europi, muzej zlata u Bradu te ostaci Sarmizegetuse Regie, glavnog grada predrimske Trakije.

TERENSKA NASTAVA

Prva godina prijediplomskog studija geografije

Terenska nastava za studente prve godine prijediplomskoga jednopredmetnog i dvopredmetnog studija geografije provedena je u tri jednodnevna dijela u ožujku, travnju i svibnju 2025. godine, a voditelji su bili doc. dr. sc. Tome Marelić i dr. sc. Julijan Sutlović te prof. dr. sc. Maša Surić i prof. dr. sc. Robert Lončarić.

Split i Šibenik (28. ožujka 2025.)
Voditelji: doc. dr. sc. Tome Marelić; dr. sc. Julijan Sutlović

Terenska nastava prvog dana, 28. ožujka 2025., održana je na području Splita i Šibenika. Na putu autocestom iz Zadra prema Splitu, na odmorištu Krka, studentima su ukratko objašnjene prirodnogeografske značajke Sjevernodalmatinske krške zaravni i rijeke Krke te suvremeni gospodarski razvoj Skradina. U Splitu je organiziran posjet Hrvatskom hidrografskom institutu, ustanovi koja prikuplja, obrađuje i vizualizira prostorne podatke na temelju čega izrađuje službene pomorske karte i upute za navigaciju (peljare). Djelatnici su studente upoznali s radom Hidrografskog, Oceanografskog i Kartografskog odjela

instituta i predstavili im muzejski postav instituta unutar kojeg je nekadašnja oprema pretvorena u eksponate koji izravno svjedoče o razvitku hidrografije i pomorske kartografije pod direktivom te ustanove tijekom njezine povijesti. Studenti su potom razgledali povijesnu jezgru Splita, a održana su im predavanja o suvremenom razvoju toga najvećeg urbanog središta na hrvatskoj obali. Nakon toga studenti su posjetili Šibenik, odnosno tvrđavu Barone izgrađenu tijekom Kandijskog rata (1645. – 1669.). Ondje su studenti dobili informacije o povijesti grada Šibenika i razvoju šibenskog kraja. Povratkom u Zadar u večernjim satima terenska nastava prvog dana je završena.

otok Pag (25. travnja 2025.)

Voditelji: prof. dr. sc. Maša Surić; prof. dr. sc. Robert Lončarić

Drugi dio terenske nastave održan je 25. travnja 2025. na otoku Pagu uz voditeljstvo prof. dr. sc. Maše Surić i prof. dr. sc. Roberta Lončarića. Prvo zaustavljanje nakon polaska iz Zadra bilo je na Paškom mostu na kojem su studenti upoznati s temeljnim geološkim, geomorfološkim i hidrogeološkim obilježjima sjevernodalmatinskog područja. Nakon upoznavanja s evolucijom okoliša od mezozojske jadranske karbonatne platforme do danas, predstavljene su i osnovne geografske specifičnosti otoka Paga – klimatske značajke s naglaskom na buru (njezinu genezu te utjecaj na prirodna i društveno-gospodarska obilježja Paga) i geoprometna važnost, posebno tijekom Domovinskog rata. Na području ornitološkog rezervata Velog blata studenti su se, uz stručno vodstvo djelatnika Javne ustanove za upravljanje zaštićenim dijelovima prirode na području Zadarske županije – Natura Jadera, okušali u *birdwatchingu* – promatranju ptica, aktivnosti koja je prepoznata kao vrlo važan dio turističke ponude otoka. Studentima je tijekom dana višekratno ukazivano na karakterističnu izmjenu geoloških jedinica bitno različitih hidrogeoloških i petroloških svojstava što rezultira i različitim gospodarskim vrednovanjem pojedinih zona – dok su okršena vapnenačka područja pogodna za stočarstvo s nadaleko poznatim uzgojem ovaca, flišne zone su tradicionalno iskorištavane za poljoprivredne kulture. Na izdancima paleogenskih fosilifernih vapnenaca studenti su mogli prepoznavati i uzorkovati foraminiferske vapnence o kojima su učili tijekom kabinetske nastave. Kraće predavanje o promjenama položaja i funkcija glavnog naselja na otoku od antičke Cisse, preko starog Paga do novog naselja koje je planski izgrađeno polovicom 15. stoljeća održano je u gradu Pagu gdje su studenti posjetili i Muzej soli. Prezentiran im je tradicionalan način proizvodnje soli koji je prostorno vezan za potopljene flišne udoline koje se protežu srednjim sinklinalnim dijelom otoka, idealnim za pozicioniranje evaporacijskih bazena. Naglasak je stavljen i na važnosti solarstva za paško gospodarstvo tijekom prošlosti otoka. Središnji dio terenske nastave bio je uspon na najviši vrh otoka Paga Sv. Vid (349 m nv), odakle se stječe najbolji uvid u geološke, geomorfološke i klimatološke predispozicije koje su uvjetovale današnji društveno-gospodarski razvoj otoka. Nakon obilaska Novalje s kratkim predavanjem o lokalnoj intenzivnoj turističkoj valorizaciji, terenska je nastava nastavljena u Lunu i tisućljetnim lunskim maslinicima gdje je istaknuta višestoljetna administrativna podjela otoka Paga koja se i danas održala u pripadnosti sjeverozapadnog dijela otoka Ličko-senjskoj, a jugoistočnog dijela Zadarskoj županiji. Atraktivni izdanci karbonatne stijene u naslagama terra rose poslužili su za ponavljanje temeljnih procesa iz područja geologije i geografije krša.

