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Microclimatic Behavior of Sustainable Urban Schemes Proposed for Hillside Areas versus Existing Neighborhoods in the Metropolitan Area of Mendoza, Argentina

Ana Castillo[A*], Erica Correa[A], María Cantón[A]

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Abstract

The Metropolitan Area of Mendoza (MMA), Argentina, has extended towards peripheral hillside areas without considering the environmental impact of this action. This growth has continued the urban model of flatland development, causing changes in the ecosystem and an increase in outdoor air temperature. This work proposes and evaluates urban schemes that incorporate design criteria with the objective of preserving environmental characteristics and mitigating the effect of urbanization on the microclimate. The proposed grid layouts, located in three predominant slopes, were linear organic and Cul-de-Sac. Methodologically, the microclimatic response of the proposed schemes was evaluated by applying ENVI-met software simulation. The results show that urban growth is possible when carefully considering environmental limitations which grant maximum air temperature reductions of up to 2 °C.

Keywords: Sustainable Urban Development; Hillside; Urban Land; Microclimatic Simulation; Mendoza; ENVI-met.

Introduction

The growth of Latin American cities has shown late transformations compared to more developed parts of the world (USA and Europe) (Castells, 2017). Until 1925, the level of urbanization in Latin America was lower than more developed regions, but during the next fifty years, the urbanization of this region accelerated notably (UN, 2016). Rapid urbanization was closely linked to high population growth with a net redistribution of the population from rural to urban areas. However, this growth steadily decreased after the 1970s due to the high rate of population moving to the outskirts of the city (da Cunha et al., 2009).

The microclimate of cities is modified by the intense anthropization of natural environments causing urban temperatures to be significantly higher than suburban or rural ones (Zhou et al., 2017). This originates two phenomena known as Urban Heat Island -UHI- and Urban Warming -UW-. Urban microclimate plays an important role not only in the energy consumption of buildings and the feeling of comfort and habitability of outdoor spaces but also in air pollution, health and the quality of life of urban areas. During the last years, intense research has been carried out to develop, test and implement efficient technologies for the mitigation of urban warming, considering the climatic and geomorphological characteristics of the implantation site. (Doulos et al., 2004; Synnefa et al., 2008; 2012; Zinzi & Agnoli, 2012; Correa et

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al., 2012; Alchapar & Correa, 2015; Sosa et al., 2018, Logaraj Ramakreshnan et al., 2018). This has fundamentally led to the use of cold materials characterized by their high solar reflectance and infrared emissivity, which can reduce the absorption of solar radiation when used in ceilings and pavements (Wang & Akbari, 2016). The incorporation of urban green spaces with an adequate design, green roofs and permeable materials is capable of promoting the reduction of heat due to their effects on evapotranspiration processes. Moreover, the addition of urban forest produces shade and improves the convective and radiative cooling processes into the city´s structure (Gill et al., 2007; Synnefa et al., 2012; Wang & Akbari, 2016; Zinzi et al., 2012; Santamouris, 2016). Finally, adequate urban planning can also play a vital role in mitigating the UHI effect due to its influence on shape and orientation in the thermal performance of urban fabric (Yamamoto, 2006; Middel, et al., 2014, 2015; Salvatti et al., 2018; Palme et al., 2017).

Most technologies are usually implemented in large-scale urban rehabilitation projects. Based on the results, the application of the different strategies can reduce air temperatures between 1 and 4 °C, cooling loads between 18 and 93%, and electricity demand during peak hours between 11 and 27%. It can also improve the internal comfort conditions by reducing discomfort hours between 9 and 10% and reduce equivalent annual carbon dioxide emissions (Akbari et al., 2009).

The urban development of the Metropolitan Area of Mendoza (MMA), Argentina, has spread to the periphery, in this case to Mendoza´s hillside area, 32.5 ° S latitude and 68.5 ° W longitude. It is a narrow 15/20 km wide strip which extends between the eastern mountains´ slopes and the plain, between 800 m a.s.l. and 1500 m a.s.l approximately. This growth model has generated anthropic pressure on the territory since it has kept typical urban models with homogeneous settlement patterns found in consolidated areas of the city. This has caused a change in the territory's morphology and landscape generating changes in the natural context on which the urban fabric is based (Haller, 2017; Moschella, 2017; Abraham, 1990). In the case of the piedmont area, this urban expansion has produced a high impact since sectors with high environmental fragility that also act as buffers have been urbanized (Lopez Rodriguez, 2008). Among the environmental impacts caused by urban growth is a higher alluvial risk due to the increase in impervious surfaces and deforestation. This brings about the loss of natural soil and its biodiversity, the sealing of land, and the increase in air pollution and noise, all of which favour the modification of the city´s temperature and wind profiles. From the microclimatic point of view, the hillside area has conditions of aridity, high solar radiation, and scarce water resources. According to Correa (2006), this determines the appearance of an urban heat island located in the piedmont area of MMA. This phenomenon could be explained by the excessive hillside urbanization which, coupled with the thermal properties of local materials -mainly stone-, has favoured the increase of thermal inertia. Thus, the cooling period of this area has extended into the early morning hours, generating a hot spot with temperatures up to 9 °C higher compared to its periphery (Correa et al., 2006).

The consequences of this urban development raise the need to rethink the urban scheme to respond to the morphological characteristics of the land and mitigate the increase in air temperature. The Institute of Environment, Habitat and Energy (INAHE), Mendoza, Argentina carries out research related to sustainable urban development based on bioclimatic design. The present work employs microclimate monitoring analysis and modelling through Computational Fluid Dynamics (CFD) simulations to evaluate the impact of different variables and urban characteristics over the thermal performance of a city´s sector. These studies have contributed to studying the effect of urbanization on the microclimate by means of two techniques: a) observational approaches: field measurements, remote sensing from GIS tools; and b) simulation approaches: energy balance models or numerical studies using CFD (Mirzaei & Haghighat, 2010). The main advantage of simulation studies over observational ones is the possibility to perform comparative analyses based on different scenarios. Urban microclimate CFD software varies substantially depending on its physical basis, spatial-temporal resolution, and output variables (Allegrini, et al., 2015). The most widely used both nationally and internationally are Envi-MET met (Crank et al., 2018; Maggiotto, 2021), Energy-Plus (Kuo-Tsang & Yi-Jhen, 2017; Yang et al., 2012), SOLENE-Microclimate (Merlier et al., 2019; Morille et al., 2015), TRNSYS (Palme & Salvati, 2018; Perini et al., 2017), and SIMEDIF (Boutet et al., 2016; Ruiz & Correa, 2015), among others.

The ENVI-met simulation software model developed by Michael Bruse (Bruse & Fleer, 1998a) is one of the most widely employed dynamic simulation tools for microclimate analysis. The review conducted by Tsoka et al., (2018) points out that up until 2017 more than 1900 registered users worldwide have used it for microclimate research. Besides this, the fact that 77% of the total number of ENVI-met studies have been published during the last five years evidences the software´s current validity. In the majority of the existing studies, the model has been applied not only to investigate current microclimatic conditions but also to compare performance assessment of various mitigation strate-

gies considering the UHI effect. This is why the ENVI-met model has been applied in this investigation. In addition; it has been applied in different regions around the world, for example, 66, 5 % of researches have been performed in Europe and Asia while only 5.1% in Latin America. Regarding the evaluated climate conditions, only 13.2 % of the studies correspond to BWh according to Köppen classification. Hence, this study will contribute to broaden the scientific data related to Latin American cities in arid climates.

The present study aims at assessing the micro-climatic performance of different urbanization schemes in order to determine the best options to reduce urban warming, take advantage of the solar resource and mitigate natural hazards of the piedmont. In their design, these schemes incorporate criteria and strategies to avoid natural disasters in hillside regions, such as avalanches, mud-flows and desertification. The ultimate goal is to contribute to the sustainable development of the hillside area.

Data and Methods

In order to compare the prevailing urban development model in the hillside area with sustainable urbanization schemes adapted to the insertion context, the following methodology was undertaken: a) characterization of study area b) characterization of case study, c) scheme evaluation method based on simulations using ENVI-met software, and d) adjustment of thermal behaviour results between the simulated model and the microclimatic measurements in an existing and representative urban scheme in the hillside of MMA.

Characterization of the study area

The metropolitan area of Mendoza is located in the central-western region of Argentina with a surface area of 368 km² and an approximate population of 1,086,000. The city´s climate is semi-desertic corresponding to BWk in the Köppen classification. The principal climatic condition is cold steppe/desert (Kottek et al., 2006), with relatively low atmospheric humidity percentage (45%), 218 mm of annual rainfall, high heliophany, and a maximum daily solar radiation average of 1022 W/m2 in summer (weather underground, n.d.). The annual average temperature is 16.50 °C, with 24.50 °C average high and 9.60 °C average low (Mendoza Aero Observations, 2014).

The urban structure of MMA shows the same growth patterns of intermediate Latin American cities: discontinuous, dispersed and low-density. This

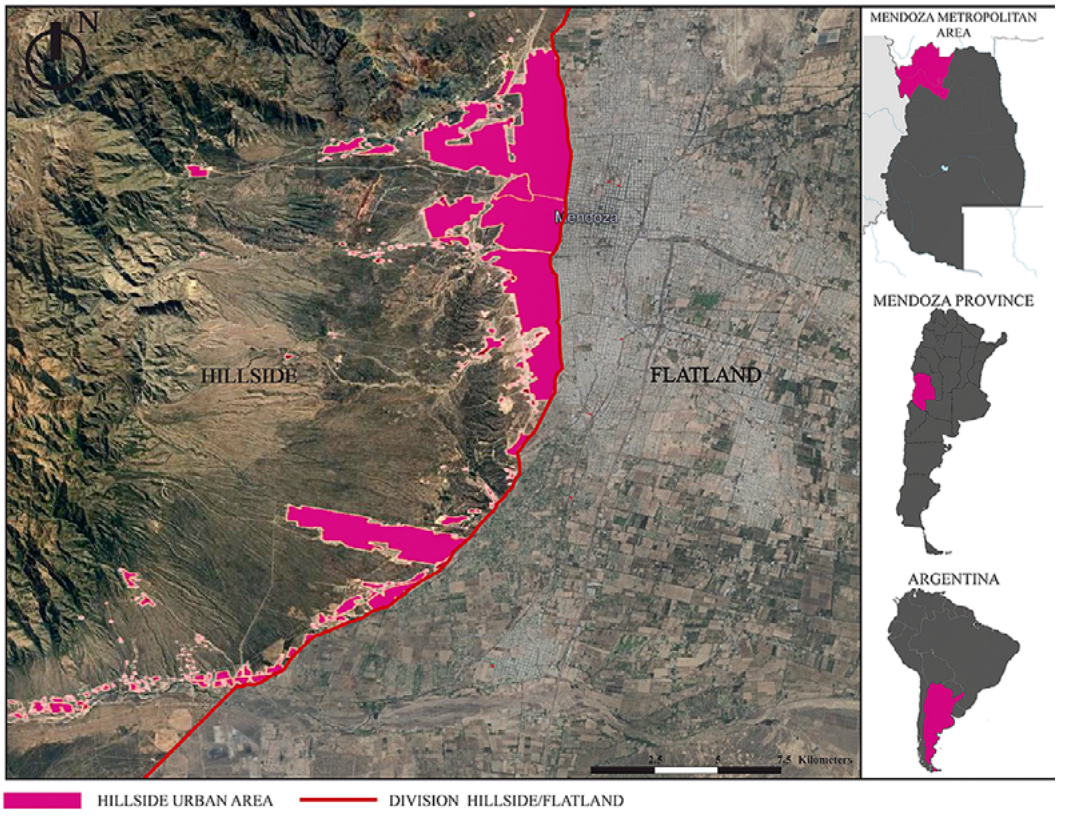


Figure 1. Location of the case study in the South American context and its expansion into the piedmont of MMA

spread arises due to the need for developable lands associated to the increase of population and the search for areas with higher environmental quality in the periphery. (Mesa & Giusso, 2014). The expansive development process has generated an excessive urbanization of the periphery towards both the east-south sector on agricultural lands and towards the west sector on piedmont areas.

The hillside study area, located in the western sector of MMA, constitutes an extensive geomorphological unit of 20 -15 km wide that connects the eastern front of the Andes foothills with Mendoza City (Gómez et al., 2017). It is characterized by its 10 to 30% steep west-east slope and the existence of various temporary water courses. It has scarce and degraded vegetation of the shrub type of Larrea sp. (jarillales) and hard grasses. The area´s soils are not consolidated and are feasible to suffer accelerated erosion processes, mainly by water. From the climatic point of view, the arid condition prevails due to the scarcity of water resources (Abraham, 1990).

During the late 20th century, urbanization processes in the piedmont area accelerated with the occurrence of the first informal urbanizations and were later intensified by state and private neighbourhood planning (Abraham, 2005). Its urban development is in line with that of the city in the flatland, that is, a predominant rational checkerboard grid scheme with forested avenues whose orientation accompany the maximum slope (West - East), incorporating forestry which is not adapted to the insertion site. The urbanized area (6,800 Ha) of the foothill sector of the MMA can be observed in Figure 1.

A field survey revealed that the urbanizations in the hillside area present the following characteristics: low-density dwellings with average height ranging between 4 and 9 m, road channels with a vegetation scheme aligned with second-magnitude species -species between 10 and 15m high, such as Morus alba- representing 42% of the trees used in road channels in the MMA, and the Melia azedarach species, which represents 18% of the afforestation in the MMA. Regarding the materiality of the elements of the urban canyons, they are characterized by: paved streets; red, yellow and grey mosaic sidewalks; flat roofs with aluminum coated membranes and plastered facades painted in various light tones.

Characterization of an existing urban scheme

A cartographic analysis of the sector was carried out to select an urban scheme representative of the current situation of this urban hillside development. This allowed the identification of a characteristic residential group of the dominant scheme in the piedmont area (80% of the rational morphology grid) (Figure 2).

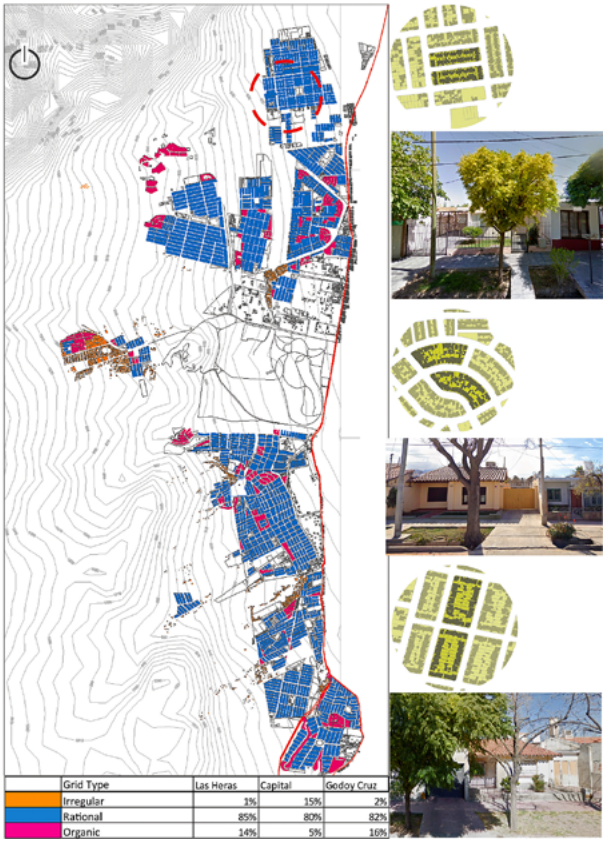


Figure 2. Existing neighbourhoods grid layout
[click on figure to enlarge]

This neighbourhood, located in the north-west zone of the MMA, has a natural 15% land slope and a neighbourhood typology which responds to the low-density housing trend within the local urban expansion.

The characterization of the representative urban canyon in the selected urban scheme was carried out through a cadastral survey and aerial images obtained by using drones (Catastro, 2018). A set of urban-building indicators was determined: 150-m block length, 16-m street width, 200 m² lot surface area, 0.55 floor area ratio, yard-side: 2m front yard and 5.50 m side yard (on one of the largest sides of the plot) (Figure 3). This is in accordance to the semi-detached housing typology. The street tree alignment consists of *Melia azedarach* (Chinaberry), a second magnitude tree

Figure 3. Current urban scheme in the piedmont area of the MMA
[click on figure to enlarge]

species with 18 m maximum height, a crown diameter between 6 and 8 m, and average solar permeability of 48% in summer (Cantón et al., 2000).

Proposed urban schemes

Based on a cadastral survey analysing both land topography and the urban growth logics of the entire MMA hillside area -3- three sectors of potential urban development were identified (North, Center, and South). These sectors present different land slopes (15, 25, and 30% respectively) (Figure 4).

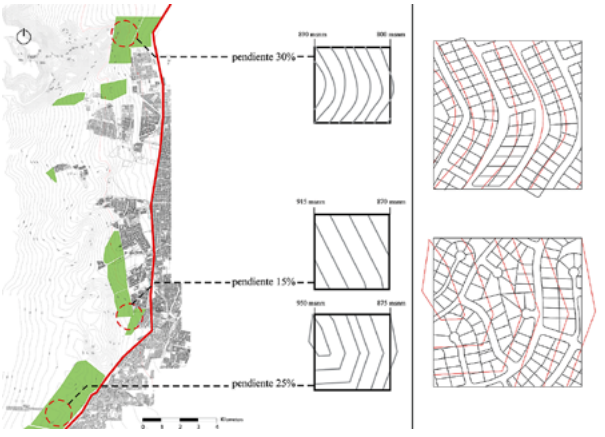


Figure 4. Identification of different suitable sectors for hillside urbanization with the incorporation of land level and urban schemes adapted to piedmont conditions
[click on figure to enlarge]

The design considerations that define the proposed schemes arise from the statistical analysis of the different micro-climatic behaviours of previously monitored urbanizations (Castillo et al., 2019), and from a bibliographic review of international and local norms that regulate urban hillside development (Castillo et al., 2017). Based on this, two grid types were proposed: a) Linear organic grid with public green space with a distributed design scheme regarding vegetation typology: 10% open space with forestation in the central area, 40% sealed surface in the semi-perimeter area, and 50% forestation in the perimeter area (Stocco, 2016); and b) Organic grid with Cul-de-Sac – a dead-end, usually a looped or circular road (urban dictionary, s-d), without public green space. These schemes incorporate infiltration areas in the urban canyons and inside the lots.

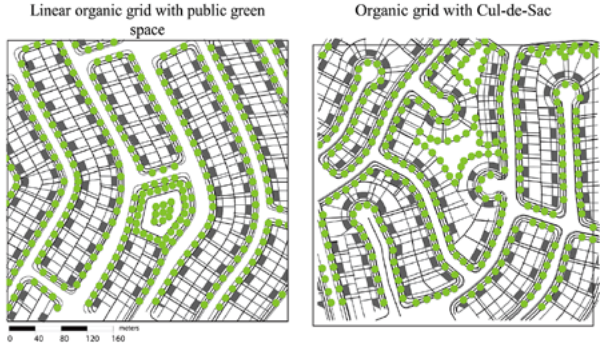


Figure 5. Proposed urban schemes adapted to hillside conditions
[click on figure to enlarge]

The following characteristics were defined for both grids: 200-m block length, 20-m street width, and 480-m² lot surface area. American regulations were adopted for the Floor Area Ratio (FAR) of the lots. This relates land slope to land use intensity: as the slope increases, the floor area ratio decreases. Consequently, the following ratios are proposed: 30% slope/0.15 FAR, 25% slope/ 0.25 FAR, and 15% slope/0.30 FAR. To preserve sun access, spacing between buildings is defined as follows: 2m frontal; 3m lateral south spacing, and 11 m north spacing. The proposed schemes contemplate alignment trees with Morus alba species, a second magnitude street tree with a height of 12 m, 6 to 8 m diameter crown size, and 32% low solar permeability in summer (Cantón et al., 1994). The tree type selection aims to increase solar control in a high solar radiation area. Figure 5 shows the grids of the proposed urban schemes.

Urban Scheme Evaluation Method

To verify and validate the behaviour of the urban proposals, an existing representative neighbourhood of the urban piedmont area was selected and monitored. The proposed schemes were micro-climatically simulated using the ENVI-met software. The results of these simulations were adjusted to those obtained by monitoring the existing case.

Simulation Model

The ENVI-met 3.1 software, which is based on the fundamental laws of fluid dynamics and thermodynamics (Bruse, 1999), was used for the microclimatic evaluation of urban schemes. Developed by Dr. Michael Bruse's Environmental Modelling Group at the Institute of Geography of the University of Mainz, Germany (http://www.envi-met.com), this 3D computer model works on an urban scale within a daily cycle and it is designed to simulate the interactions between the air and surface of the urban environment with a typical resolution of 0.5 to 10 meters every 10 seconds. The model includes the simulation of flows around and between buildings; the heat and vapor exchange processes of soil and wall surfaces; turbulence; vegetation parameters; bioclimatology; and contaminant dispersion (Bruse, 2009). The use of ENVI-met is widely validated both locally (Alchapar, 2014; 2016; Stocco, 2016; Sosa, 2017) and internationally (Tumini & Higueras, 2012; Tumini & Pérez Fargallo, 2015; Perini & Magliocco, 2014; Middel, et al., 2014; Yucekaya & Uslu, 2020).

For the configuration of ENVI-met theoretical models, data are incorporated in the following main input files:

- Area Input File: Created through a graphic interface, it contains data of the model's physical design values including the geographic location of the urban scheme, the building´s shape and size, the vegetation, and the real soil type conditions of the monitored case study as well as the receptors located in the proposed scheme.
- Database: Data and characteristics of forestation and soil composition are incorporated in this section. The "Tb" tree species was selected from the ENVI-met PLANTS.DAT database. The height was set at 10 m corresponding to the average development of a second magnitude tree. This tree typology is characterized by 400 minimum stomatal resistance, 0.20 plant leaf shortwave albedo, 2 m root zone total depth, 0.80 to 2.00 m^2/m^3 LAD, and 0.10 m^2/m^3 RAD.
- Configuration File: This includes the meteorological data that initiates the model. The ENVI-met input variables are:10-m (m/s) wind speed, wind direction, roughness (Zo), starting atmospheric temperature, specific humidity at 2500 m (g water/kg air), relative humidity at 2 m (%), internal temperature, temperature, and soil humidity. Indoor temperature was set at 296 K (24 °C) in accordance to the average summer indoor temperature suggested by the Argentinean Energy Department.

The initial simulation parameters must be carefully defined since predictions from the microclimatic simulations strongly depend on the initial boundary conditions and input data. Table 1 shows the input data "Configuration File" for the adjustment of the rational grid layout. This table is divided into three data categories: meteorological, building, and soil. The input meteorological data and the weather conditions at the mesoscale level are kept constant in the settings. The building data are also kept constant since both the construction technology and the materials of the existing dwellings in the case studies are the same (existing urban scheme and selected urban canyons). Finally, soil category data vary in terms of the surface temperature values of their initial and middle layers (0 to 50 cm).

Description of the simulation´s physical model

The simulations were carried out with a reference surface area of 300 × 300 m. The grid is 100 × 100 × 30; therefore, the resolution of the area is 3 × 3 × 3 m and the total number of grids is x: 86; y: 86; z: 30. To obtain data from each analysed set on the effect of the grid layout on the air temperature, nine receptors were lo-

Table 1. ENVI-met simulation input parameters

Parameters for Envi-met configuration	Values
Meteorological	
Wind speed 10 m from the ground (m/s, Airport weather station observatory data)	3.5
Wind direction (0°: N, 90°: E, 180°:S, 270°:W) (Airport weather station observatory data)	135º
Roughness z0	0.1
Solar adjustment factor	1.5
Initial atmospheric temperature (K) (University of Wyoming, station 87418 Mendoza)	298
Specific humidity at 2500 m.a.s.l. (g/kg^{-1})	2.8
Relative humidity at 2 m (%) (obtained by a measuring campaign)	37
Building	
Indoor temperature (K)	296
Wall conductivity (W/m^2K)	2
Roof conductivity (W/m^2K)	0.78
Wall albedo	0.3
Roof albedo	0.2
Soil	
Initial upper soil layer temperature (K)	293
Middle upper soil layer temperature (K)	290
Deeper upper soil layer temperature (K)	290
Initial soil layer (0-20 cm) moisture content (%)*	20
Middle soil layer (20-50 cm) moisture content (%)*	35
Deeper soil layer moisture content below 50 cm) moisture content (%)*	60

** Default ENVI-met values*

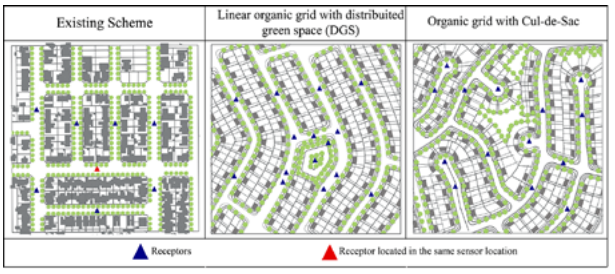


Figure 6. Location of receptors in the proposed urban grids
[click on figure to enlarge]

cated in the urban canyons and six more near public green spaces, as defined in the model. The first three were placed within a 50 m radius and the next three within a 100 m radius. For the organic grid with Cul-de-Sac, five receptors were located in the center of each Cul-de-Sac in addition to the receptors in the urban canyons. Figure 6 shows the location of the receptors in the proposed urban grid.

Adjustment of thermal behaviour results between the simulated and measured model

To validate and give statistical reliability to the analysed urban scheme results, the urban canyon which was monitored in situ was adjusted with the numerical model. For this, microclimatic data was captured during a measuring campaign. A fixed sensor- HOBO UX100-003 Temperature/Relative Humidity data logger (within 3.5% accuracy)- was installed in a solar radiation shield 2 m from the ground to prevent irradiation and ensure adequate air circulation (Oke, 2004). The location of the sensor in the grid is identified in Figure 6 in red. The sensor recorded data every 15 minutes during a 20-day period along the summer of 2017. January 12th was selected as the study day since

Figure 7. Photographs of the equipment used in measurement campaigns and the position of the sensors in the monitored urban canyons
[click on figure to enlarge]

its meteorological conditions correspond to a typical summer day in an arid region -high temperature (T° max.: 38 °C, T° min. 24 °C y amplitude: 14 °C), clear sky conditions, moderate wind, low relative humidity, and no precipitation - (Weather Underground). In addition, the Sky View Factor (SVF) of the monitored urban canyons was obtained by digitally processing fish-eye pictures using "*Pixel de Cielo*" software (Correa et al., 2006). The measured and simulated SVF value was adjusted to the corresponding receptor in the simulated grid. Figure 7 shows the equipment used to develop the monitoring campaigns.

In keeping with the results obtained by Wang & Akbari (2016), the stabilization period for the simulation process was 72 hours. Moreover, as stated in their findings, only the values for the last 24 hours were considered valid output to correctly reproduce the phenomenology of the selected day.

Figure 8 and Table 2 show the adjustment values used to validate the reliability of the simulation results. The error rate resulting from their use was evaluated based on the comparative analysis of the simulated and measured air temperature curve (Figure 8). Error identification and quantification was performed by determining: the adjusted correlation coefficient of determination (R2), the mean bias error (MBE), the mean absolute error (MAE), the mean absolute percent error (MAPE), the root mean square error (RSME), the systematic root mean square error (RSMEs) and the random mean square error (RSMEu). Each indicator expresses the model´s accuracy or error rate from different perspectives. While MAPE expresses the error as a percentage, the MAE and RMSE indicate the magnitude of the average error. The MBE, on the other hand, describes error bias direction whose value is related to the magnitude of the used values; a negative MBE occurs when predicted values are smaller than the observations. The statistical analysis that characterizes and compares the data shows a good prediction of the thermal behaviour of the evaluated day, with an R2 = 0.93 coefficient of determination and an RMSE = 2.2 mean square root error. Table 2 shows the adjustment data of the simulated case with the maximum, minimum, average, and amplitude air temperature values, as well as SVF values and the six statistical indicators used to estimate the accuracy of the numerical model versus the real one (Alchapar and Correa, 2016; Sosa et al., 2018). There are also acceptable low magnitudes of RMSE and their components—RMSES and RMSEU—suggesting that these base scenarios are largely accurate. MBE is equal to –1.9 °C, indicating an underestimation of the average amount.

In Figure 8, results show a similar correspondence between the fixed point and the simulated point, the R2 indicates a good accuracy of the model (0.93).

Table 2. Statistical indicators. January 12th

T°	Max.	Min.	Av.	Amp.	SVF
Simulated	34.56	22.72	27.52	11.84	0.69
Measured	34.96	22.48	28.86	12.48	0.62
Delta	0.40	-0.24	-1.34	0.64	0.07

MBE	MAE	MAPE	RMSE	RMSEs	RMSEu
-1.9	0.5	-6.1%	2.2	1.0	1.1

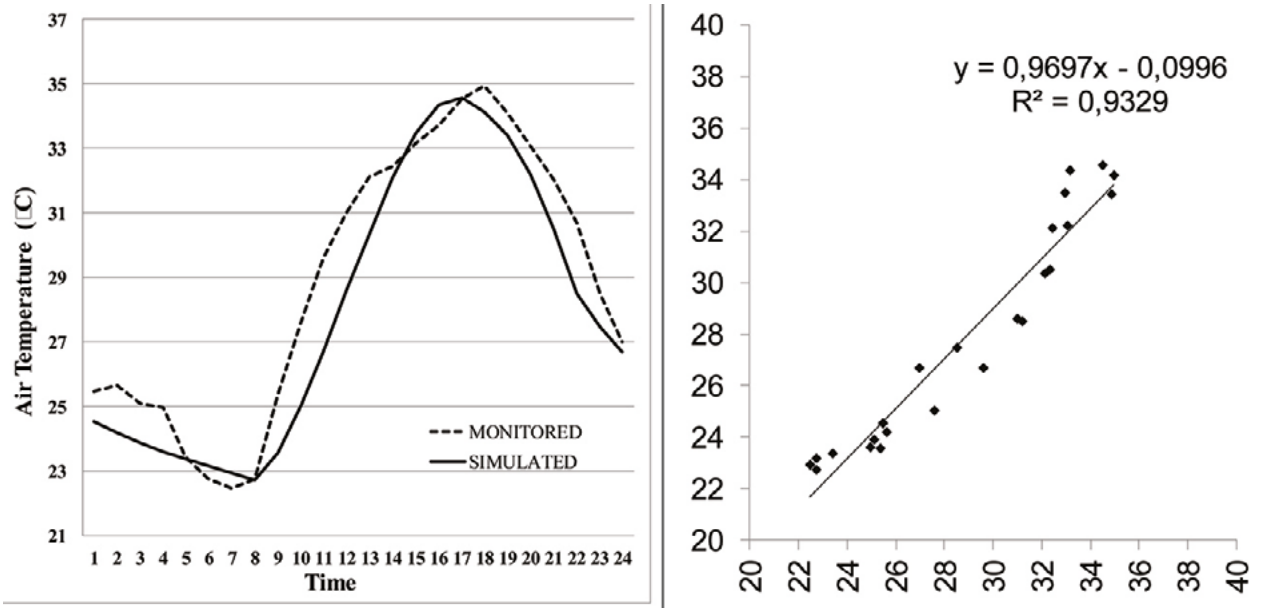


Figure 8. Adjustment curve of the simulated case

Results

In order to identify the urban scheme with the best thermal response, a comparative analysis of maximum- minimum and average air temperatures reached on a typical summer day was carried out together with a box-plot analysis showing the variability of the thermal responses of each scheme.

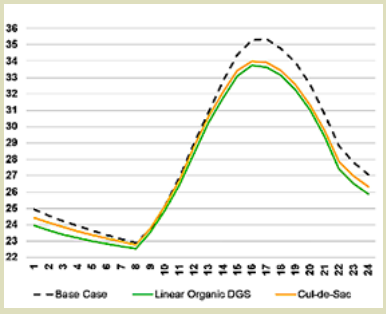
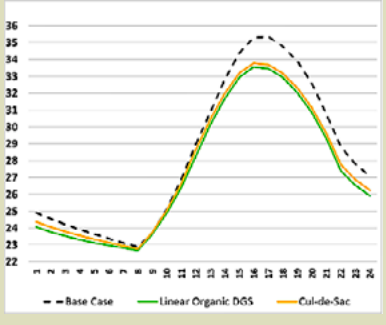
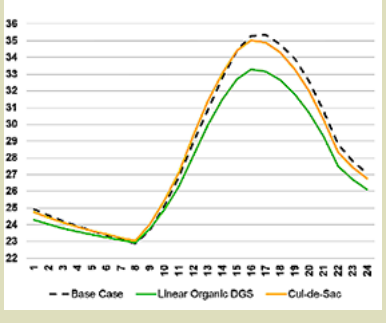
Comparative analysis of average maximum, minimum, and mean air temperatures

The results of the ENVI-met simulations are shown below. Table 3 shows the results of the average temperatures of all the receptors corresponding to the maximum, minimum, and average air temperature curve. These were calculated from the results of the receptors placed in the seven simulated schemes -the existing case and six urban schemes adapted to the different slope degrees. These results correspond to the behaviour of the three evaluated schemes -the existing scheme and two proposed urban schemes- in the three analysed slopes -30, 25, and 15%-.

Based on the average thermal responses of the analysed urban schemes, Table 3 reveals that the linear organic grid with distributed public green space has the best thermal performance on all slopes. This scheme design is also beneficial considering its simplicity and economy in terms of infrastructure and street layout when compared to the organic grid with Cul-de-Sac. This allows its replication in different hillside areas.

Regarding maximum and average temperatures, improvements are more noticeable as the slope decreases with differences from around 1.6 °C to 2°C. The organic grid with Cul-de-Sac is the least favourable alternative since it reaches higher minimum temperature values than the existing scheme and the difference between maximum and average temperature values is minimum compared with the existing case. Finally, the proposed schemes show a low impact over minimum temperature.

Table 3. Average temperatures of the analysed schemes

	Slope 30%	Base Case	Linear Organic DGS	Cul-de-Sac
	Max.	35,36	33,75	33,99
	diff.		1,61	1,37
	Mín.	22,89	22,54	22,77
	diff.		0,35	0,12
	Average	28,32	27,35	27,70
	diff.		0,97	0,62
	Slope 25%	**Base Case**	**Linear Organic DGS**	**Cul-de-Sac**
	Max.	35,36	33,57	33,78
	diff.		1,79	1,58
	Mín.	22,89	22,68	22,77
	diff.		0,21	0,12
	Average	28,32	27,34	27,6
	diff.		0,98	0,72
	Slope 15%	**Base Case**	**Linear Organic DGS**	**Cul-de-Sac**
	Max.	35,36	33,3	35,03
	diff.		2,06	0,33
	Mín.	22,89	22,93	23,04
	diff.		-0,04	-0,15
	Average	28,32	27,37	28,23
	diff.		0,95	0,09

Temperature distribution analysis

Box-plot graphs were produced to contrast the behaviour of all the receptors located in the different points of the urban schemes. These graphs show the maximum, minimum, and average temperature distribution.

Maximum temperature

Figure 9 shows the variability of the maximum temperatures of all the receptors located in the seven urban schemes. When comparing the values of each slope, the schemes located on the 15% slope are those that reach the lowest maximum temperature values. In addition, the organic linear grid with green space distributed over the 15% slope has the best behaviour with a greater differentiation from the base case and the lowest variability of maximum temperatures, with 75% of the values between 33.45 °C and 34.23 °C (quartiles Q1 and Q3). This responds to two components present in this scheme, namely, the increase in thermal inertia caused by an increase in land use intensity. It should be noted that regulations for hillside urbanization for soils with a 15% slope establish an 0.30 FAR and the existence of green space. A marked decrease in maximum temperatures becomes evident when comparing the values of the proposed schemes with those of the existing scheme. The latter displays a value of 36 °C in the Q1 quartile against the most efficient proposed urban scheme with a value of 33.5 °C.

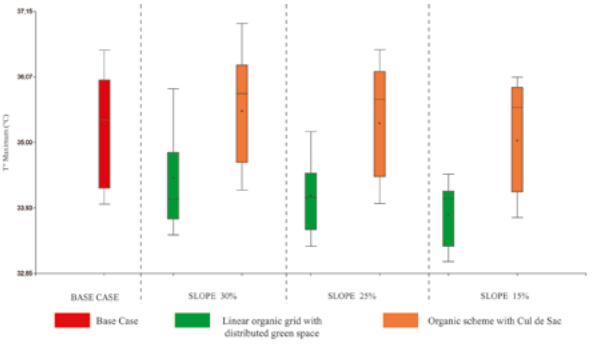


Figure 9. Box-plot graph for maximum temperatures of the seven proposed schemes
[click on figure to enlarge]

Minimum temperature

The minimum temperature variability diagram (Figure 10) shows that linear organic grids with distributed green space have the greatest value variability, but also the lowest minimum temperature, reaching Q1= 22.5 °C at the 30% slope. This is because their morphology with vegetated areas affects temperature decrease at night.

Unlike the maximum temperatures, schemes located on a 15% slope have the highest minimum temperature values and the lowest variability. Hence, it can be inferred that there is a more exposed surface allowing an increased night cooling in scenarios with steeper slopes.

Average Temperature

Figure 11 shows the box-plot graph with the distribution of values in the different schemes for the average temperature variable. It highlights the lowest variability in the linear organic grid with distributed green space located at the 15% slope, with values between 27.5 °C and 27.9 °C. In addition, this scheme reaches the lowest temperatures (27 °C) on the 30% slope. The linear organic grid with distributed green space located in slopes of 30% and the Cul-de-Sac grid in all slopes show the highest average temperature variability.

Evaluation of thermographic images of the existing urban scheme according to the urban proposal schemes

This section presents thermographic images obtained from the simulation results with the application of Leonardo v3.7, an extension of ENVI-met software (Figure 12). They correspond to maximum air temperature distribution at 2 m height for each scheme for January 12, 2017, at 16:00 h.