otok Ugljan (9. svibnja 2025.)

Voditelji: doc. dr. sc. Tome Marelić; dr. sc. Julijan Sutlović

Treći dan terenske nastave održan je na otoku Ugljanu 9. svibnja 2025. Nakon dolaska brzobrodskom linijom u Preko studenti su se šetnjom po profilu od Preka do utvrde svetog Mihovila upoznali prirodnogeografska obilježja i društveno-gospodarske značajke razvoja otoka Ugljana. Održana su izlaganja o geomorfološkim i klimatskim značajkama, specifičnostima otočne hidrografije i o različitim oblicima vrednovanja prirodnih resursa. Posebno su razmotreni elementi otočnoga krajolika, njegove promjene kao posljedica prirodnih i antropogenih procesa, a vizura reljefa više je puta uspoređena s njegovim planimetrijskim prikazima na topografskoj karti i ortofoto karti. U krajoliku su studenti uočili brojne

otiske depopulacije, deagrarizacije i istodobne tercijarizacije, to jest razvitka uslužnih djelatnosti koncentriranih uz uski obalni rub te markacije na tlu koje se ucrtavaju kao kontrolne točke aerofotogrametrijske izmjere za izradu digitalnih ortofoto karata.

Druga godina prijediplomskog studija geografije

Voditelji: doc. dr. sc. Branimir Vukosav i Mislav Stjepan Čagalj, mag. geogr.

Terenska nastava za studente druge godine preddiplomskog studija geografije održana je od 5. do 7. svibnja 2025. na prostoru Istre i dijela Like.

Nastava je započela u ponedjeljak, 5. svibnja, polaskom autobusom iz Zadra u ranim jutarnjim satima te vožnjom autocestom A1 kroz prostor Like do prvog odredišta, pećinskog parka Grabovača. Tijekom vožnje studenti su usmenim izlaganjem voditelja upoznati s prirodnogeografskim i sociogeografskim značajkama prostora Like. Po dolasku u park Grabovača, uslijedilo je kraće pješačenje te obilazak špilje Samograd uz stručno vodstvo. Na putu autocestom kroz Gorski kotar te riječkom obilaznicom i dalje do tunela Učka studenti su upoznati s prirodno-geografskim, historijsko-geografskim i sociogeografskim obilježjima Gorskog kotara, razvojem i funkcijama grada Rijeke te značajem i ulogom tunela Učka u kontekstu hrvatskoga prometnog sustava. Dolaskom u Istru organiziran je posjet naselju Hum, povijesnom utvrđenom naselju sa samo 30 stanovnika te izvrsno očuvanim sustavom fortifikacija i specifičnom gradskom fizionomijom. Nakon obilaska i ručka, vožnja je nastavljena prema Rovinju u kojem su studenti i voditelji noćili.

Drugog dana terenske nastave, 6. svibnja, terenska je nastavljena putom u Pazin. U Pazinu su se studenti pješice spustili dijelom staze prema poznatoj Pazinskoj jami. Pritom im je stručni vodič dao sve informacije o postanku i značajkama ovoga krškog fenomena. Uslijedila je šetnja Pazinom uz izlaganje voditelja te slobodno vrijeme nakon kojega su se studenti i voditelji autobusom uputili u Fažanu na ručak, a zatim prema Puli, najvećem istarskom gradu. U poslijepodnevnim satima bio je obilazak Pule te izlaganje voditelja o povijesnom i geografskom razvoju grada, s naglaskom na demografske i političko-geografske značajke razvoja u 20. i 21. stoljeću. Uslijedio je povratak u hotel te večera i slobodno vrijeme.