When analysing the maximum temperature images of the proposed scenarios, the images show that:

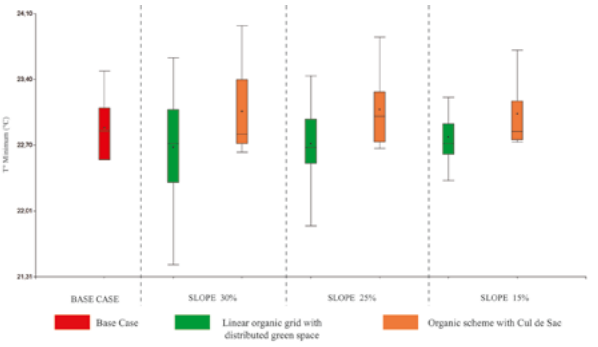


Figure 10. Box-plot graph for minimum temperatures of the seven proposed schemes
[click on figure to enlarge]

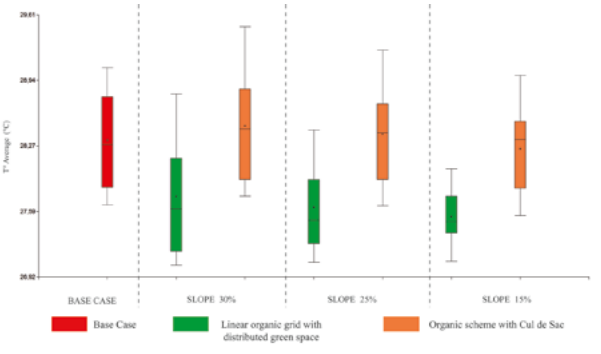


Figure 11. Box-plot graph for average temperatures of the seven proposed schemes
[click on figure to enlarge]

- The base case -rational grid used on the flatland- concentrates the largest areas and hot spots, both in the streets and courtyards of the blocks located in the S-E edge of the analysed area.
- Temperature values decrease as the slope decreases.
- Schemes adapted to hillside conditions show a homogeneous distribution of cool areas, since the backyards present similar temperature behaviour as the road channels.
- Public green spaces incorporated in the organic linear grid schemes provide a slight microclimatic influence to its environment.

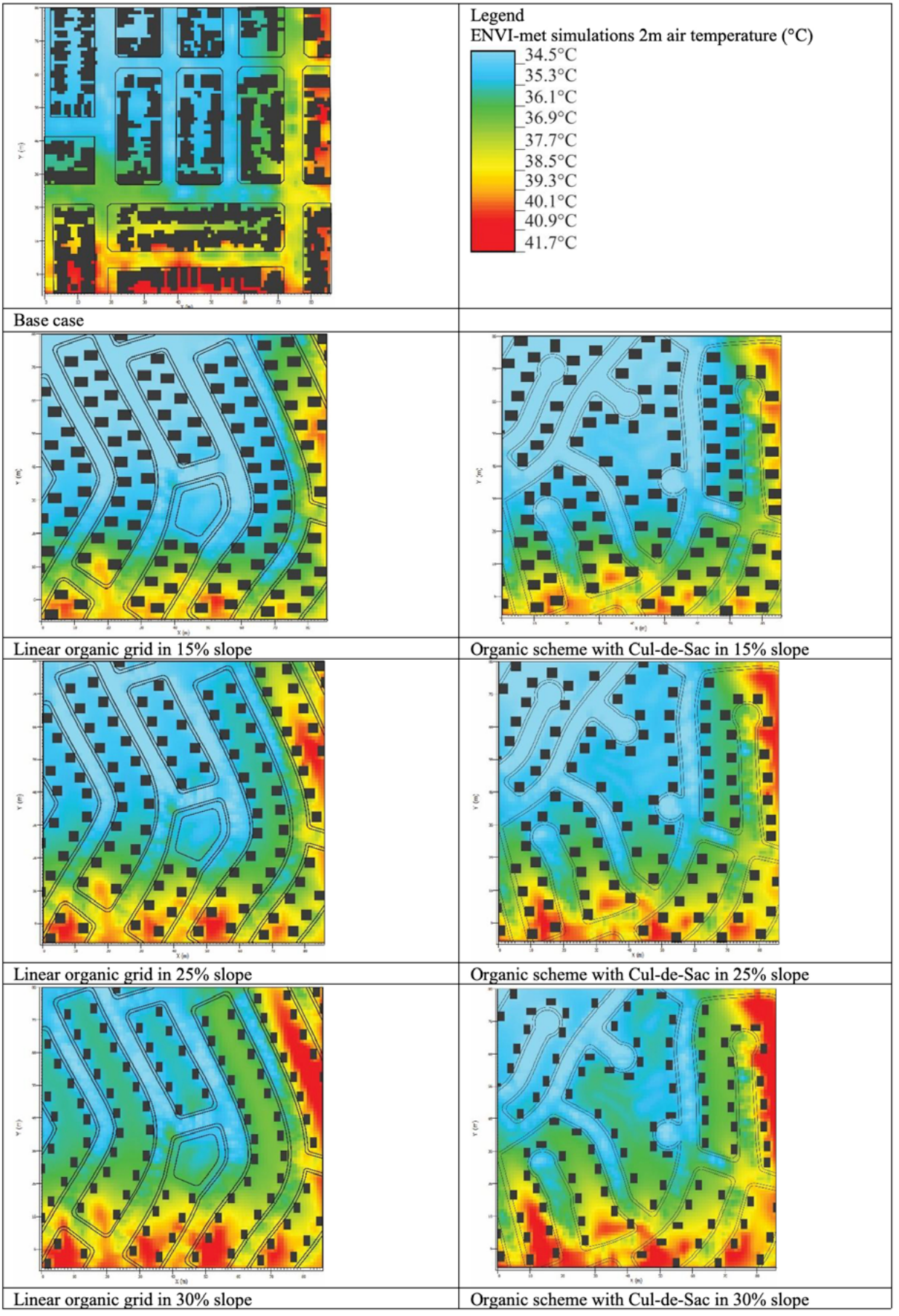


Figure 12. Thermographic images of maximum temperature for January 12, 2017, 16:00 h

Discussion

The results within the present study show that organic linear plot schemes with higher soil occupation achieve a decrease in air temperature of 2 °C in relation to the base case during the day. When comparing the morphology of both schemes, it is observed that the base case presents a compact pattern that, for hillside conditions, is the most beneficial typology. (Castillo et al., 2018). These results are consistent with those achieved by Middel et al. (2014) which point out that regarding urban form, compact scenarios present the most advantages for daytime temperature cooling, reaching differences of 2 °C with respect to spread schemes in flatland areas. However, compact grids do not allow adaptation to terrain with marked unevenness and generate high soil sealing. This implies the removal of natural terrain and the reduction of infiltration and runoff in an area with high alluvial risk. Responding to these conditions requires the use of a spread type organic grid and the control of the solar resource from the use of forestall species. Unlike state of art parameters related to the greater thermal efficiency of compact forms, this work has shown that it is possible to simultaneously improve the thermal behaviour of the urban area and respond to the environmental limitations of the hillside. This is achieved through open, strongly shaded organic type urban proposals, with a predominantly North-South orientation to accompany the levels of the natural terrain and the incorporation of open vegetated spaces of a public nature. These schemes allow an air temperature decrease of 2 °C, a magnitude comparable to those achieved in compact-type grids.

Concerning the impact of shaded areas on the microclimatic response of the plot, the results are similar to those discussed by Middel et al. (2015). These authors demonstrated that an increase of the current shaded area from 10% to 25% in the City of Phoenix - an arid zone city similar to the case study- would allow a reduction in daytime temperature by 2 °C on a neighbourhood scale. At the local level, Alchapar et al. (2016) analysed the impact of different urban cooling strategies applied in open type rational grids inserted in flatlands areas. The results also show that vegetation increase improves urban thermal conditions, reducing maximum air temperatures by 1.7 °C. Finally, Maleki and Mahdavi (2016) establish that the increase in vegetation combined with the incorporation of permeable pavements would reduce air temperature. This combination of strategies is aligned with the proposals of this work which dispose areas of permeable land to improve infiltration, slow down the speed of runoff and reduce the risk of avalanches.

Regarding the orientation of the urban grid, Ali-Toudert and Mayer (2006) point out that in arid areas, the rotation of the streets towards a predominantly North-South orientation leads to better comfort conditions due to a greater efficiency of the shading effect of vertical envelopes with respect to East-West orientations. In their studies for Mendoza´s City, Sosa et al. (2018) found that North-South grid orientations show the highest energy efficiency during the summer period. The results discussed are analogous to those achieved in this work.

In addition, it has been shown that the efficiency of the incorporation of vegetation is associated with its location in the context of urbanization type and green distribution. In this sense, Middel et al. (2015) have determined that the strategy of locating green space affects pedestrian comfort and improves energy savings in buildings. Declet-Barreto et al. (2013) indicate that temperature reductions are associated with the type of vegetation, reaching a 2 °C temperature decrease in vegetated areas with grass and up to 8 °C in wooded areas. At local level, Stocco et al. (2020) determined the proportion and distribution of vegetation in open public spaces that contributes to achieving the best thermal conditions and urban comfort. The results show that the most effective scheme for the rehabilitation of squares is the one that concentrates 60% of the wooded land around a sealed center with an area that does not exceed 20% of the square's surface. In this work, the vegetated public space is centrally located on the urbanization proposal and its design responds to the previously described criteria.

Finally, the methods used in the compilation of the state of art developed by Santamouris et al. (2017) and Tsoka et al. (2018), as well as those used in the previously cited works, validate the methodological design and tools used in this research. In addition, it shows that they are relevant for the prediction and analysis of the thermal behaviour associated with the development of urban proposals.

Conclusions

Considering the comparative analysis of the proposed schemes regarding the prevailing urbanization pattern of hillside areas, this work concludes that it is possible to improve the microclimate of the urban frame and to respond to the intrinsic characteristics of the piedmont. Moreover, linear organic grids with North-South orientation, which are strongly shaded and have public green spaces, decrease air temperature by up to 2 °C.

Regarding the proposed schemes, results show that the highest energy efficiency in hillside areas happens with slighter slopes. This is due to higher land occupation patterns associated with the increase of the FAR index. This condition rises the thermal grid inertia provoking an impact on the attenuation of maximum temperatures. Considering that 70% of the developable land corresponds to slope values lower than or equal to 15%, an improvement in micro-climatic performance would be achieved by the adoption of design criteria incorporated in the linear organic grid with distributed green space in future hillside urban developments. In lands with the greatest slopes, urbanization patterns are hotter during the day (around 0.5 °C) and slightly cooler at night. In addition, proposals incorporating vegetation as a solar control strategy and a greater proportion of permeable surface allow water infiltration from summer storms. This links the geomorphologic limitations of the insertion context with its microclimate. Another favourable aspect within this proposal is the simplicity of its design since it is better in terms of accessibility and service distribution due to its linear urban morphology when comparing the organic grid with Cul-de-Sac.

From the methodological point of view, the present study demonstrates the potential of ENVI-met software as a prediction tool since it reliably reproduces the main processes of atmospheric change that affect the microclimate of a sector: wind flows, radiation, temperature, and humidity. This tool simplifies and facilitates the work of urban planners and architects as it determines the urban-build design variables with the greatest impact on the thermal behaviour of development areas. Therefore, it can be inferred that the use of micro-climatic simulation is fundamental in the process of urban-build design. In addition, simulation allows measurement testing and a better understanding of how each urbanization scheme component works. This makes it possible to analyse the performance of theoretical proposals that cannot be evaluated by on-site measurements.

Finally, this work presents the likelihood of urbanization in areas of high fragility by developing design proposals which consider the potentialities and limitations of the insertion context by means of controlling the environmental impact of urbanization and planning urban growth within the framework of sustainable development testing.

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Pandemic Populism: COVID-19 and the Rise of the Nationalist AUR Party in Romania

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Abstract

Many Central and Eastern European countries elected nationalist parties after the collapse of communism: a phenomenon often attributed to a combination of socioeconomic crisis and political instability. In 2010s, after the decay of other nationalist parties, Romania was seen as an exception to this rule, but the Covid-19 pandemic times have witnessed the rapid rise of a new nationalist party: the AUR (the Alliance for the Union of Romanians). Parliamentary elections in December 2020 saw this new political force gain 9.1% of the vote. Whereas previous nationalist parties in post-communist Romania tended to appeal to more senior/elderly voters, there is evidence that the AUR vote is strong amongst men under the age of 35 who are educated to an elementary or high school level. This paper uses national electoral data, media analysis, and in-depth interviews with young, educated people to explore the spatial distribution of AUR support, the ways in which the COVID-19 pandemic has assisted the party's rise to prominence, and attitudes amongst university students to both the style and content of their politics. The paper concludes that the AUR offer a potent mix of old nationalism, religious faith, traditional family values and new ideological elements, such as environmentalism, anti-globalization, and anti-government critique to create a self-consciously 'alternative' political rhetoric. This is presented via new channels (especially social media) in a deliberately opportunistic, controversial, and spectacular manner. However, our investigation suggests that neither the content nor the style of this politics has widespread appeal among the more educated younger participants to the interview.

Keywords: populism; COVID-19; nationalism; AUR; political party; Romania

Introduction

Many Central and Eastern European countries elected nationalist parties after the collapse of communism: a phenomenon often attributed to a combination of socioeconomic crisis and political instability. Until recently, Romania was seen as an exception to this rule. Though far-right populist movements had a presence in the country, often campaigning against marginalized social groups such as Roma people, LGBT individuals, Jews, and Hungarians, they have not gained parliamentary power. On the other hand, electoral data suggest that following the death of Vadim Tudor, the leader of the nationalist party Partidul România Mare (Greater Romania Party) in 2018, many of his political followers shifted their vote to more mainstream parties (BEC, 2020).

However, recent months have witnessed the rapid rise to power of a new nationalist party: the AUR (the Alliance for the Union of Romanians), established in September 2019. Parliamentary elections in December 2020 saw this new political force gain 9.1% of the vote (541,938 total votes for the Senate, 9.17% of the total; 535,831 votes for the House of Deputies, 9.08% of the totals, which equates to 14 senators and 33 deputies). Turnout for this election was 33.3%, the lowest figure

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of the post-communist era, in part due to intensifying pandemic restrictions in response to the "second wave" of coronavirus infections. The AUR's success was partly due to reductions in the number of older people voting during the pandemic: the demographics of the party suggest that around 40% of their supporters are aged under 35, though only 8% of the total voters for AUR are university educated. However, during the last two years, the AUR have successfully capitalized on a series of political crises, including rising food, electricity, gas, and petrol prices and the recent collapse of the coalition government between the conservative PNL (National Liberal) party and the reformist and economically liberal USR (Save Romania Union). As a consequence, at the time of writing (October 2021) the AUR are polling around 15% (Pîrvu, 2021), though support for the left wing Social Democrat Party (PSD) has also increased.

There is some evidence that the COVID-19 pandemic has had particular influence over the rise of the AUR. The pandemic has intensified trends towards growing mistrust of the 'mainstream' political class, and growing trust in religious leaders, not least because the Coalition government has conspicuously mismanaged public health during the outbreak. In the summer of 2021, the Coalition lifted all public health restrictions, despite the fact that Romania had one of the lowest COVID-19 vaccination rates in Europe (under 40% of the population are fully vaccinated). The rapid spread of the Delta variant consequently led to a lethal fourth wave of coronavirus, peaking at around 500 deaths a day in October 2021. As a result, restrictions have had to be reintroduced, including mask wearing in public places. These, and the government's suggestion that a "vaccine passport" might be necessary to access public places, have been stringently opposed by AUR members, who have organized protests in response. Romanian media suggests that many of those actively protesting against vaccination in Romania are supporters of AUR.

Much recent work has focused on the rise of populism as offering a conspicuously different alternative to established democratic politics (Gherghina et al., 2013; Kriesi, 2014), often using new tools, such as social media, and a very different rhetorical style (Bos et al., 2013; Carter, 2005; Ignazi, 2003; Mudde, 2004; Taggart, 2000;). In this paper, we will focus particularly on the ways in which the visibility of state power during the pandemic, with the enactment of lockdowns, mask wearing, and vaccination programs, has proven fertile ground for populist movements in Romania. The AUR has campaigned against such measures, developing a counter-rhetoric that has linked pandemic measures with more profound themes such as fatherland, family, and religiosity.

This paper will explore the recent rise of the AUR, with a view to reflecting on the different strands of recent political disquiet that have contributed to the rise of populism in Romania. Findings have wider applicability to the rise of nationalism and populism in East-Central Europe in particular (adding to the work of Gherghina & Miscoiu, 2014; Orenstein & Bugaric, 2020; Pirro, 2015) and across Europe and other parts of the world (Albertazzi & McDonnell, 2008; Brubaker, 2017; Brubaker, 2020a; Brubaker, 2020b; de Cleen & Stavrakakis, 2017; Taggart, 2000). The study aims:

a) to understand the spatial distribution of votes for AUR in Romania
b) and to explore the ways in which the COVID-19 pandemic has created conditions that are conducive to the AUR's success in certain regions
c) to assess responses of the educated younger Romanians to the content and style of the AUR's political ideology

Populism, nationalism and COVID-19 in Central and Eastern Europe

An explosion of interest in populism following Laclau's (2005) seminal work on the subject has led to criticism of the term's vagueness and overuse. Part of the problem is that populism not only takes many different forms in nationalist identity-based parties across the world (Betz, 2002), but haunts the failures of traditional politics in a variety of different ways (Kriesi, 2014). As Stroschein (2019) has argued, understanding this new politics requires a study of both the *forms* by which such parties enter and navigate electoral and party systems and the *content* of their rhetorical appeals to public. In this paper we redeploy this to explore the intertwined *content* and *style* of AUR politics, arguing that a deliberately oppositional challenge to contemporary ways of doing politics in the pandemic context of highly visible government exertions of power is central to their recent success.

Commentators disagree on whether populism operates a troublingly simplistic politics of virtue, or acts as an emancipatory social force through which marginalized groups challenge dominant power groups and structures (Laclau, 2005). Mudde & Kaltwasser (2013) contend that there are exclusionary and inclusionary varieties of populism, with different configurations succeeding or failing with the public in different places (Carter, 2005; Ignazi, 2003). We seek to explain that both things are simultaneously true: the rise of the AUR is grounded in the opportunity of-

fered by the pandemic to mount a strong challenge to dominant liberal capitalist ideologies and the exertion of government power, but that this tends to be grounded in an exclusionary and xenophobic nationalist politics. The strangeness of populism, we contend, is that it is often quite prescient in its recognition of the symptoms of contemporary problems (e.g. the effects of rampant capitalism, closed liberal-political structures that simply allow the reproduction of the status quo), yet the racist, xenophobic, and conspiracy-laden misdiagnoses that it subsequently offers divert attention away from real to imagined grievances (Chapman, 2021).

The relationship between populism and nationalism is complex. De Cleen and Stavrakakis (2017) argue for a conceptual distinction between populism and nationalism: in their vision, populist discourse stands on a vertical axis and pictures the people are underdog against an elite, whereas nationalist discourse works on a horizontal axis, and conceptualizes the people as nation. This idea has been criticized by Roger Brubaker (2020a) who argues that it is precisely the productive ambiguity of populist appeals to 'the people', and their ability to mix a critique of elites with an opposition to those who are outside of the nation, that gives them power. In his view, populism is successful because it can slide between definitions of the enemy as both above the people (an analysis centring on inequality within the system) and adjacent to them (an analysis centred on a rejection of difference). Brubaker's combined view helps to explain the ways in which populism counters liberalism with the claim that is a theatre for elite corruption that is also unpatriotic and undermining to national interests.

In Central-Eastern Europe, the 2008 financial crisis combined with shifts in the relationships between individual states and the European Union has given this rhetoric considerable power. In Poland, Hungary, and Serbia, the perceived failure of the neoliberal consensus has led to an intensified form of economic nationalism, which emphasizes sovereignty (often a conservative statism), natalism, and workforce activation (Orenstein & Bugaric, 2020).

The COVID-19 pandemic has arguably strengthened opposition to neoliberal economics and politics, as disease control measures have increased health, spatial, and socioeconomic forms of inequality. Low-skilled workers and poorer groups, have been disproportionately affected (Mocanu, 2021), particularly those working in agriculture, (traditional and modernized) industries, and tourism (Lucheş et al., 2021; Matei et al, 2021; Popa et al., 2021). Rising unemployment and the imposition of public health measures have accentuated feelings of resentment against the government. COVID-19 has acted as a framework for the rise of AUR, by making government exertions of power unusually visible – thus dialectically creating a space for the vigorous assertion of populist opposition.

The AUR, social media, and the 2020 Romanian Parliamentary elections

Like many other populist organizations, the AUR are highly active on the internet, and especially on social media, using Facebook, TikTok and Instagram. Despa & Albu (2021) argue that AUR create a series of 'echo-chambers' for the propagation of their views. In these online environments, internet users rarely encounter opinions that contradict their own viewpoint or assumptions, so that existing views are continually reinforced. However, the "echo chamber" metaphor requires qualification, because it tends to assume that limited contact with opposing viewpoints is at the heart of the problem. In fact, populist parties often *emphasize* the fact that they offer an anti-establishment and oppositional alternative, creating the impression that they are opening a political and discursive space outside of the 'mainstream'. Populism is reactively constructed against established truths: the ability of its adherents to accept an alternative viewpoint (sometimes involving conspiracy theories) is constructed as the hallmark of a "free thinking" individual who has liberated themselves from the dominant ideological blindness.

On their official homepage (Partidul AUR, 2021a), the AUR is presented as the sole opposition party in Romania. Their main political objective is described as the unification of Romania and Moldova, though there is a heavy emphasis on Christian faith, nation, freedom, and traditional family values (homosexuality and same sex marriages are strongly condemned). For instance, in what Voiculescu and Groza (2021) presented as the five spatial articulation of attitudes (the politically conformant, the tolerant, the homophobic, the homosexual, and the passive rural) towards the LGBT families in Romania, AUR members would clearly identify with the homophobic attitude.

The party's opposition to the neoliberal consensus is outlined, with actions against the Hungarian minority living in Transylvania, and protests against political corruption. Objections to pandemic restrictions figure prominently: the individuals responsible for national quarantine, reduced opening hours, school closures, and face-masking are relentlessly criticized, in particular the former Health Minister, Vlad Voiculescu, and the head of the Public

Health Service, Raed Arafat (Partidul AUR, 2021b). The AUR argues that the system of fines for breaking the state of emergency imposed in 2020-2021 was unconstitutional (Partidul AUR, 2021c), and the party organized a major protest in Bucharest on 13 April 2021 against poor management of public health during the pandemic.

The Facebook page of AUR leader George Simion is highly active: thousands of followers immediately share any post he makes. Messages are simply worded, and present issues in black-and-white terms: all mainstream politicians are corrupt, the values of the Christian family are under threat, Romania is being used as a rubbish heap with garbage imported from other European countries, and so on. The communication style makes heavy use of slogans that present both liberal policies and links to other countries as a weakening influence: "Romania exports cheap wheat and imports poor quality frozen bread that is 13 times more expensive", "Romania imports 70% of the food it consumes", "the Government jeopardizes the health of the population by closing gyms and sports places" etc. (Simion, 2021). The AUR are quick to capitalize on accidents and tragedies, which they blame on the policies of the European Union: Simion blamed the brutal murder of a Romanian driver by illegal immigrants in France during May 2021 on a lack of protection for such workers from the Romanian Foreign Ministry and the European Union.

As this might suggest, the party are strongly against globalization, using the pandemic as an illustration of the ways in which the sovereign nation is weakened and made vulnerable by international connections. The party presents a view of the future as dominated by strong, national economies that are able to provide all of the goods and services required by their population. For example, they insist on the development of a 'national vaccine' by the Romanian pharmaceutical industry, and especially the Cantacuzino National Institute of Research in Bucharest (Rădulescu, 2021). Sometimes AUR activism can appear oddly contradictory in its logic: the party has campaigned against the involvement of a Canadian company in the Roșia Montană mine on anti-globalization grounds, yet has argued for the inclusion of the site in the UNESCO's World Heritage patrimony (Curierul Național, 2020). However, this combination has proven attractive both to those who are against gold exploitation in the area, and to vulnerable groups confronted with rural decline and unemployment as a result of mono-industrialism (Vesalon & Creţan, 2013; Rîșteiu et al., 2021). Xenophobia, anti-globalization, nostalgic conservation of the past, and an apparent concern for the marginalized are thus woven together in a politics that appeals to multiple demographics.

Yet, despite the insularity of populist rhetoric, there is some limited evidence of foreign influence over populist policy. While direct proof is lacking, a recent investigation by the Balkan Investigative Reporting Network in Bucharest suggests that there is a significant overlap between AUR rhetoric and policy and that of the Russian Federation (Despa & Albu, 2021). Social media is a particular focus for these concerns, with AUR-associated Facebook sites promoting the view that corrupt Western influences are responsible for the plunder of Romanian resources and the decline of traditional values. For example, a recent controversy over sex education in schools led the AUR to defend 'traditional' family values via an onslaught against 'gay propaganda' in schools. Their rhetoric closely echoed that which accompanied the passage of a 2013 law in Russia, which banned the "promotion of non-traditional sexual relations to minors". Further, Viktor Orban's Hungarian government promoted similar legislation in mid-2021, banning the depiction of homosexuality to people under 18 years of age (see Despa & Albu, 2021).

The success of AUR in 2020 Romanian Parliamentary elections came as a shock to both the wider Romanian population and to political analysts and journalists. The surprise was not simply that the party had gained seats, but that it had managed to poll around 9% of the vote. The reasons for their success are complex. Turnout was exceptionally low at 33.3, due in part to pandemic restrictions, but also to the fact that many pro-European liberals did not vote, apparently because they were unconvinced by the established parties appealing to their demographic (the Liberal Party, The Social Democrat Party, the USR-Plus Alliance). Another factor was the fact that many younger conservative-leaning or undecided voters who did cast a ballot were not particularly familiar with AUR policies, but felt abandoned by traditional parties and a ruling Coalition dominated by internal struggles for power (Badea, 2020). COVID-19 constitutes an important context across the political spectrum: the government compounded a slow and incoherent response with an emphasis on the needs of big business, which left small to medium enterprises and ordinary people feeling alienated. The failure by any of the established parties to communicate the need for pandemic restrictions in a clear and empathetic way led to a general perception of incompetent and self-interested leadership, and rising distrust. Recognizing this, in the wake of their electoral success, the AUR declared themselves the most important anti-establishment party on the current Romanian political scene.

Since the election result, AUR's success in recruiting well-known and highly recognizable personalities to its cause has led to something approaching a

"celebrity political war". Writers, philosophers, university professors, and other men and women with a high cultural profile have rallied to the cause of the far right, igniting opposition by a phalanx of similarly influential cultural figures in defence of liberal democratic values In early 2021, the latter created a petition to the leaders of the governing coalition (PNL, PSD, UDMR, USR) asking them not to collaborate with the AUR in any way. They criticize the party's "extremist, toxic ideological mix" in the name of "Euro-Atlantic values", focusing particularly on AUR's "fundamentalist, nationalist, and conspiratorial themes" that are "anti-globalist and anti-individualist" in nature (Gava, 2021; Voicu, 2021). Their argument is that any political party that vehemently opposes the institutions of liberal democracy should not be normalized and legitimated via participation in either dialogue or government. The AUR responded by declaring such actions to be themselves undemocratic: they argue that their policies represent the views of 10% of 'ordinary Romanians', who would feel disenfranchised by such an act of exclusion (Gava, 2021). The major parties failed to respond to the petition, because it was too politically difficult, so they ignored it.

AUR also deploys the internet to stage spectacular, sometimes, violent 'events', which are livestreamed to their followers. In June 2019, local authorities in Valea Uzului, closed a military cemetery, preventing access to the graves of World War II soldiers of several nationalities. Led by politicians from the Democratic Alliance of the Hungarians in Romania (UDMR), who represent the Hungarian minority in the area, ethnic Hungarians were placed on guard. In response, AUR leader George Simion joined with the New Right movement and a Christian orthodox organization to organize protests. Those attending dressed in traditional folk costumes or as Dacians (the ancient ancestors of Romanians), presenting themselves as the champions of ethnic Romanians, and insisting on their right of entry. Behind this sits a narrative propagated by the AUR that ethnic Romanians living in majority Hungarian areas (like Harghita and Covasna counties) have been abandoned by the government, and left at the mercy of political leadership from the UDMR. Neither the Hungarian minority not its political leadership are represented as being 'properly' loyal to the Romanian state (Partidul AUR, 2021d; Partidul AUR, 2021e). The event ended in violent clashes between the protesters and the local population, and a diplomatic standoff between the foreign offices of Romania and Hungary, with Kelemen Hunor, leader of the UDMR demanded the resignation of both the Foreign Minister and the Minister of Internal Affairs.

Similarly, the government's decision to suspend the traditional pilgrimage and procession to celebrate Saint Parascheva, the patron saint of Moldova, in the autumn of 2020 restrictions proved fertile ground for the AUR. This is the most important pilgrimage in the Romanian Orthodox church, and attracts thousands of people from all over the eastern part of the country, but COVID-19 led to significant restriction of its usual scale: only residents were allowed to participate. Bitter popular resentment, compounded by discontent from members of the Orthodox Church (Popescu, 2020) fuels a narrative propagated by the AUR. AUR members exploited this case by presenting pandemic restrictions as an assault on religious freedom and the 'right to pray'.

Methodology and data

This paper uses a mixed methods approach to explore the spatial distribution of votes for the AUR in Romania, and to suggest reasons for its success in certain regions and to assess the attitudes of educated younger Romanians to AUR's populist rhetoric. It brings together primary statistical election data, secondary online data (journalism), and in-depth, semi-structured interviews conducted in summer 2021. The election data derives from the Biroul Electoral Central (Romanian Electoral Bureau), and provides an insight in the spatial location of AUR voters, allowing us to compare rural and urban voters in the aggregate, and to explore nationalist support in different regions and local counties within Romania. The secondary data explores the representation of Romanian politics in the mainstream press, based on an internet search using the following keywords: AUR, Romania, nationalism and populism. We selected five critical sources on AUR to explore how they represented the party's policies, using thematic and discursive analysis to identify major themes. Three were drawn from national online journal platforms (Ziare.com, Hotnews, and Agerpress) and two from smaller dedicated news platforms (DC News and PS News, plus a well-known blog by journalist Cristoiu Ioan). We also used the official webpage of Partidul AUR to explore the party's ideology and activism (Partidul AUR, 2021 a, b, c, d, e).

COVID-19 restrictions forced us to adopt Meho's (2006) technique of conducting (semi-structured) interviews by email in order to collect data on the attitudes of educated younger Romanians towards the AUR. Between 6 June and 1 August 2021, we emailed 60 students from the West University of Timisoara (WUT) but only 15 agreed to participate (7 male and 8

females, most of them residents in western part of Romania) (Table 1). This is a typical number of participants in e-mail interviewing. Range of participants in email interviewing can be from 10 to 60 participants, in comparison to face-to-face interviewing which usually ranges from 5 to about 10 or 15 participants (Meho, 2006, p. 1287). We believe the pandemic was a significant factor in reducing people's availability to engage with online interviews, but the responses we elicited supplied rich information. As Meho (2006) argues, 'semi-structured e-mail interviewing can be a viable alternative to the face-to-face and telephone interviews, especially when time, financial constraints, or geographical boundaries are barriers to an investigation (p. 1293). Students were easy to be selected : they are Romanian speaking geography students in their second and third year of study, and their email address are easy to be found in the listserv of WUT. They have some previous knowledge about the AUR party because they have followed political geography and other human geography courses. There were 19 open-ended questions and 8 closed questions, probing knowledge and feelings about AUR. Interviews took 30-45 minutes to complete, with responses returned between 1 week and 2 weeks from the date of sending. All respondents signed a consent sheet and were diligently informed about the ethics of the interview process. We obtained permission to use name abbreviations and county of residence in publications (Table 1). There were no clear-cut cleavage between categories of interviewees (gender and age) and the dropout rate was zero, as no one dropped out during data collection. Overall response rate was 90%. Data was analyzed thematically and discursively (Bryman, 2006; Mullet, 2019), and cross-referenced to the analysis of journalistic content outlined above to find common areas.

Table 1. Socio-demographic characteristics of respondents.

Nr.	Code/In-text abbreviations	Age	Gender	Residence urban/rural	County
1	CB	22	female	urban	Timiș
2	AB	22	male	rural	Sibiu
3	BA	22	male	urban	Timiș
4	AB	19	female	urban	Gorj
5	BG	21	female	rural	Timiș
6	RB	21	male	rural	Hunedoara
7	MP	20	female	urban	Timiș
8	TL	46	female	rural	Maramureș
9	AC	20	male	urban	Hunedoara
10	RT	21	female	rural	Timiș
11	MS	21	female	rural	Timiș
12	IC	21	female	urban	Timiș
13	MV	25	male	urban	Timiș
14	IV	27	male	rural	Caraș Severin
15	CGD	38	male	rural	Arad

Source: based on authors' own data interpretation gathered from the interviewees

Results

Spatial distribution of votes for AUR at the 2020 Romanian Parliamentary elections

Post-communist Romanian electoral politics has been characterized by constant changes in the governing party or coalition. Support for particular parties has proven especially volatile since Romania joined the EU in 2007 (Giugăl et al., 2011). The December 2020 election was no exception, with power passing from the left-wing PSD to a more centre- right PNL-USR-PLUS coalition. As previously mentioned, data from the Central Electoral Bureau (BEC, 2020) suggests an exceptionally low turnout, with only 33.3% of the eligible population voting. Turnout was highest in the south (Figure 1), which traditionally supports the left, peaking at 42% in Mehedinti county, and in Transylvania, where the Hungarian minority population votes faithfully for the Democratic Alliance of Hungarians in Romania, or UDMR, (turnout was 36% in Harghita). Eastern counties that have previously been notable for high turnouts were surprisingly low, un-

der 30%. The total turnout in the capital, Bucharest, (in the south-east) was 30.07%.

The results by party show that the PSD (Social Democrat Party) received the greatest share of the vote at 29%, followed by the PNL (National Liberal Party) at 25.5%. The USR-PLUS Alliance (Social Democrat Union-PLUS Alliance) came third at 15.8%, and the AUR fourth, at 9.10%. The UDMR scored 5.7%, the PMP (People's Movement Party) 4.8%, and PRO-Romania 4.10%. A spatial map of regional vote distribution suggests that this followed conventional electoral tendencies (Figure 3), with a strong east-west/social democrat-liberal divide that correlates with socioeconomics (the east is generally poorer and less developed).

At a county level (Figure 4) the left-wing USR-Plus alliance won in two wealthier and more developed counties, Timis and Brasov, as well as in the capital city, Bucharest. The UDMR were predictably victorious in areas with a strong ethnic minority vote (Harghita, Covasna, Mures, Satu Mare). The only exception to the established patterns was in Vrancea: here, the liberal PNL were victorious over the PSD for the first time in 30 years. However, breaking down these results shows telling differences between the wealthier, more educated residents of urban areas, who voted PNL and USR-Plus, and the population from rural areas and smaller towns (Figure 5) who voted PSD.

The AUR vote looks remarkably consistent across both regions and counties, with distinct support from the eastern part of the country, but also from Arad and Hunedoara and Alba counties in the west (Figure 6). This shows that AUR support does have a strong spatial correlation with either wealth or deprivation. This bears out the work of Romanian sociologist Dumitru Sandu, who has argued that AUR support is highest in areas of intermediate socio-economic status, and is often strongest in communities that are situated at significant distances from major cities (Sandu, 2020). More finely grained analysis of BEC data bears this out: in 'intermediate' socio-economic areas more than 9% of the population voted AUR (BEC, 2020). However, our spatial map suggests that AUR received a significant share of the vote even in wealthy cities: 53% of AUR voters come from urban/city and small town areas. This contrasts sharply to the figures for the USR-PLUS, which has a highly urban electorate (73%).

National level demographic analysis of the election data suggests that AUR supporters tend to be younger: 40% of those aged 18-35 voted AUR. Within that 40% figure, 60% of the young people voting AUR were men (BEC, 2020). The only party to poll higher amongst 18-35 year olds was the left-wing USR-PLUS (45%). This suggests a very different electorate for AUR than for its predecessor, the Greater Romania Party (PRM),

Figure 1. Turnout at the Romanian parliamentary election, December 2020, by county
Data source: BEC, 2020
[click on figure to enlarge]

Figure 2. The winning parties in the historical regions of Romania, Romanian parliamentary elections, December 2020
Data source: BEC, 2020
[click on figure to enlarge]

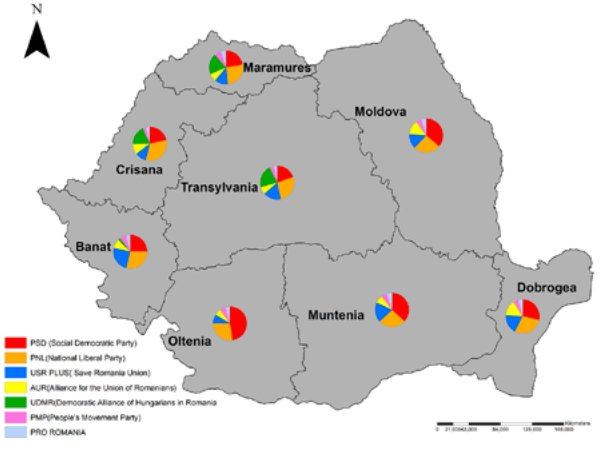

Figure 3. Vote share for the main parties in the historical regions of Romania, Romanian parliamentary elections, December 2020
Data source: BEC, 2020
[click on figure to enlarge]

Figure 4. Winning parties by county, Romanian parliamentary elections, December 2020
Data source: BEC, 2020
[click on figure to enlarge]

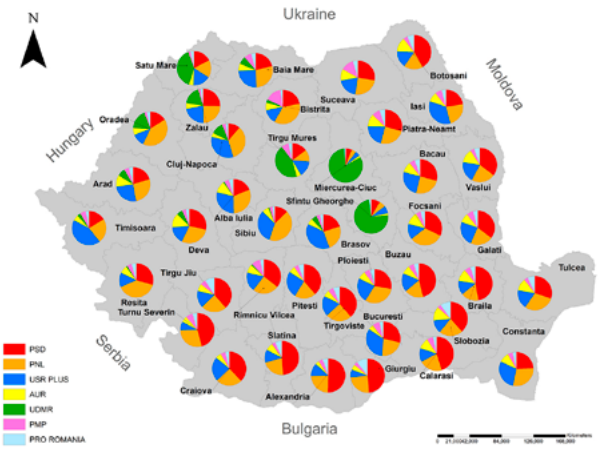

Figure 5. The results of the 2020 Parliamentary elections in Romania at the level of county capital municipalities
Data source: BEC, 2020
[click on figure to enlarge]

which tended to draw support from older people who were nostalgic for communism (Badea, 2020).