Treći i posljednji dan terenske nastave, 7. svibnja, započeo je obilaskom Rovinja uz stručno vodstvo. Studenti su upoznati s poviješću i razvojem Rovinja kao i njegovom ulogom jednoga od najvećih naselja i najznačajnijih turističkih središta Istre, najprosperitetnije hrvatske turističke regije. U sklopu obilaska posjećena je i crkva sv. Eufemije, barokne crkve u kojoj se čuva sarkofag s ostacima istoimene kršćanske mučenice i svetice koji je u grad dopremljen još 800. godine. Nakon obilaska i kraćeg slobodnog vremena, organiziran je posjet zvjezdarnici u Višnjanu poznatoj po velikom broju otkrivenih malih tijela Sunčeva sustava kao i po brojnim edukacijskim programima za visoko motivirane i darovite učenike iz cijele Hrvatske. Studente i voditelje dočekao je voditelj zvjezdarnice Korado Korlević koji im je u sklopu obilaska zvjezdarnice demonstrirao rad kupole teleskopa te iznio detalje o osnovnoj zadaći i djelovanju zvjezdarnice. Nakon obilaska, Korlević je studentima održao zanimljivo predavanje uz PP prezentaciju pod naslovom „Kome pripada budućnost?“. Posjetom zvjezdarnici ujedno je završila terenska nastava i uslijedio je povratak u Zadar u večernjim satima.

Prva godina diplomskog jednopredmetnog sveučilišnog studija primijenjene geografije

Terenska nastava za studente 1. godine diplomskog jednopredmetnog studija primijenjene geografije (2024./2025.) održana je na području grada Makarske i Parka prirode Biokovo uz sudjelovanje studenata Lorene Botice, Luke Lešića i Zvonimira Pušelje (Sl. 11.).

Nastavu su vodili prof. dr. sc. Ante Šiljeg (voditelj) i doc. dr. sc. Ivan Marić (suvoditelj), uz asistenciju doc. dr. sc. Frana Domazetovića i Lovre Pandže, mag. geogr., koji su bili zaduženi za uvodna predavanja, organizaciju aktivnosti, nadzor letačkih operacija i sigurnost na terenu.

Cilj terena bio je stjecanje praktičnih znanja iz fotogrametrije i daljinskih istraživanja primjenom UAV

Slika 11. *Studenti i voditelj doc. dr. sc. Ivan Marić na terenu*

Slika 12. *Primjena bespilotnih letjelica*

Slika 13. *Označavanje i prikupljanje orijentacijskih točaka*

sustava, pri čemu su studenti prošli ključne korake procesa: planiranje misija, označavanje i GNSS mjerenje orijentacijskih i kontrolnih točaka te izvođenje letačkih operacija.

Korištene su različite platforme (DJI Mavic 3, DJI Phantom 4 Pro, DJI Matrice 210 i DJI Matrice 300) i senzori (RGB, termalni i LiDAR) kako bi se demonstrirale mogućnosti i ograničenja pojedinih tehnologija u urbanom i planinskom okolišu (Sl. 12.).

Prvi dan fokusiran je na Makarsku (urban i priobalni prostor), uz teorijski uvod, planiranje fotogrametrijskih misija te automatizirane misije i "free flight" vježbe, a na kraju dana provedena je provjera kvalitete snimaka i sigurnosna pohrana podataka.

Drugi dan proveden je u Parku prirode Biokovo te je naglasak bio na radu u zahtjevnijem reljefu, dodatnim sigurnosnim mjerama i procedurama dozvola (AMC portal) za letenje u zaštićenom području.

Studenti su prikupili vlastite skupove podataka koji će se koristiti u vježbama iz kolegija Daljinska istraživanja i kao podloga za praktični dio ispita (izrada ortofota, DSM/DTM, oblaka točaka i 3D modela) (Sl. 13.).

Zaključno, terenska nastava ostvarila je planirane ishode učenja i pružila studentima intenzivno iskustvo primjene UAV fotogrametrije u različitim prostornim uvjetima s naglaskom na tehničku, sigurnosnu i regulatornu dimenziju rada.