Educationally, only 8% of all AUR voters have a university or further education degree, in comparison to 37% of voters for USR-PLUS. In short, the archetypal AUR voter is male, young, educated to an elementary or high school level, and lives in small town or rural area that is neither very deprived nor very wealthy (Badea, 2020).

Secondary data analysis

The success of AUR generated intense debates online. We identified five different influential interpretations in media that attempted to explain their success. Firstly, there were those who stressed the *novelty* of AUR, such as Ion Cristoiu, a prominent Romanian journalist, who considers their rise "the most spectacular event of the 30 years, following the change of regime in December 1989" (Cristoiu, 2020). For Cristoiu, it was the rhetorical shift from traditional policy areas to new themes such as corruption that attracted voters. By contrast, Gelu Duminică, a Roma sociologist, argues that the AUR won by *ideological obfuscation*, "through deceit, just as the fascist did in 1930," in particular the promulgation of xenophobic prejudice against minorities. However, Duminică is also critical of the failure of mainstream, traditional parties to speak to ordinary people at a time of crisis, and their tendency to priorities the needs of business (Hotnews, 2020). Similarly, Dumitru Sandu argues that the votes represent the *disenfranchisement* of the population from traditional politics, and widespread perception of government incompetence in the handling of COVID-19 (Sandu, 2020). By contrast, Duminică's emphasis on fake news and conspiracy is shared by Cristian Pârvulescu, though where Cristoiu emphasizes novelty, Pârvulescu stresses *continuity* between

Figure 6. Proportion of AUR votes on counties
Data source: BEC, 2020
[click on figure to enlarge]

the electorate for the AUR and previous supporters of the PRM, and the refusal of the PSD to capitalize on xenophobia (Matei, 2020). In contrast to these opinions, electoral data revealed that AUR took important shares of voters from PSD, especially from its more extremist voters (Badea, 2020).

Finally, relations with minorities in Romanian society play an important part in these debates. Some strands of media discourse emphasized *the importance of Roma leaders in garnering support for the AUR*, and there is indeed some evidence that prominent members of the Roma community lobbied strongly for the party. It is not uncommon for politicians to endeavor to appeal to the Roma vote in the run-up to elections across Central-Eastern Europe (Creţan et al., 2020; Creţan et al., 2021; Méreiné-Berki et al., 2017; Méreiné-Berki et al., 2021). Duminică condemns this support, reminding the Roma community of their racialization and persecution at the hands of far right leaders, including the deportation (and sometimes

murder) of 25,000 Roma to Transnistria under Marshal Antonescu during World War II (Iacob, 2020). His argument connects drives for racial purity (the desire for a pure "Romania, like the holy sun on the sky") and the creation of racial 'scapegoats' with periods of crisis, when people feel drawn to authoritarian leaders, nostalgia, and a retreat to so-called 'traditional' values. Effectively, he accuses AUR-voting Roma of being complicit with the same logic that has led to their own marginalization, though he acknowledges that modern targets of AUR's xenophobia range from the Hungarian minority to the European Union.

COVID-19 acts as an important context for all of these explanatory frameworks. *The pandemic has provided the AUR with an opportunity to grandstand against the government,* organizing protests in Bucharest and in other Romanian cities against mask wearing that acted as a gateway to a set of populist and nationalist ideas, such as the suggestion that the pandemic is a fiction to conceal malign foreign intervention against Romanians. The leaders of the party shifted thus the focal point from public health to anti-establishment statements that purportedly reassert Christian values, Romanian identity, and national interest against the weakening influence of atheism, social liberalism, global capitalism, and foreign influence. These have become increasingly dominant features of political rhetoric in the country since the 2008 financial crisis, though evidence suggests that Romanian nationalism is also supported by the Romanian diaspora, the fifth largest group of immigrants in OECD countries. Mocanu (2021) has drawn attention to the influential role of everyday habits, such as cooking traditional food, keeping up with the Romanian news, or video calling with family members, in the creation of a "banal nationalism" amongst this group, which work in combination with social media to mobilize political support at a distance. The COVID-19 pandemic may have been particularly disruptive for the Romanian diaspora, who often represent low-skilled workers desperate for employment to sustain their families.

Interview data

Our interviews assessed (i) where participants had learned about AUR (ii) what they knew about AUR ideology (including major rhetorical themes) and (iii) what role participants thought social media had played in their success. The majority of participants stated they heard about the party in the online press. Only a qurter had heard of AUR on Facebook, one fifth from friends, and the others on YouTube, and one respondent from a combination of the press and Facebook.

It is not clear that respondents could place the AUR in the wider Romanian political landscape, or cite many of their policies. However, most respondents had some understanding of the AUR's ideology as a form of nationalism, though their understanding of this term was somewhat basic in the majority of cases. Most respondents linked AUR's nationalism to some positively perceived virtues, like patriotism, pride in national history, preservation of traditional values, and anti-globalization sentiment. They thought that it was necessary for a nationalistic party to exist in Romania, either for reasons of political balance, or because they supported nationalist arguments: 'there should be someone who is vocal for the family, the country, faith, and freedom,' argued one (BG, 21, female). Other students associated nationalism with placing a value on people rather than money (TL, 46, female) and with positive desire for leadership by the in-group, rather than by strangers (MS, 21, female). One respondent thought that a nationalist party should exist in Romania, but that AUR were a poor representation of such ideas:

"Yes, a nationalist party should be present on the Romanian political scene, but not with these characters, because one can easily see they are just for show, they lack substance." (MV, 25, male)

A quarter of participants explicitly associated AUR's nationalism with negative political dimensions. For instance, one interviewee saw it in liberal terms as an anti-modern force, using language that draws on ideas of 'progress':

"No, because of the transition period, the change of government from one party to another, which didn't do much for the evolution of this country… a nationalist party would only hinder the processes of progress that the country always wasted." (CDG, 37, male)

Others saw it as a force leading to hatred, homophobia, and discriminatory xenophobia:

"I am convinced that Romanians can preserve their essence and traditions living side by side with other nationalities, so nationalism is useless; it is not necessary to promote this party, especially when this involves actions that instigate to hatred and violence." (AB, 19, female).

The damage done to public discourse by misinformation was also a feature of responses:

"Nationalism can be used today to manipulate people who don't look for more sources of information on some subjects and who like charismatic leaders or opinion makers." (CDG, 37, male)

On this theme, another participant noted the AUR's highly visible participation in COVID-19 protests and illogical ideologies as a hallmark: 'They promote their ideas rather ostentatiously and fervently' (MV, 25, male). Several respondents were alert to the role of controversy in promoting the AUR's platform, and the fact that algorithms can favour strong

and bold statements over more carefully reasoned arguments.

Only one third of respondents were able to give an account of AUR ideology in terms of the traditional party political ideological spectrum: one stated that it was new, conservative, anti-European, and pro-Russian political force (AB, 22, male). A female respondent stated that the AUR wanted the reunification of Romania and an end to corruption (TL, 46, female). These results suggest that their ideological program may play a secondary role to the behavior and discourse of members, their opportunistic opposition to particular government decisions, and their deliberate courting of controversy.

Most respondents had a positive attitude towards *the use of social media for sending political messages*, provided the messages were not annoying, distressing or fake:

"I think it is very efficient as social networks are very much used by the majority of the population, especially the young, who are not always active in politics" (IC, 21, female)

Many respondents saw rapid and wide dissemination "as a positive feature, though some noted difficulties of information verification as a problem (though one respondent seemed to place the same weight on this as on grammatical accuracy!)

Political messages may be promoted on social media, "as most people are increasingly finding their information on there, but most of the time they are exaggerated and use bad grammar" (AB, 19, female)

One respondent believed that such messages would particularly influence those who did not grow up with technology, despite the tensions between such a view and the youthful demographics of the AUR (CA, 20, male).

For others, the distinction was between those who possessed critical skills and those who were incapable of distinguishing fake news from real (AB, 22, male). Other interviewees perceptively offered the view that social media gave marginalized individuals the opportunity to express opinions and to interact directly with 'important' party members, perhaps creating a sense of openness and belonging:

One can see them live on TV and social media at any hour, at any place, and due to the algorithms used by the social networks, even discussion forums were created by them. People on social media like to have an opinion and they can express themselves and even get in contact with party members, they feel important. They create a small virtual universe in which they feel important (CDG, 37, male).

It is possible that this lends AUR politicians an availability and a connection with ordinary people that more conventional politicians appear to lack, helping to forge an image of them as the party of the people.

Surprisingly, however, most of the respondents admitted to having seen messages from AUR on social media. They had not encountered these or could not remember if they had or not. Those who saw AUR messages recalled them being about the main themes supported by the party, such as traditional family values (AB, 22, male) and corruption (TL, 46, female), as well as their position against COVID-19 restrictions and the LGBT community (AB, 19, female). Many participants noted that the presentation made their messaging difficult to ignore, again emphasizing style over content:

"The majority of the methods they use to gain publicity are ostentatious, even people who are not interested in politics already have an image of AUR, and even if you disagree with what they say, you cannot ignore how spectacularly they present themselves, even if the way in which they do it resembles a circus act which people forget about the next moment" (MV, 25, male)

However, less than a half of participants stated that they did not find such actions interesting, or were unaware of them. Even where participants identified a theme of AUR discourse as important, they tended to distance themselves from the party:

"The most interesting activity is the attempt to reunify Romania with Moldova, but I believe the way in which they are trying to do this is appalling" (AB, 19, female)

Participants further also asked asked their feelings on specific AUR party policies. ***The AUR campaign against pandemic restrictions*** proved a particularly divisive issue. More than half of the participants were against the AUR stance related to the COVID-19 restrictions:

- "It is a nationalist party involved in anti-restrictions and anti-COVID protests and has members with illogical ideologies" (CA, 20, male)
- "People believed their false allegations and voted for them because they were anti –vaccines or anti-COVID-19 or anti-Europe" (AB, 22, male)

This reflects wider social trends, with the younger Romanian generations (and the very religious) more suspicious of vaccination than older people.

COVID-19 was a fertile ground for AUR to launch counter-actions against the Romanian Government restrictions. There were many protests organized by different party members in numerous cities in Romania in 2020-2021. 'Mask down!' and 'No to the vaccine!' were among their major slogans. They used to wear masks made by plastic even in the Parliament, just as a form of resistance to Government rules.

A majority of interviewees felt that ***the unification of Romania and the Republic of Moldova*** was impossible to accomplish in practice, and hence considered it a rhetorical 'trick' by the party to rouse public feeling by touching a sensitive chord. However, some argued that unification was long overdue (RB, 21, male) or that it would be welcomed by the people of Moldova (BG, 21, female). Others were aware that there is not currently much popular support for unification in Moldova, as recent elections and a referendum on the subject indicate (CDG, 37, male; AB, 22, male).

Traditional Orthodox family values divided respondents. A quarter of interviewees supported the view that family should be a heterosexual unit:

- "Family was always formed by a man and a woman, what happens now can only upset God" (TL, 46, female)
- "The best idea is that marriage is between a man and a woman, not a woman and another woman, or a man and another man" (BG, 21, female)

Others took a more socially liberal view, and argued that homophobia helped to generate attention for the AUR, but was ultimately divisive in its impacts on the population (MV, 25, male; CDG, 37, male). Several participants argued that families should receive financial support and free time to raise children (BA, 22, male).

Support for ethnic Romanians in majority Hungarian areas was not prioritized by respondents, possibly due to a lack of knowledge about the issues, since they affect a different area of the country. However, one participant did echo AUR rhetoric:

- "Romanians are harassed in the counties where Hungarians are the majority" (TL, 46, female)

However, other respondents understood that such a discourse could be used to manipulate voters:

- "Romanian communities in Transylvania and their cultural heritage will always be used as themes in electoral campaigns, but real ethnic problems in the Transylvanian region will never be fixed due to lack of interest" (CDG, 37, male).

The fight against the entry of foreign companies into the Romanian economy was controversial. Since Romania passed from communism to liberalism, the state has been eager to attract new foreign investment, particularly to revivify ageing infrastructure that requires new (Creţan et al, 2005). This has led to a degree of pressure on the government from foreign interests who are eager to invest to shape favourable policies to their needs. The AUR has successfully capitalized on the disquiet that this introduction of global capital has created, using it to attract senior/elderly voters. Certainly, among the elderly generations who lived in communism there are some nostalgic people of communist industrialized spaces (Săgeată, Mitrică, & Mocanu, 2021). Some participants supported the AUR's campaign, arguing that it would lead to the development of local businesses and generate beneficial development and economic growth as profits were reinvested locally or regionally rather than extracted to fund projects elsewhere (IC, 21, female; RT, 21, female). Many respondents believed that foreigners should not be allowed to head Romanian businesses or to own land in the country. However, a quarter of respondents underlined the importance of foreign help for the development of the country, arguing that Romania could not exist outside a globalized context as the economy would be dead without foreign investments. Other interviewees thought that business policies that discriminated against foreign companies would cause them to flee, generating economic problems.

All respondents considered ***the fight against the corruption of the political class*** as an idealistic pursuit, rather than a realizable goal. This cynicism perhaps indicates the long-lasting problem of corruption as a persistent feature of Romanian politics, during the post-communist era. Corruption undermined democratic consolidation in Romania (Ristei, 2010). Even if the post-communist Romanian political discourse has been dominated by the fight against government corruption, little has been done to solve this issue (Hein, 2015):

- "Corruption exists and I doubt that one party could do anything about it" (MV, 25, male)
- "Corruption will always exist, but fighting against it is a good idea" (CA, 20, male)

While one respondent argued that politicians were too readily accused of corruption by those not in power: 'First one party has to get to the power and then talk about fighting corruption' (CDG, 37, male), others argued that it remained an important ambition: 'I don't think that it is possible to eradicate corruption but a change in this direction would be welcome and implementing stronger measures against corruption would be some solution (IC, 21, female)

The AUR's ***anti-bear hunting campaign*** was stimulated by the shooting of 'Arthur', the largest bear in Romania, by Austrian Prince Emmanuel of Lichtenstein (whether or not this particular bear was the one shot, however, remains open to dispute). This issue brings together environmental concerns and an animal rights agenda with an older class politics. Habitat loss in Romania has led to a spate of bear attacks on people, as the

human and ursine populations are brought into closer contact by deforestation. Animal rights have also become a heated area of debate post-communist Romania, with the killing of dogs (Crețan, 2015) and wild animals a particularly sensitive issue. Further, hunters are perceived by middle class Romanians as members of a privileged upper class, whose interests do not necessarily coincide with the rural classes who farm and manage land for a living (O'Brien & Crețan, 2019).

In the aftermath of this particular shooting, the AUR took to the airwaves to protest, a stance supported by the majority of younger participants, many of whom took a wider ecological perspective or animal rights perspective on the matter:

- "This is very important as it would protect bears from extinction" (IC, 21, female)
- "I agree with this too. Bears were deprived of their habitats so they come in the cities and villages." (TL, 46, female)
- "I was very upset when I heard the news about the killing of Arthur the bear" (RT, 21, female)

However, other younger respondents were skeptical about whether the AUR had a real solution to the underlying problem of habitat destruction (AB, 22, male), though one noted that the party was endeavouring to prevent the destruction of forests in the Carpathians (RB, 21, male). Others questioned the significance of the problem to the wider population: 'Trophy hunting is a very profitable business and this theme upsets some very select groups of people' (CDG, 37, male).

Summing up, AUR brings to the public sphere a mix of nationalism, religious faith, traditional family values and several ideological elements, such as anti-globalization, environmentalism, animal rights, and anti-government critique to create an 'alternative' political rhetoric. Our research bears out the contention that this mixture of issues relies on the productive ambiguity of a blended critique that offers a rhetoric of elite corruption intertwined with xenophobic and nationalist ideas (Table 2). In the fertile ground offered by the visible exertion of government powers with the enactment of COVID-19 restrictions, this mixture has proven persuasive to many Romanians, though our interviews suggest that it has limited appeal to more educated young people.

Table 2. Results summary

RESULTS OF STATISTICAL ELECTORAL DATA INTERPRETATION	
Statistical electoral data on AUR	AUR electorate rests more in Dobrogea/Dobruja and Moldova regions
	Profile of AUR voter – up to 35 years old men with elementary and high school education
	40% of AUR voters are younger people (under 35)
	8 % of AUR voters are younger educated people
RESULTS OF MEDIA DATA INTERPRETATION ON AUR	
Opinion of major political analysts on AUR	Cristoiu Ion: AUR comes with *novelty in ideology bringing to the forefront the issue of corruption*
	Duminică Gelu: AUR has *ideological obsfucation* (e.g. the promulgation of xenophobic prejudice against minorities)
	Sandu Dumitru: votes for AUR came as *disenfranchisement* of the population from traditional politics and the COVID-19 restrictions
	Pîrvulescu Cristian: *nationalist continuity and relation with the PRM* (Greater Romania Party)
	Duminică Gelu: the importance of *AUR relation to minorities* (e.g. *Roma leaders* garnered support in elections for the AUR)
The COVID-19 context for mobilizing support for AUR	The COVID-19 has provided the AUR with an opportunity to grandstand against the government, organizing protests

RESULTS OF INTERVIEW DATA INTERPRETATION			Number of respondents	%
Perceived AUR political discourse		Appropriate	1	6.67
		Homophobic and Xenophobic	4	26.67
		Violent	3	20
		Anti-European and Pro-Russian	2	13.33
		Manipulative of information/ promoter of fake news	5	33.33
Use of social media for sending political messages		Approved	11	73
		Disapproved	-	-
		Ambivalent	3	20
		Not know	1	6.67
		No response	-	-
Major themes promoted by AUR	Anti-pandemic and COVID-19 restrictions stand	Approved	5	33.33
		Disapproved	5	33.33
		Ambivalent	2	13.33
		Not know	2	13.33
		No response	1	6.67
	Unification of Romania and the Republic of Moldova	Approved	9	60
		Disapproved	3	20
		Ambivalent position	1	6.67
		Not know	1	6.67
		No response	1	6.67
	Traditional Orthodox family values	Approved	8	53.33
		Disapproved	6	40
		Ambivalent position	-	-
		Not know	1	6.67
		No response	1	6.67
	Support for ethnic Romanians in regions inhabited in majority by ethnic Hungarians	Approved	5	33.33
		Disapproved	4	26.67
		Ambivalent position	2	13.33
		Not know	2	13.33
		No response	2	13.33
	Fight against foreign corporations in Romania	Approved	8	53.33
		Disapproved	5	33.33
		Ambivalent	-	-
		Not know	1	6.67
		No response	1	6.67
	Fight against corruption of politicians	Approved	7	46.67
		Disapproved	3	20
		Ambivalent position	2	13.33
		Not know	1	6.67
		No response	2	13.33
	Environmental/animal right issues	Approved	12	80
		Disapproved	1	6.67
		Ambivalent position	1	6.67
		Not know	-	-
		No response	1	6.67

Source: based on authors' own data interpretation based on national electoral data, media sources and interview data

Conclusions

This paper suggests that the COVID-19 pandemic has forced the exertion of power by the government to the highly visible forefront of everyday life, which has played an important role in creating discursive space for the rise of nationalist parties. Pandemic restrictions have thus provided an ideal opportunity for the AUR to take a series of 'non-mainstream' oppositional stances, to stoke controversy, and to capitalize on decreasing social trust in the state.

In terms of the content of AUR policies, our research confirms the analysis of Ben Stanley, who argues that populism is a 'thin' political ideology, which seeks to make opportunistic use of a more broader and established right wing ideological repertoire (Stanley, 2008). Our findings also confirm Brubaker's contention that populism mixes a critique of elites with a xenophobic antipathy to those who are outside of the nation, sliding between these two registers across a series of issues. Yet there is a mixture of older and newer ideologies in play, as populist parties reinvent far right agendas to respond (often opportunistically) to issues of the present. The Romanian experience of the COVID-19 pandemic has provided an ideal opportunity for the AUR to harness old political antagonisms (nationalism, ideas of the 'fatherland', the reunification of territory, xenophobia, homophobia, a defence of 'traditional values', religious faith, and nostalgia for communism) to newer causes (environmentalism, anti-globalization, anti-public health restrictions), which may help to explain its appeal to younger voters. While our research found that educated young Romanians were not particularly favourable to the AUR, many did express some degree of agreement with elements of their ideological stances.

Like many other populist parties, the style of AUR's campaigning is also innovative. They pursue deliberately controversial lines of attack, seeking visibility to the point of relying on stunt-like spectacle at times and making use of new technologies to disseminate their messages (social media, mobile phone video). Our research suggests that educated young Romanians did not find these techniques persuasive, and were alerted by the style of politics to the potential for 'fake news' and misrepresentation in the content.

Our findings suggest that there are commonalities between the rise of the AUR and the style of illiberal conservatism promoted by Viktor Orbán in Hungary. In fact, the politics of some parties in Central and Eastern Europe is arguably characterized at the present time by the challenge presented to liberal democracy by these forces. While many educated younger people are aware of the ideological thinness of the AUR's politics and the multiple layers of misrepresentation in their messaging, the popularity of the party is nonetheless rising amongst younger demographics, and those who are unhappy with the current political, social, and economic configuration. The combination of an anti-elite ideology with strong xenophobic nationalism is clearly a potent one, particularly in more rural areas and small towns, and especially at times of crisis. More follow-up research is urgently required to chart the future of the AUR and its changing ideological commitments, but we hope that this article will sound an alarm amongst readers that this is not simply an old threat in new clothes, but a reinvented and potentially vigorous reworking of nationalist ideology.

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Can Tourism Climatic Indices Reflect the Impact of Cold Surges?

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Abstract

Hibernation tourism in East and Southeast Asia is directly impacted by wintertime cold surges, which can result in high winds, extreme low temperatures, frost, freezing rain, and even sandstorms. This study compares two existing tourism climatic indexes—the Comprehensive Comfort Index (CCI) and the Tourism Climate Index (TCI)—to establish their ability to capture the full impact of cold surges on the tourism industry. From a climatic perspective, the TCI is more sensitive than the CCI, revealing a significant negative correlation with cold surge days. As illustrated here using a specific case study, the colder surge days in a month, the lower the TCI score for that month. This paper also evaluates potential reasons for the observed disparity between the two indices and proposes that the TCI exhibits a higher temperature standard and preference for long sunshine hours than does the CCI.

Keywords: Tourism Climate Index; Cold surge; Climate comfort; Hibernation tourism

Introduction

Hibernation tourism, also known as cold avoidance tourism, has become an important industry sector in recent decades (Feng et al., 2010). This is particularly true for older generations, who commonly migrate to warmer, more comfortable environments during the winter months to reduce the risk of seasonal health problems. Despite its popularity, however, hibernation tourism is not invulnerable to cold surges, which are anomalous meteorological events (Chang et al., 2011) characterized by strong northerly winds and depressed surface air temperatures (Pang & Lu, 2019). Cold surges have also been linked to the intensification of atmospheric convection and amplified rainfall and flooding (Pullen et al., 2015). Ultimately, the clear risks posed to outdoor activities by cold surges warrant a more nuanced understanding of how these meteorological events impact hibernation tourism.

Researchers seeking to investigate climatic comfort quantitatively and objectively can now draw from a large number of indices, factors, and scores developed specifically for this purpose. In this study, we pose the question: Do existing tourism climatic indices fully reflect the impact of cold surges? To address this question, we compared the output of two current indices. First proposed by Mieczkowski (1985), the Tourism Climate Index (TCI) has since been applied widely (Scott et al., 2004; Shi, 2016) and is also used as the foundation for more recent indices, including the Climate Index for Tourism (CIT; de Freitas et al., 2004), the Modified Climate Index for Tourism (MCIT; Yu et al., 2009), and the Holiday Climate Index (HCI; Scott et al., 2016), among others. We compared the TCI with the Comprehensive Comfort Index (CCI; Ma et al., 2009), which is a composite of the Temperature and Humidity Index (THI; Thom, 1959),

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the Wind Effect Index (WEI; Terjung, 1966), and the Clothing Index (ICL; de Freitas, 1979), which has been used extensively to analyze the comfort of summer and winter climates (Yu et al., 2018; Luo et al., 2017; and Deng et al., 2020).

Popular Chinese destinations for hibernation tourism include Hainan and Yunnan Provinces (Lin et al., 2019). In one recent study, Lin et al. (2013) investigated the number of climate comfortable days during the winter months (November to April) in 11 tourist cities; they reported that Sanya and Haikou on Hainan both experience 181 days with temperatures of >16°C, while Jinghong in Yunnan experiences 145 days > 16°C. Lin et al. (2013) also observed that Sanya (Jinghong) experiences a total of 585 (543.6) sunshine hours in winter. Considering both local climate conditions and environmental pollution, comfortable periods are generally longest in Sanya, Hainan, and second longest in Kunming, Yunnan (Zhang and Han, 2020). Because both provinces are located at low latitude, and thus characterized by mild winter climate conditions (Deng & Bao, 2020), we employed Hainan and Yunnan as example locations in the present paper. Specifically, we applied the CCI and TCI to assess winter climate comfort for hibernation tourism in both provinces, before comparing the capacity of each index to reflect the impact of cold surges. In doing so, our overarching objectives are to improve our understanding of both indices and provide a nuanced view of how extreme weather impacts tourism.

Data and methods

Data

For this investigation, we employed basic daily meteorological variables (e.g., air temperature, relative humidity, surface wind speed, and sunshine hours) recorded by base stations operated by the China Meteorological Administration between 1981 and 2010. Our specific temporal focus is the winter months (DJF: December, January, and February) and all data have been evaluated for quality control. For homogeneity and validation purposes, we have excluded those stations with records spanning <30 years, with the result that our analysis is based on a total of 27 stations in Yunnan Province and seven on Hainan (Fig. 1). Located in southwest China, Yunnan Province is characterized by mountainous and plateau topography. Climatically, winters are mild due to the blocking of cold air currents by the Tibetan Plateau to the northwest, and summers are relatively cool due to the region's generally high elevation. Between May and October, Yunnan is influenced by monsoonal winds arriving from both the Pacific and Indian Oceans; winters are typically dry, with little rain and abundant sunshine.

Hainan is an island off the south coast of China and experiences a year-round tropical maritime climate. Summers are hot and humid, with frequent typhoons and thunderstorms; winters are generally warm and pleasant, with comparatively few meteorological hazards. Tourist reception numbers for Hainan are publicly available for the period since 1998 (http://lwt.hainan.gov.cn/xxgk_55333/lytj/2019data/) and have been provided on a monthly basis since 2002. For this study of winter tourism, we employed reception numbers for the months December–February.

CCI and TCI

This study utilized the CCI and TCI to evaluate the hibernation capacities of Yunnan and Hainan Provinces.

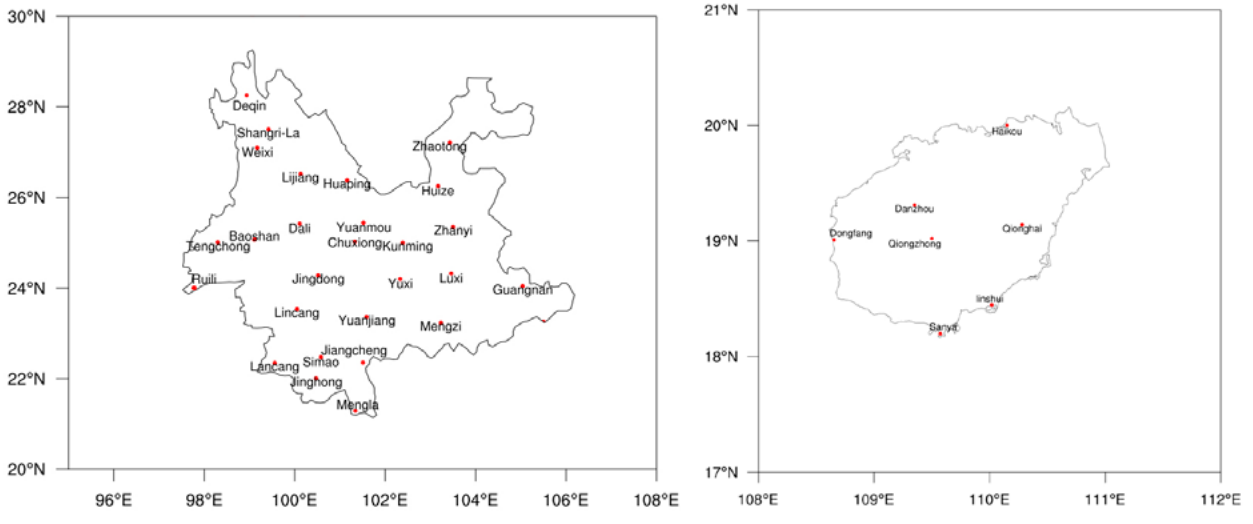

Figure 1. Locations of the 27 Yunnan (left) and 7 Hainan (right) stations

Comprehensive Comfort Index (CCI)

The CCI is a composite of three indices (THI, WEI, and ICL) used to represent tourism climate comfort (Xin et al., 2019) and is derived as follows:

$$CCI = 0.6X_{THI} + 0.3X_{WEI} + 0.1X_{ICL} \quad (1)$$

Developed in 1959 by the US Meteorological Administration (Thom, 1959), the *THI* integrates temperature and humidity to quantify heat exchange between the human body and its surrounding environment:

$$THI = (1.8t + 32) - 0.55(1 - f)(1.8t - 26) \quad (2)$$

where t represents air temperature in degrees Celsius (°C) and f is relative humidity (%).

The *WEI* was introduced in 1966 as an improved version of the wind chill index (Terjung et al., 1966). Incorporating different combinations of wind speed and temperature, in conjunction with heat dissipation by the human body, the *WEI* quantifies the degree to which human skin experiences the effects of warm and cold wind according to the equation:

$$WEI = -(10\sqrt{V} + 10.45 - V)(33 - t) + 8.55S \quad (3)$$

where t denotes air temperature (°C), V the surface wind speed (m/s), and S the hours of sunshine per day (h/d).

The fourth index, the *ICL* (de Freitas, 1979), accounts for the discomfort caused by climate change by considering the atmospheric and physiological variables that affect the thermal state of a human body outdoors:

$$ICL = \frac{33 - t}{0.155H} - \frac{H + \alpha R\cos\alpha}{(0.62 + 19.0 \cdot \sqrt{V})H} \quad (4)$$

where t is air temperature (°C), V is surface wind speed (m/s), a = 0.6, H = 87W/m², and the solar constant R = 1367 W/m². In this equation, α represents the solar altitude angle, which in winter is generally set as 90-β-23° 26' (β denotes latitude; Xu et al., 2000). Ultimately, the individual *THI*, *WEI*, and *ICL* scores are implemented in equation (1) to calculate the *CCI*. The *CCI* classifications and grades are given in Table 1.

Tourism Climate Index (TCI)

The *TCI* (Mieczkowski, 1985) is a widely used tool that incorporates multiple meteorological factors:

$$TCI = 2(4CID = CIA = 2P = 2S = W) \quad (5)$$

To refine the TCI, Shi (2016) made the addition of the *THI*, resulting in a more straightforward calculation:

$$TCI = 2(4ATHI + MTHI + 2P + 2S + W) \quad (6)$$

Here we calculate the TCI using equation (6), in which *ATHI* represents the maximal *THI* for a given day (derived from equation (2), with maximum air temperature and minimum relative humidity), and *MTHI* is the *THI* averaged over both day and night. The *ATHI* and *MTHI* classifications and scores are the same as those provided in figure 1 of Mieczkowski (1985). For equation (6), variables P, S, and W are average monthly precipitation, average monthly sunshine hours, and average monthly wind speed, respectively.

Table 1. CCI classification scheme

Comprehensive Comfort Index (CCI)	7 ≤ CCI ≤ 9	5 ≤ CCI < 7	3 ≤ CCI < 5	1 ≤ CCI < 3
Grade	Comfortable	Relatively comfortable	Less comfortable	Uncomfortable

Table 2. Classification scheme for the TCI

Tourism Climate Index (TCI)	Description of tourist comfort level
90–100	Ideal
80–89	Excellent
70–79	Very Good
60–69	Good
50–59	Acceptable
40–49	Marginal
30–39	Unfavorable
20–29	Very Unfavorable
10–29	Extremely Unfavorable
<9	Impossible

Classifications and scores for P, S, and W are provided in tables 1–3 of Mieczkowski (1985). The TCI classifications are given here in Table 2.

Cold surges

East Asian cold surges are one of the most prominent wintertime meteorological phenomena in the Northern Hemisphere (Chang & Lau, 1980) and involve the anomalous penetration of cold, high-latitude air masses into lower latitudes. Environmentally, cold surges can result in severe weather impacts such as gales, cold temperatures, frost, freezing rain, and sandstorms over large areas of East and Southeast Asia (Ding, 1990). Physiologically, these events decrease the effective temperature (ET) experienced by the human body, which in turn impacts climate comfort (Wu et al., 2017ab). The mean low-level, meridional, northerly wind component is employed as an index for cold surge intensity (Chang and Lau, 1980). Specifically, a cold surge occurs when northerly airflow at 925 hPa over the northern South China Sea (15°–20°N, 110°–115°E) increases to 8 m/s (Lau et al., 1983; Ding, 1990). To identify individual wintertime cold surges between 1981 and 2010, we employed NCEP/NCAR Reanalysis 1 data provided by the National Centers for Environmental Prediction/National Weather Service and the National Oceanic and Atmospheric Administration (NOAA) of the United States (NCEP/NCAR Reanalysis 1: NOAA Physical Sciences Laboratory). These data are provided four times daily and have a spatial resolution of 2.5° × 2.5°.

Results

Comparison between the CCI and TCI

Distributions of mean wintertime CCI and TCI for Yunnan and Hainan provinces between 1981 and 2010 are shown in Figures 2 and 3; detailed classifications of both indices are given in Tables 3–5. In Hainan, both indices exhibit relatively high scores (Figs 2 and 3), indicating that the island province is climatically comfortable for hibernation tourism during winter. A key difference between the CCI and TCI occurs in Sanya, for which the former assigns a Relatively Comfortable (CCI = 6) grade in February, while the latter gives an Ideal (TCI = 90) score (Table 5). Although the TCI temperature standard is relatively high (i.e., an ET of 20°C–27°C is considered optimal), that same range is considered to be hot and only relatively comfortable in the CCI. According to Lin et al. (2003) and Huang (2016), Sanya is classified as hot in winter, which is more consistent with the CCI classification.

Larger discrepancies between the two indices occur in Yunnan (Figs 2 and 3). In Figure 2, for instance, the CCI identifies uncomfortable areas primarily in northwestern Yunnan, whereas the TCI provides relatively low scores for northeastern and eastern Yunnan. Other disparities include Shangri-La, which is assigned an Uncomfortable wintertime score by the CCI (< 3) owing to the prevalence of cold and windy conditions, but which is described as Good by the TCI (60–69) on account of the long sunshine hours (Tables 3–5). Consequently, the CCI deems Shangri-La unsuitable for tourism, whereas the TCI, which is more strongly weighted towards sunshine hours, considers the region suitable. Similarly, while the CCI gives Huaping a Relatively Comfortable grade (CCI = 5.6) for the month of January, the TCI describes this location as Excellent (TCI = 81; Table 4), owing largely to its long sunshine hours (8h/d). The biggest (smallest) differences in Yunnan are in January (February), for which 12 (5) stations give conflicting CCI and TCI classifications (Tables 3 and 5). We note that both indices agree that the most comfortable locations for hibernation tourists are in southwestern Yunnan.

Generally speaking, the CCI and TCI give more consistent results for Hainan, suggesting that the province is more climatically suitable than Yunnan for hibernation tourism. Because the TCI demonstrates a preference of long sunshine hours, the typically dry and sunny climate of Yunnan in winter affords the province an Acceptable score on this index (TCI > 50; Tables 3–5). The CCI, in contrast, classes certain parts of Yunnan (e.g., Deqin, Shangri-La, and Zhaotong) as Uncomfortable (Tables 3–5 and Fig. 2). There is also disagreement on which sites are optimal for hibernation tourism; Jiangcheng and Mengzi in Yunnan are considered Comfortable by the CCI, but do not score as highly in the TCI.