Prva godine dvopredmetnog diplomskog studija geografije

Od 5. do 7. svibnja 2025. studenti su u sklopu terenske nastave boravili na području Like, Velebita i otoka Raba. Terenska nastava provedena je radi upoznavanja prirodno-geografskih obilježja regije, s posebnim naglaskom na kršku morfologiju, hidrologiju i specifične geomorfološke procese.

Prvoga dana terenske nastave studenti su posjetili vidikovac iznad kanjona rijeke Zrmanje te su imali priliku analizirati geomorfološke procese oblikovanja kanjona. U nastavku dana razgledali su Berberov buk

Slika 14. *Studenti Odjela za geografiju u posjetu Cerovačkim špiljama*

Slika 15. *Terenska nastava na području Nacionalnog parka Sjeverni Velebit*

u Muškovcima, no zbog jake kiše bili su prisiljeni predavanje održati ispod nadstrešnice obližnjeg restorana (Sl. 14.). Nakon predavanja nastavili su prema Cerovačkim špiljama. Obilazak Donje i Gornje Cerovačke špilje omogućio je uvid u krško podzemlje Crnopca te značajke špiljskih morfoloških oblika (Sl. 15.). Nakon obilaska uslijedio je ručak u Gračacu, a potom put prema otoku Rabu na kojem je organizirano noćenje.

Drugog dana boravka na terenu studenti su obišli područje Lopara – nekoliko žala unutar Geoparka Lopar. Studenti su tijekom prijepodneva na obilasku kružne staze imali priliku analizirati specifične geomorfološke procese i reljefne oblike vezane za pješčane i klastične naslage koje obilježavaju sjeverni dio otoka Raba. Na terenskom obilasku studenti su vidjeli kako tehnologije poput bespilotnih letjelica olakšavaju terensko rekognosciranje i kartiranje geomorfoloških formi. Nakon terenskog rada u Loparu uslijedio je ručak, a u poslijepodnevnim satima organizirano je stručno vođenje kroz povijesnu jezgru grada Raba.

Trećega dana studenti su posjetili su Nacionalni park Sjeverni Velebit te obišli dionicu Premužićeve staze od Zavižana do Rossijeve kolibe. Tijekom obilaska studenti su se upoznali s dinarskim krškim oblicima i jedinstvenim geomorfološkim procesima koji obilježavaju najviša velebitska područja. Poseban naglasak stavljen je na duboke jame i endokrški reljef Sjevernog Velebita. Nakon obilaska dijela Premužićeve staze i kratkog odmora u planinarskom domu na Zavižanu, slijedio je put prema Krasnom, gdje je organiziran kasni ručak, a zatim povratak u Zadar.

Jednodnevna terenska nastava studenata druge godine diplomskog studija

U petak, 8. studenoga 2024., održana je jednodnevna terenska nastava studenata druge godine diplomskog studija geografije na širem području Parka prirode Vransko jezero. Terenski rad organiziran je u sklopu kolegija Klimatske i (paleo)okolišne promjene te Geografske izvannastavne i izvanškolske aktivnosti, a predvodile su ga prof. dr. sc. Nina Lončar i prof. dr. sc. Ana Pejdo (Sl. 16.). U realizaciji terenske nastave sudjelovao je i doc. dr. sc. Jure Šućur s Odjela za arheologiju te prof. dr. sc. Maša Surić i prof. dr. sc. Robert Lončarić. U terenskom radu sudjelovali su i studenti na međunarodnoj razmjeni. Posebnu vrijednost terenskoj nastavi dala je suradnja sa stručnim djelatnicima Parka prirode i lokalnih institucija. Maja Ćuza Denona, stručna voditeljica PP Vransko jezero, i stručna suradnica Marija Kragić održale su uvodno predavanje o značajkama, vrijednostima i izazovima upravljanja Parkom. Svoja znanja i iskustva podijelio je i ravnatelj Javne ustanove Agencija Han Vrana, arheolog i povjesničar Marko Meštrov.

Tijekom terenskog obilaska studenti su povezali sadržaje geoarheologije, paleookolišnih rekonstrukcija i geografske terenske metodologije. Poseban naglasak bio je na razumijevanju prošlih okolišnih uvjeta i povijesnog korištenja prostora.