Temporal changes in the CCI and TCI for Hainan are depicted in Figure 4, where they are compared directly with tourist reception numbers (http://lwt.hainan.gov.cn/xxgk_55333/lytj/2019data/). Overall tourist reception numbers for the province have been available since 1998, and monthly reception numbers (including winter months) have been available since 2002. Our comparison of CCI and TCI scores is restricted to the period 2002–2010. The obvious upward trend in tourist reception numbers for Hainan (Fig. 4: blue line) reflects the development of Chinese tourism over that period. To account for this factor, we have detrended the data (i.e., the linear trend is fitted and subtracted from the original data; blue bars in Fig. 4). Table 6 lists the correlations between the CCI

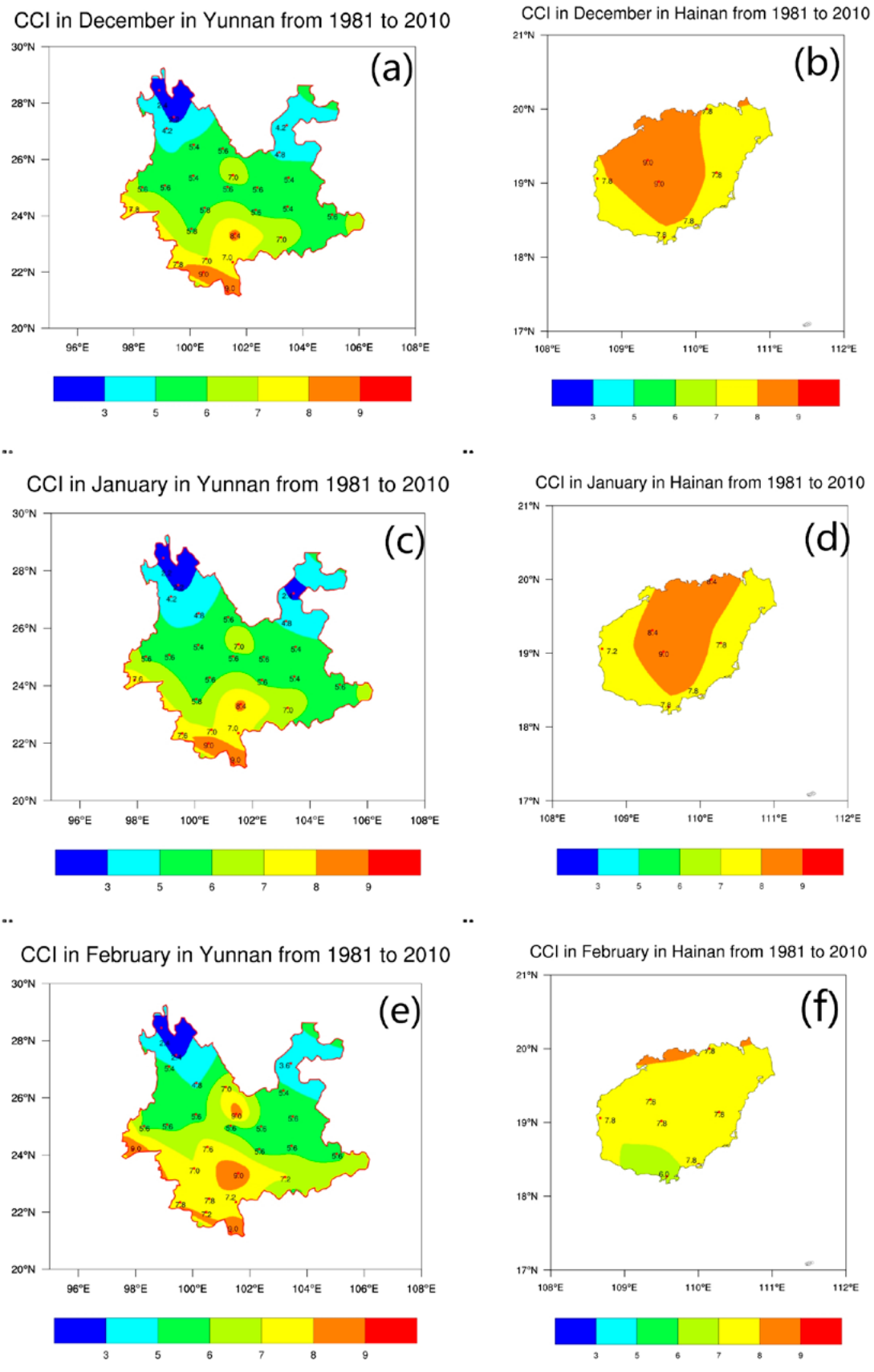

Figure 2. Mean CCI distributions for (a and b) December, (c and d) January, and (e and f) February for the period 1981–2010. Panels (a), (c), and (e) correspond to Yunnan Province, and Hainan Province is depicted in panels (b), (d), and (f). On this color scale, 7 ≤ CCI ≤ 9 is Comfortable, 5 ≤ CCI < 7 is Relatively Comfortable, 3 ≤ CCI < 5 is Less Comfortable, and 1 ≤ CCI < 3 is Uncomfortable

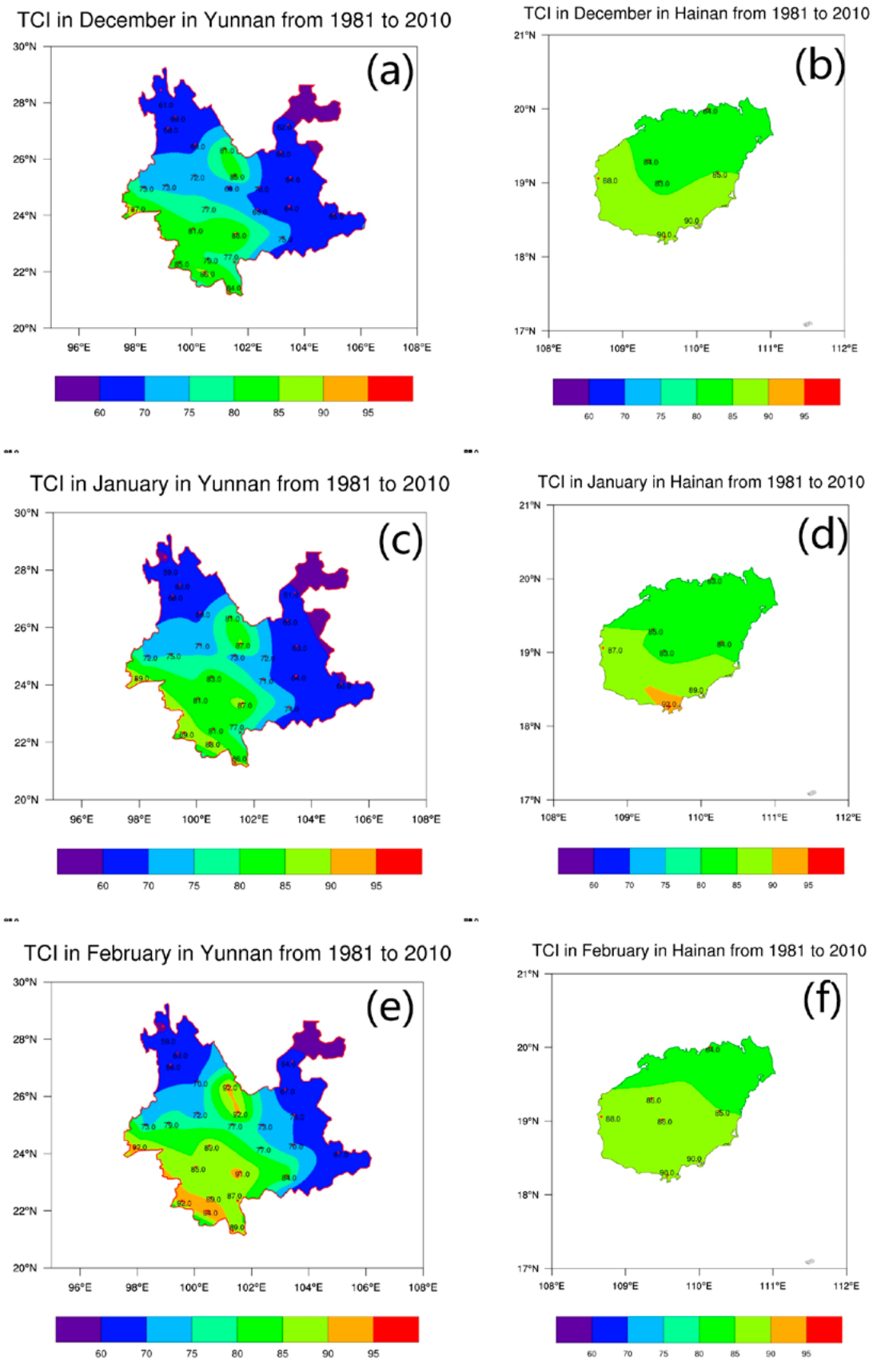

Figure 3. Mean TCI distributions for (a and b) December, (c and d) January, and (e and f) February for the period 1981–2010. Panels (a), (c), and (e) correspond to Yunnan Province, and Hainan Province is depicted in panels (b), (d), and (f). On this color scale, 90–100 is Ideal, 80–89 is Excellent, 70–79 is Very Good, 60–69 is Good, and 50–59 is Acceptable

Table 3. December CCI and TCI classifications for Yunnan (first 27 stations) and Hainan (last 7 stations) provinces between 1981 and 2010.

Index	CCI				TCI			
Station Grade	7 ≤ CCI ≤ 9	5 ≤ CCI < 7	3 ≤ CCI < 5	1 ≤ CCI < 3	80–100	70–79	60–69	50–59
Deqin				√			√	
Shangri-La				√			√	
Weixi			√				√	
Zhaotong			√				√	
Lijiang		√					√	
Huaping		√			√			
Huize			√				√	
Tengchong		√				√		
Baoshan		√				√		
Dali		√				√		
Yuanmou	√				√			
Chuxiong		√					√	
Kunming		√				√		
Zhanyi		√					√	
Ruili	√				√			
Jingdong		√				√		
Yuxi		√					√	
Luxi		√					√	
Lincang		√			√			
Lancang	√				√			
Jinghong	√				√			
Simao	√					√		
Yuanjiang	√				√			
Mengla	√				√			
Jiangcheng	√					√		
Mengzi	√					√		
Guangnan		√					√	
Haikou	√				√			
Dongfang	√				√			
Danzhou	√				√			
Qiongzhong	√				√			
Qionghai	√				√			
Sanya	√				√			
Lingshui	√				√			

Table 4. January CCI and TCI classifications for Yunnan (first 27 stations) and Hainan (last 7 stations) provinces between 1981 and 2010.

Index	CCI				TCI			
Station Grade	**7 ≤ CCI ≤ 9**	**5 ≤ CCI < 7**	**3 ≤ CCI < 5**	**1 ≤ CCI < 3**	**80–100**	**70–79**	**60–69**	**50– 59**
Deqin				√				√
Shangri-La				√			√	
Weixi			√				√	
Zhaotong				√			√	
Lijiang		√					√	
Huaping		√			√			
Huize			√				√	
Tengchong		√				√		
Baoshan		√				√		
Dali		√				√		
Yuanmou	√				√			
Chuxiong		√				√		
Kunming		√				√		
Zhanyi		√					√	
Ruili	√				√			
Jingdong		√			√			
Yuxi		√				√		
Luxi		√					√	
Lincang		√			√			
Lancang	√				√			
Jinghong	√				√			
Simao	√				√			
Yuanjiang	√				√			
Mengla	√				√			
Jiangcheng	√					√		
Mengzi	√					√		
Guangnan		√					√	
Haikou	√				√			
Dongfang	√				√			
Danzhou	√				√			
Qiongzhong	√				√			
Qionghai	√				√			
Sanya	√				√			
Lingshui	√				√			

Table 5. February CCI and TCI classifications for Yunnan (first 27 stations) and Hainan (last 7 stations) provinces between 1981 and 2010.

Index	CCI				TCI			
Station Grade	**7 ≤ CCI ≤ 9**	**5 ≤ CCI < 7**	**3 ≤ CCI < 5**	**1 ≤ CCI < 3**	**80–100**	**70–79**	**60–69**	**50–59**
Deqin				√				√
Shangri-La				√			√	
Weixi			√				√	
Zhaotong				√			√	
Lijiang			√			√		
Huaping	√				√			
Huize		√					√	
Tengchong		√				√		
Baoshan		√				√		
Dali		√				√		
Yuanmou	√				√			
Chuxiong		√				√		
Kunming		√				√		
Zhanyi		√				√		
Ruili	√				√			
Jingdong	√				√			
Yuxi		√				√		
Luxi		√				√		
Lincang	√				√			
Lancang	√				√			
Jinghong	√				√			
Simao	√				√			
Yuanjiang	√				√			
Mengla	√				√			
Jiangcheng	√				√			
Mengzi	√				√			
Guangnan		√					√	
Haikou	√				√			
Dongfang	√				√			
Danzhou	√				√			
Qiongzhong	√				√			
Qionghai	√				√			
Sanya		√			√			
Lingshui	√				√			

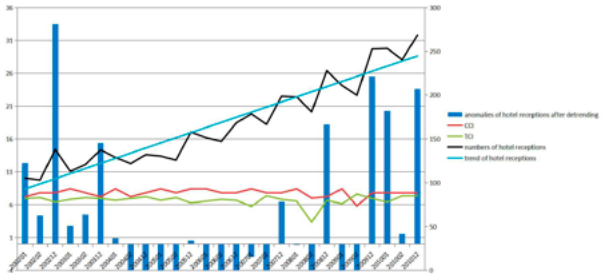

Figure 4. Temporal changes in CCI (left vertical axis; red line) and TCI (right vertical axis; green line) scores, hotel reception numbers (right vertical axis; black line; unit: 10,000 people), the linear trend of hotel reception numbers (blue line), and anomalies in hotel reception numbers after detrending (left vertical axis; blue bars) for winter (December, January and February) on Hainan between 2002 and 2010
[click on figure to enlarge]

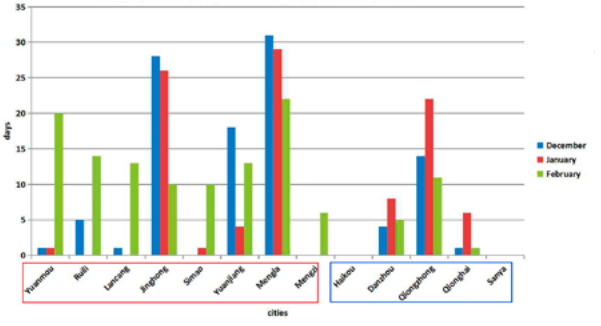

Figure 5. Number of days classed by the CCI as Optimal (CCI = 9) during December (blue), January (red), and February (green) for eight cities in Yunnan (red rectangle: Yuanmou, Ruili, Lancang, Jinghong, Simao, Yuanjiang, Mengla, and Mengzi) and five cities on Hainan (blue rectangle: Haikou, Danzhou, Qiongzhong, Qionghai, and Sanya)
[click on figure to enlarge]

(TCI) and hotel reception numbers and detrended hotel reception numbers for Hainan. We observe that, although the TCI and CCI both exhibit positive correlations (0.153 and 0.096, respectively) with the detrended tourist reception data, these correlations are not significant, implying that tourism is influenced by factors other than climate, such as infrastructure, propagation of social media in tourist centers, regional economic development, and epidemic outbreaks.

Table 6. Correlation coefficients for the CCI and TCI, hotel reception numbers, and anomalies of hotel reception numbers (after detrending) on Hainan.

Correlations	Hotel reception numbers	Anomalies in hotel reception numbers after detrending
CCI	−0.095	0.096
TCI	−0.046	0.153

The period of climatic comfort is a critical factor for hibernation tourism. Since the TCI utilizes monthly data, this approach cannot quantify comfort levels on a daily basis. Therefore, the CCI is more appropriate for investigating climatically comfortable periods in high resolution. In this study, we focused our evaluation on those cities and tourism hotspots with relatively high CCI scores, including eight in Yunnan Province (Yuanmou, Ruili, Lancang, Jinghong, Simao, Yuanjiang, Mengla, and Mengzi) and five in Hainan Province (Haikou, Danzhou, Qiongzhong, QiongHai, and Sanya). Figure 5 depicts the numbers of Optimal days (CCI = 9) in winter: Mengla exhibits the highest value (82 days), followed by Jinghong (64 days); all eight cities in Yunnan attain Optimal status in February. In Hainan, Qiongzhong experiences the highest number of Optimal days (47 days), whereas Haikou and Sanya both report zero Optimal days. Optimal days in Hainan are highest in January, underscoring a key difference in the timing of peak hibernation tourism between Yunnan and Hainan.

Correlations with cold surges

Figure 6 shows the comparison between TCI and CCI scores and the wintertime occurrence of cold surge days between 1981 and 2010 and highlights the strong interannual variability in cold surge events (blue line in Fig. 6). For Hainan and Yuanjiang (Yunnan), we observed a clear negative relationship between the occurrence of cold surge days and TCI scores, whereby a higher number of surge days corresponds to generally lower index scores. From this we infer that more frequent cold surge events result in a higher probability of low temperatures and high wind speeds. In contrast, the relationship between the occurrence of cold surge days and the CCI is less obvious.

Table 7 lists the correlation coefficients between the TCI and CCI and the number of cold surge days in Hainan and the cities of Yuanjiang, Mengla, and Jinghong in Yunnan between 1981 and 2010. The three Yunnan stations were selected because they are classified as being optimally comfortable during winter. Whereas correlation coefficients between the number of cold surge days and the TCI are all significantly negative, those for the CCI are more variable, being negative in Yuanjiang and Mengla but positive in Hainan and Jinghong. Moreover, the CCI correlation coefficients are not significant. This result indicates that the TCI reflects the influence of cold surges in a climatic perspective better than the CCI. As discussed in the previous section, the TCI has stricter temperature and sunshine hour thresholds, making the index generally more sensitive than the CCI to the influence of cold surges.