Studenti su se upoznali s primjenom geomorfoloških pokazatelja, arheoloških ostataka i povijesnih izvora u rekonstrukciji okoliša, procesom nastanka i datiranja sedre, paleookolišnim izgledom prostora Vranskog polja i njegovim promjenama tijekom vremena, trasom, konstrukcijom i funkcijom rimskog akvedukta koji je vodu s izvora Pećina dovodio do antičkog Zadra, ulogu i poviješću srednjovjekovnog grada Vrane, značenjem trapova kao tradicionalnih sustava za izlov ribe.

Studenti su posjetili nekoliko ključnih lokaliteta: vidikovac Kamenjak, izvor Pećina, Maškovića han, Vrana (Gradina), lokalitet Crkvina i nekoliko dodatnih točaka relevantnih za interdisciplinarne terenske zadatke. Terenska nastava na području PP Vransko jezero omogućila je studentima stjecanje izravnog uvida u kompleksnost odnosa prirodnih procesa, klimatskih promjena, geomorfoloških obilježja te kulturno-povijesnog razvoja prostora. Uz podršku stručnjaka i nastavnika, studenti su imali priliku integrirati teorijska znanja s praktičnim terenskim radom, razvijajući pritom analitičke, interpretacijske i istraživačke vještine. Terenska nastava završila je razmjenom dojmova i zajedničkom refleksijom o važnosti interdisciplinarnog pristupa u proučavanju okoliša i baštine Vranskog jezera.

Slika 16. *Terenska nastava studenata 2. godine diplomskog studija u sklopu kolegija Klimatske i (paleo)okolišne promjene i Geografske izvannastavne i izvanškolske aktivnosti na području Parka prirode Vransko jezero*

Diplomirali na Odjelu za geografiju u Zadru 2024./2025.

1. Ivan KARAMARKO: *Arktičke plovidbene rute u okviru aktualnih geopolitičkih i klimatskih okolnosti* (10. listopada 2024.)
2. Hrvoje, JANČI: *Uloga i značaj poluotoka Krima u suvremenih geopolitičkim odnosima* (9. listopada 2024.)
3. Denis ŠTANGL: *Demografski razvoj Osječko-baranjske županije 2001.-2021. godine* (21. listopada 2024.)
4. Matea BASIOLI: *Razvoj školstva zadarskih otoka u uvjetima demografske regresije* (23. listopada 2024.)
5. Nina ŠTAJEREC: *Razvoj i perspektiva alternativnih oblika prometa u Gradu Čakovcu* (28. listopada 2024.)
6. Donat PELAJIĆ: *Višegodišnje prostorno-vremenske promjene uzorkovane erozijom tla na primjeru poluotoka Santiš* (29. listopada 2024.)
7. Sara VUKAS: *Problematika određivanja granica u Južnom kineskom moru* (29. listopada 2024.)
8. Dominik BRAZDIL: *Geografski i geopolitički aspekti suvremenih migracija u Europu* (20. listopada

2024.)
9. Dino KURSAN: *Urbana slika Trogira u vrijeme kolere sredinom 19. stoljeća* (10. prosinca 2024.)
10. Manuela MIHALINA: *Demografska obilježja slovačke nacionalne manjine u Osječko-baranjskog županiji* (4. ožujka 2025.)
11. Zvonimir SLIEPČEVIĆ: *Procjena točnosti batimetrijskih modela različitih razina detaljnosti* (6. ožujka 2025.).
12. Filip ČOTA: *Utjecaj iseljavanja na demografski razvoj Grada Đakova* (19. ožujka 2025.)
13. Marko ĆAVAR: *Suvremeni demografski trendovi u priobalju Zadarske županije* (21. ožujka 2025.)
14. Pere STIPIĆ: *Suvremeno iseljavanje iz Republike Hrvatske u Njemačku* (21. ožujka 2025.)
15. Ivano MADŽAR: *Demografski trendovi u jedinicama lokalne samouprave Splitsko-dalmatinske županije u 21. stoljeću* (26. ožujka 2025.)
16. Mihaela ANTIČEVIĆ: *Prostorno-vremenska analiza devastacija suhozida na prostoru otoka Vira* (28. ožujka 2025.)
17. Ivan GOLUBIČIĆ: *Primjena geoprostornih tehnologija u detekciji recentnih promjena zemljišnog pokrova otoka Paga* (31. ožujka 2025.)
18. Ante DŽAKULA MIŠKOVIĆ: *Etnički inženjering u Središnjoj Aziji tijekom 20. stoljeća* (17. lipnja 2025.)
19. Petra GALIĆ: *Prostorna preobrazba Grada Kaštela pod utjecajem turizma* (30. lipnja 2025.)
20. Ivan FRANKO: *Sakralni elementi urbanog krajolika u multikonfesionalnim zajednicama na primjeru grada Zenice* (14. srpnja 2025.)
21. Nika Maria BASTAJA: *Suvremeni demografski razvoj Grada Karlovca* (14. srpnja 2025.)
22. Anamaria LASIĆ: *Prostorna analiza poljoprivrednih poticaja u Republici Hrvatskoj na primjeru maslinarstva* (10. srpnja 2025.)
23. Andrija RAVNJAK: *Primjena GIS-a u optimizaciji lokacija punionica za električna vozila* (7. srpnja 2025.)
24. Gabrijela ĆUMURDŽIĆ: *Demografski razvoj Grada Novske od 1991. do 2021. godine* (15. srpnja 2025.)
25. Leonarda DEAN: *Ekonomska aktivnost žena u Republici Hrvatskoj* (16. srpnja 2025.)
26. Bruno BENETI: *Razvoj kartografskih prikaza Jadranskog mora kroz povijest* (12. rujna 2025.)
27. Nina NJEGOVAN: *Geografska imaginacija na kartama u književnom opusu Johna R. R. Tolkiena* (12. rujna 2025.)

Dolasci studenata u akademskoj godini 2024./2025.

ID	PREZIME	IME	SEMESTAR	TEMELJ MOBILNOSTI	MATIČNO SVEUČILIŠTE
1.	Alessandro	Santoni	Zimski	Erasmus+	University of Urbino
2.	Clodagh	Landers	Zimski	Erasmus+	University of Limerick
3.	Leah Mary Ireland	O'Neill	Zimski	Erasmus+	University of Limerick
4.	Ian	Sadler	Zimski	Easmus+	University of Limerick
5.	Coline	Mainguy	Ljetni	Erasmus+	University of La Rochelle
6.	Juliane	Drouillard	Ljetni	Erasmus+	University of La Rochelle
7.	Louise	Durecu - Blanquet	Ljetni	Erasmus+	University of La Rochelle
8.	Titouan	Le Goaziou	Ljetni	Erasmus+	University of La Rochelle
9.	Dilda	Bukenbayeva	Ljetni	CEEPUS	Mendel University in Brno
10.	Iryna	Tarakanava	Ljetni	CEEPUS	Mendel University in Brno

DJELOVANJE CENTRA ZA GEOPROSTORNE TEHNOLOGIJE 2024./2025.

Centar za geoprostorne tehnologije (GAL) osnovao je Senat Sveučilišta u Zadru potkraj veljače 2023. godine kao posebnu sastavnicu, odnosno znanstveno-istraživački centar unutar Sveučilišta. Centar je znanstvena i stručna sastavnica Sveučilišta u Zadru koja primarno obavlja znanstveni i stručni rad te služi kao podrška svim sastavnicama na Sveučilištu koje u svojim znanstvenim i stručnim istraživanjima primjenjuju neki oblik geoprostornih tehnologija i metoda. Osnovni cilj Centra je okupljanje tima iz različitih znanstvenih područja, polja i grana radi provođenja interdisciplinarnih znanstvenih istraživanja, edukacije mladih istraživača, primjene novih znanja i tehnologija te razvoja inovativnih metoda istraživanja u definiranim područjima.

Tijekom 2024./2025. akademske godine GAL je djelovao kao istraživačko-razvojna i stručna platforma s naglašenim fokusom na GIS, daljinska istraživanja, UAV sustave, 3D dokumentaciju te okolišni monitoring i upravljanje resursima. U znanstvenom i diseminacijskom segmentu, u 2025. godini objavljeno je 14

Slika 17. *Sudjelovanje na međunarodnim konferencijama*

Slika 18. *Izvođenje terenskih istraživanja*

znanstvenih radova, a članovi Centra sudjelovali su s ukupno 19 izlaganja i postera na 10 konferencija (Sl. 17), čime je osigurana kontinuirana prisutnost na relevantnim međunarodnim i domaćim skupovima (od okolišne integracije i FOSS4G tema do kulturne baštine i morskih ekosustava).

Projektna komponenta rada Centra u promatranom razdoblju bila je izrazito snažna: u 2025. GAL je bio aktivno uključen u ukupno 11 projekata (četiri projekta Sveučilišta u Zadru, tri projekta Hrvatske zaklade za znanost – HRZZ i tri INTERREG projekta), pri čemu se kao posebno važan okvir ističe Interreg projekt SMART-Water (razdoblje provedbe 1. kolovoza 2024. – 31. srpnja 2027.) s tri pilot-lokacije (Vransko jezero, Deransko jezero i Skadarsko jezero), u kojem su povezani razvoj metodologija monitoringa, terenski rad i prijenos znanja prema javnosti.

Operativno, terenski rad bio je jedna od ključnih okosnica djelovanja: provedeno je više od 30 terenskih istraživanja (od UAV snimanja i 3D skeniranja lokaliteta, preko projektnih terena u Hrvatskoj, BiH i Crnoj Gori, do stručnih sastanaka s dionicima i studijskih putovanja) (Sl. 18.).

Edukacijska i društveno-angažirana uloga Centra dodatno je osnažena s dva edukacijska programa te četiri događanja usmjerena popularizaciji znanosti u 2025., pri čemu se posebno ističu javno-edukativne aktivnosti u okviru SMART-Watera (npr. GeoTech dan s izraženim edukativnim karakterom) te otvoreni

Slika 19. *Održavanje GeoTech dana*

dani i posjeti učenika, kojima je GAL sustavno gradio prepoznatljivost geoprostornih tehnologija u široj zajednici i poticao STEM interes kod mlađih dobnih skupina (Sl. 19.).

NAPUTAK AUTORIMA

O ČASOPISU

Geoadria je znanstveni časopis u otvorenom pristupu koji primarno objavljuje rezultate istraživanja hrvatskoga litoralnog pojasa i Hrvatske u cjelini, a potom i rezultate istraživanja različitih geografskih i geografiji srodnih znanstvenih disciplina o prostoru Jadrana, Sredozemlja i Europe. Dobrodošli su radovi bilo koje geografske tematike koji na teoretski, metodološki ili primjenjiv način razmatraju probleme i međudjelovanje prirodnih i društvenih sastavnica prostora. Posebno potičemo objavljivanje rezultata dobivenih geoprostornim alatima i metodama kao i onih koji se nadovezuju na prethodno objavljene rezultate istraživanja u Geoadriji.

Geoadriju izdaju Hrvatsko geografsko društvo – Zadar i Odjel za geografiju Sveučilišta u Zadru od 1996. Od 2006. godine svi se radovi u časopisu objavljuju na hrvatskom i engleskom jeziku ili samo na engleskom jeziku (strani autori).

U časopisu se objavljuju radovi koji podliježu najmanje dvjema dvostruko anonimiziranim recenzijama, a svrstavaju se u sljedeće kategorije:

a) **izvorni znanstveni članak (*original scientific paper*)** – izvorno znanstveno djelo u kojem su izneseni novi rezultati fundamentalnih ili primijenjenih istraživanja
b) **prethodno priopćenje (*preliminary communication*)** – znanstveni članak koji obavezno sadrži jednu ili više znanstvenih informacija, ali bez dovoljno pojedinosti koje bi omogućile čitatelju provjeru iznesenih znanstvenih spoznaja
c) **pregledni članak (*review*)** – donosi, na temelju literature, cjelovit prikaz dosadašnjih znanja o nekoj temi nastojeći objasniti trenutačno razumijevanje te teme.

Otvoren pristup

Geoadria je časopis u otvorenom pristupu. Sadržaj časopisa u cijelosti je besplatno dostupan. Korisnici smiju čitati, preuzimati, kopirati, distribuirati, tiskati, pretraživati ili stavljati poveznice na materijal te mijenjati, preoblikovati i prerađivati materijal ili ga koristiti na druge zakonite načine, sve dok odgovarajuće citiraju izvornik, u skladu s CC BY 4.0 licencom.

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Troškovi

Prijava radova, recenzija i objavljivanje članaka se ne naplaćuje.

Publiciranje, vremenik

Tiskani brojevi časopisa Geoadria izlaze polugodišnje, u lipnju i prosincu, i to na hrvatskom i engleskom jeziku. Geoadria primjenjuje sustav objavljivanja „prvo na mreži" (online first) što znači da se radovi postavljaju na mrežnu stranicu platforme Hrčak nakon recenzije i lekture, a prije grafičkog uređenja. Konačna verzija postavlja se nakon izrade prijeloma. Od prijave do objave rada u tiskanom obliku potrebno je, otprilike, od četiri do osam mjeseci.

ZAPRIMANJE RUKOPISA

Uredništvo prima rukopise cijele godine. Rukopis se podnosi na hrvatskom i engleskom jeziku (ili samo na engleskom – za strane autore) preko izdavačke platforme Morepress (**https://morepress.unizd.hr/journals/geoadria**). Radovi poslani putem e-pošte neće se uzeti u obzir. Autori u članku posebnu pozornost moraju obratiti na odgovarajuće strukturiranje teksta i odgovarajuću duljinu u skladu s priznatim standardima znanstvene metodologije. Zbog toga autorima predlažemo da prouče i koriste obrazac za pisanje članka. Prije slanja rada paziti da nigdje u rukopisu nisu navedeni osobni podaci autora (ime i prezime) ili u postavkama Word dokumenta. Pri imenovanju rukopisa predlažemo korištenje skraćene verzije naslova rada.

Radovi ne bi trebali imati više od 13 000 riječi, odnosno najviše 15 000 nakon recenzije. To uključuje sve reference. Kategoriju rada koja se objavljuje u zaglavlju članka utvrđuje glavni urednik na temelju dviju recenzija (po potrebi i više) i mišljenja uredničkog odbora. Ostali rukopisi i prilozi svrstavaju se u stalne i povremene rubrike. Prijava radova, recenzija i objavljivanje članaka (APC) se ne naplaćuje.

Prijava treba sadržavati:

A Rukopis
B) Sve slike kao zasebne datoteke (ako ih ima)
C) Excel dokument s izrađenim grafikonima (ako ih ima)
D) Popratno pismo koje sadrži puna imena (s podcrtanim prezimenima) svih autora, njihove titule i potpis dopisnog autora kojim se potvrđuje da rukopis ili njegov dio nije prihvaćen za objavu ili da se razmatra za objavu ili da je objavljen negdje drugdje (Izjava o autorstvu) i Izjavu u sukobu interesa (ako postoji).
E) Dopuštenje o objavi grafičkih priloga koje autori nisu sami izradili (ako ih ima)
F) Dodatne dokumente

Prijava članka i provjera

Prijava članka podrazumijeva da rad nije prethodno objavljen (osim u obliku sažetka, objavljenog predavanja ili ocjenskog rada), da nije u razmatranju za objavljivanje na drugom mjestu, da su njegovo objavljivanje odobrili svi autori i insitucija gdje je istraživanje provedeno te da, ako bude prihvaćen, rad neće biti objavljen drugdje u istom obliku, na engleskom ili bilo kojem drugom jeziku, uključujući elektronički oblik.

Grafički prilozi

Izvorni znanstveni članci u načelu se ne bi trebali koristiti grafičkom dokumentacijom drugih autora. Ako se koristi takva dokumentacija iz graničnih područja (npr. geologije), obvezno treba citirati autora. Tablice i slike (karte, crteži, grafikoni, dijagrami, fotografije) u rukopisu trebaju biti raspoređene tako da ih se može pratiti usporedo s tekstom.

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slike pišu se ispod slike. Izvori na temelju kojih su slike ili tablice izrađene moraju se obavezno naznačiti, a u punom obliku se trebaju nalaziti i u popisu izvora i literature. Najveći format priloga je 50 × 40 cm. U člancima regionalnogeografske tematike obvezno je priložiti orijentacijski crtež sa svim važnijim geografskim imenima koja se spominju u tekstu.

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Uredništvo

GUIDELINES FOR AUTHORS

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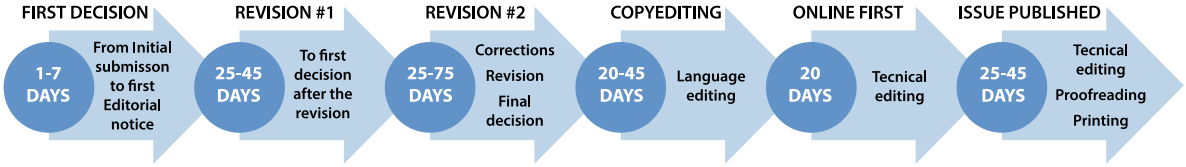

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