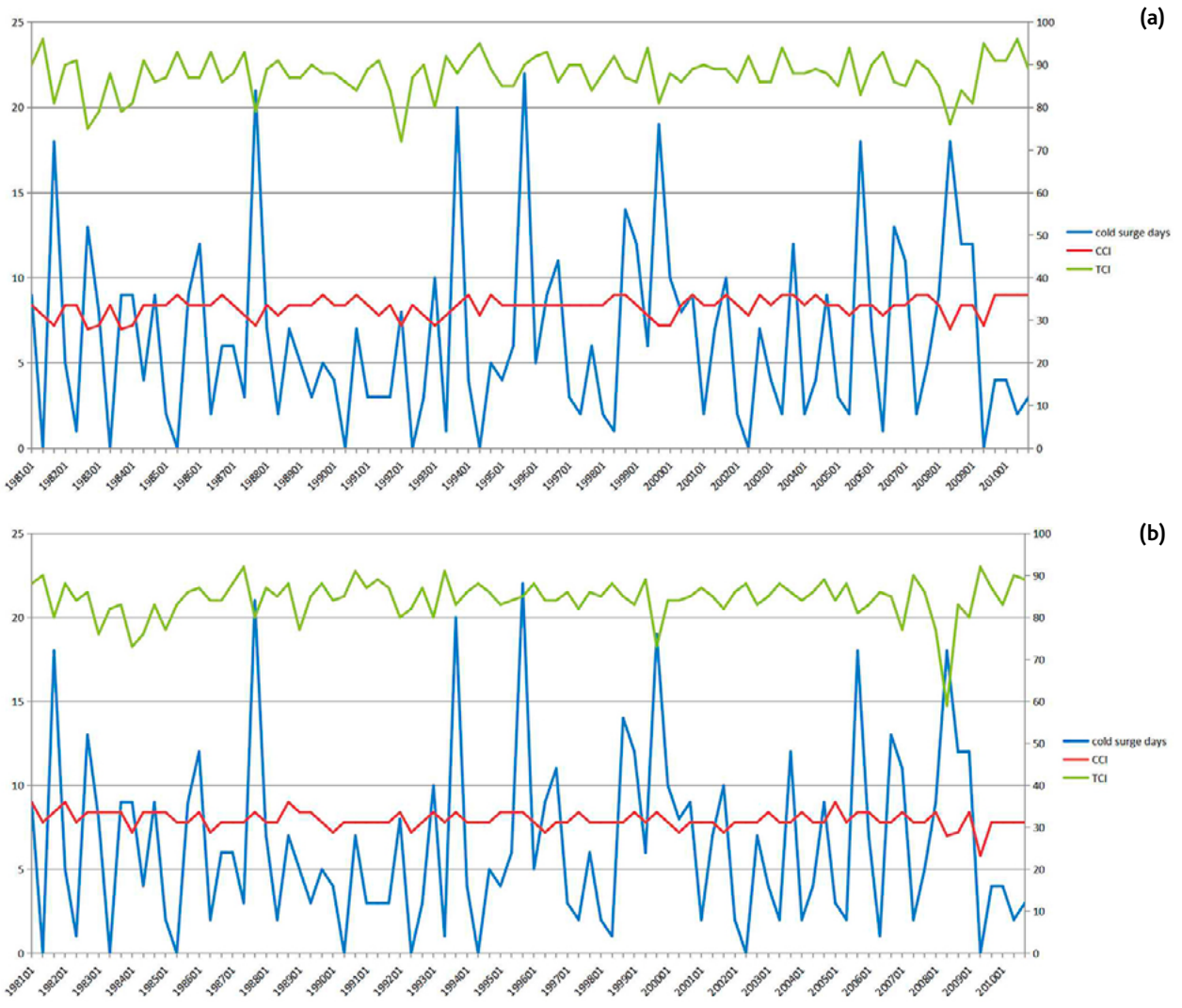

Figure 6. Monthly changes in the CCI (left vertical axis; red line) and TCI (right vertical axis; green line) relative to the incidence of cold surge days (left vertical axis; blue line) in winter for the period 1981–2010. Panel (a) corresponds to Yuanjiang in Yunnan; panel (b) depicts Hainan

Here we investigate the specific case of a strong East Asian cold surge, which occurred between 30 December 2004 and 2 January 2005 (Zhao & Zeng, 2005). During this event, the South China Sea region and lower adjacent latitudes experienced anomalously strong winds and a pronounced drop in temperature. In Damaoshan (Hong Kong Province), for example, the air temperature dropped to –2°C early in the morning of 1 January 2005. This cold anomaly even crossed the equator, penetrating the Southern Hemisphere and bringing heavy rainfall to northern Australia (Zhao & Zeng, 2005). Between 30 and 31 December 2004, Hainan experienced significant cooling (Fig. 7), with temperatures in the mountainous central region dropping below 10°C. During the same event, temperatures in northwestern and northeastern Yunnan dropped below freezing from 30 December 2004 to 1 January 2005 (Fig. 8). Despite the onset of warmer weather on 2 January 2005,

Table 7. Correlation coefficients between the TCI and CCI, the TCI and cold surge days, and the CCI and cold surge days in Hainan and Yunnan (Yuanjiang, Jinghong, and Mengla) from 1981 to 2010 (* and ** denote significance levels of 95% and 99%, respectively)

	TCI of Hainan	TCI of Yuanjiang	TCI of Jinghong	TCI of Mengla	Cold surge days
Cold surge days	–0.45*	–0.57**	–0.49**	–0.55**	
CCI of Hainan	–0.12				0.23
CCI of Yuanjiang		0.43*			–0.25
CCI of Jinghong			–0.41*		0.26
CCI of Mengla				–0.11	–0.12

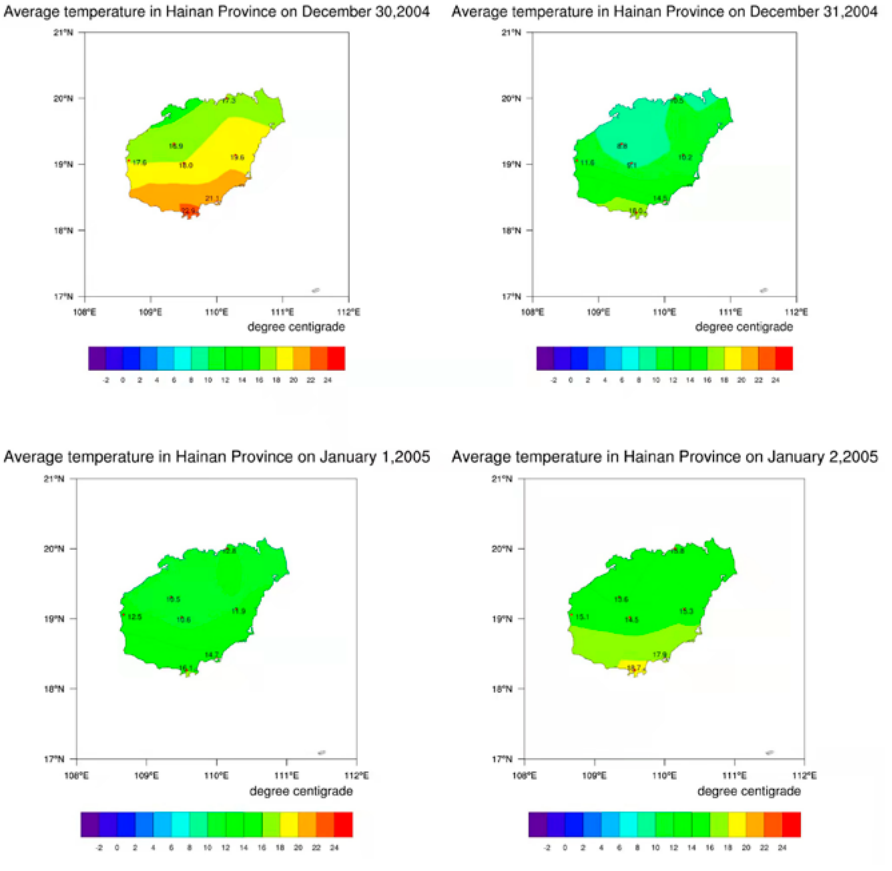

Figure 7. Daily temperature distributions for Hainan between 30 December 2004 and 2 January 2005 (°C)

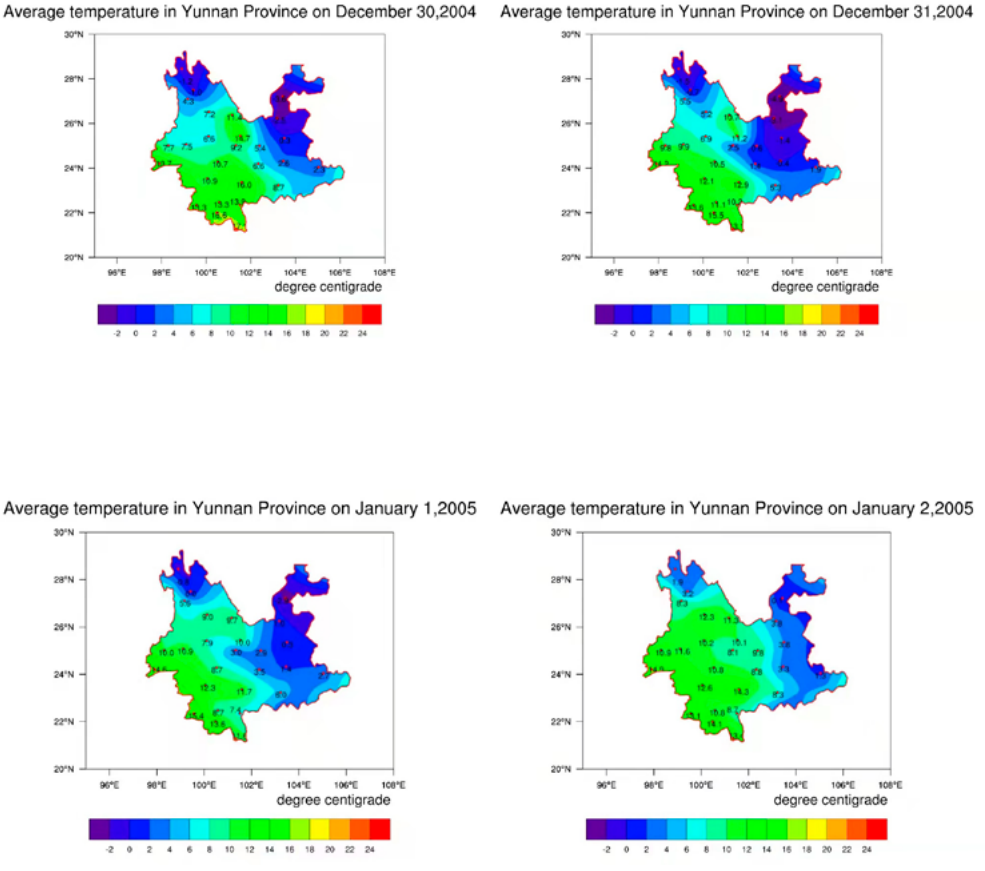

Figure 8. Daily temperature distributions for Yunnan between 30 December 2004 and 2 January 2005 (°C)

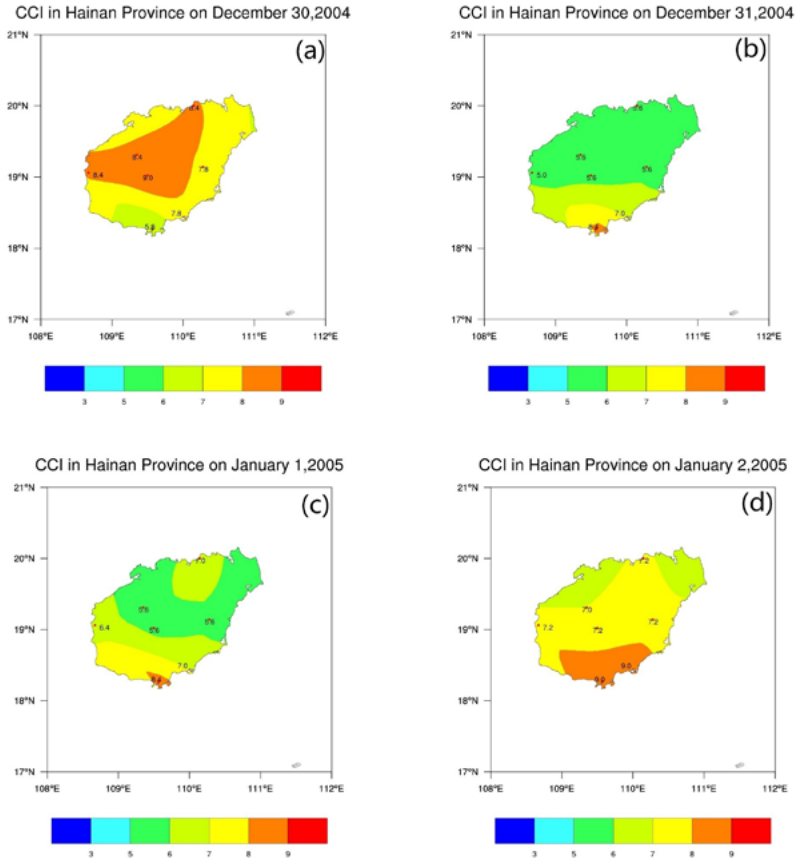

Figure 9. CCI distributions for Hainan between 30 December 2004 and 2 January 2005

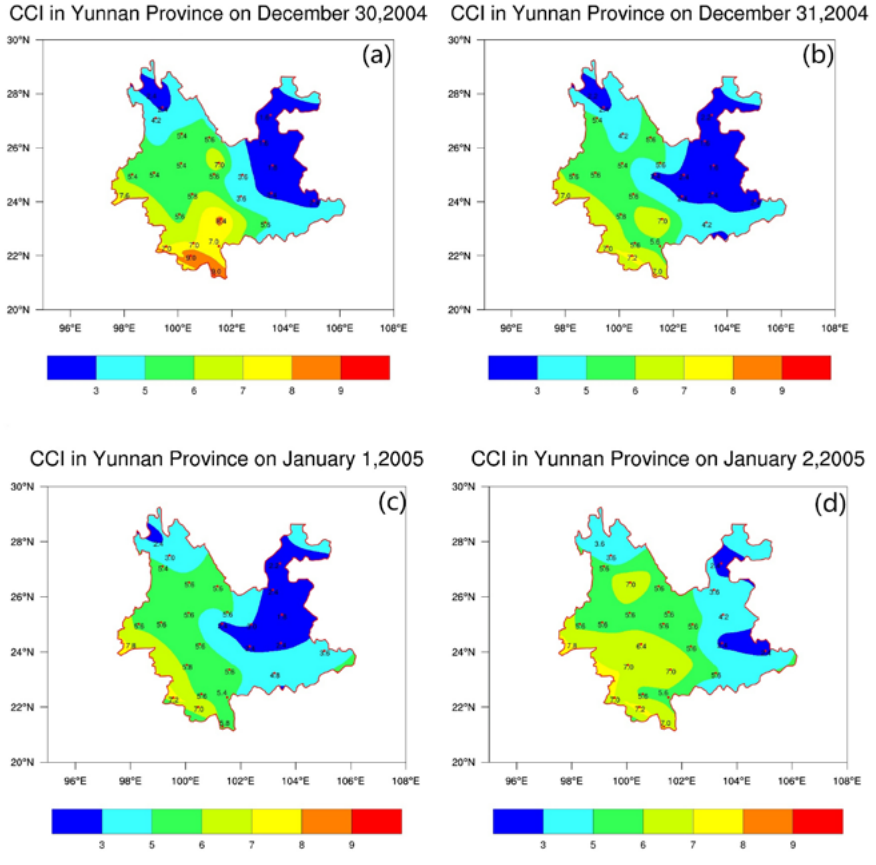

Figure 10. CCI distributions for Yunnan between 30 December 2004 and 2 January 2005

temperatures in those regions remained anomalously low (<4°C). In both Hainan and Yunnan, the cold surge was associated with elevated wind speeds and low precipitation (<3 mm; not shown).

As a result of the 2004–2005 cold surge, CCI scores for both Hainan and Yunnan dropped measurably (Figs 9 and 10), with northwestern and northeastern Yunnan registering Uncomfortable ratings (Fig. 10). The impact of this cold surge is captured effectively by the CCI; however, the monthly average resolution of the TCI precludes a direct comparison of the two indices. The inability of the TCI to quantify daily comfort conditions is thus a major limitation of this metric (Scott et al., 2016).

Discussion and conclusions

Winter tourism is an economically significant component of the tourism industry (Pullin et al., 2015). Although the potential impacts of climate change on this sector are the focus of research both globally (Scott et al., 2012) and regionally/nationally (Steiger & Scott., 2020), previous work has focused primarily on the skiing industry (Steiger & Stötter, 2013; Scott et al., 2019; 2020; Steiger et al., 2019; Steiger & Scott., 2020), which is already being impacted by insufficient snow cover and shorter winter seasons (Steiger et al., 2019; Steiger & Scott, 2020). In contrast, climatic impacts on hibernation tourism, particularly in China, are less well understood. Within the context of climate change, the declining number of extremely cold days in China (Wu et al., 2017a; Jin et al., 2019) suggests that, on average, winters will become more climatically comfortable. What is missing from this assessment, however, is a nuanced understanding of the effects of extreme weather, such as cold surges, on hibernation tourism. Bringing gales, cooling, frost, and freezing rain, cold surges serve to reduce the effective temperature of the human body and thus our perception of climatic comfort (Wu et al., 2017a). Acknowledging the direct link between cold surges and human comfort, this paper has evaluated two widely used indices to provide a climatic perspective on the impacts of extreme weather on hibernation tourism. Our principal conclusions are as follows:

1. The correlation between the TCI and cold surge days is higher and more significant than that between the CCI and cold surge days. During our 1981–2010 study period, the TCI of Hainan and of Yuanjiang, Mengla, and Jinghong (Yunnan) all show significantly negative correlations (>95% confidence) with cold surge days, whereby higher numbers of surge days per month result in lower TCI scores. The correlation between cold surge days and the CCI, however, is lower and not significant. We conclude, therefore, that the TCI is more effective for capturing the climatic influence of cold surges, due primarily to the higher temperature standards of that index and the preference for long sunshine hours. This finding was confirmed by Scott et al. (2016) and Hasanah et al. (2020), who both showed that the TCI yields the highest scores when sunshine hours are >10 hours.
2. Correlations between the CCI and TCI time series for the period 1981–2010 are not uniform among the various stations. The spatial difference between the CCI and TCI is most obvious in Yunnan, where the daily resolution of the CCI is more effective for analyzing daily comfort than is the monthly resolved TCI. As a result, various researchers have sought to improve the TCI and develop additional diurnal-scale indices, such as the CIT (de Freitas et al. 2004) and HCI (Scott et al. 2016). We propose that a direct comparison of these approaches will be a valuable contribution to our understanding of how cold surges impact hibernation tourism.
3. Correlations between the CCI and TCI and the Hainan tourist reception data for the period 2002–2010 in Hainan are poor, indicating that climatic comfort is not the sole factor affecting winter tourism. Other potential factors include government decision-making, economic development, infrastructure, and publicity. In their recent study of climatic comfort and visits to the Borobudur Temple, Indonesia, Hasanah et al. (2020) reported a correlation between TCI score and foreign visitations, although this correlation is not strong. In our study, we do not differentiate between foreign and domestic tourists. Hasanah et al. (2020) also showed that the HCI index returns higher correlations with both foreign and domestic tourist visitations.
4. In general, the island of Hainan is more climatically comfortable for hibernation tourists than Yunnan, as reported by Deng and Bao (2020). During the strong cold surge between 30 December 2004 and 2 January 2005, the drop in temperature on Hainan was less than that in Yunnan. We also note that the climatically optimal time for hibernation tourism is February in Yunnan and December–January on Hainan. Moreover, the cities of Mengla and Jinghong are the most comfortable locations for hibernation tourism in Yunnan, which is consistent with the study of Wu et al. (2017b).

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Urban Expansion of the Largest Cities in Bosnia and Herzegovina over the Period 2000-2018

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Abstract

The paper analyses the databases Urban Atlas (UA), Imperviousness, and CORINE Land Cover (CLC) for the largest cities in Bosnia and Herzegovina (B&H). The UA database contains information for five functional urban zones with more than 100,000 inhabitants: Sarajevo, Banja Luka, Tuzla, Mostar, and Zenica. The Imperviousness database is related to the subclasses of the urban atlas because the impermeability percentage has been used for a more detailed classification within the discontinuous urban area. The CLC database provides insight into the intensity of expansion of these cities during three six-year periods: 2000-2006, 2006-2012, and 2012-2018. The research has been used to analyse the expansion of urban zones, the structure, and form of cities, and the impact of urban expansion on the surrounding area. The results of the research show that, despite the negative demographic trends, there is a trend of urban expansion in B&H, mainly overthe agricultural land. According to the CLC database in the period 2000-2018, artificial areas increased in spatial coverage from 1.35% to 1.7%, and urban fabric from 0.99% to 1.27%. The Imperviousness database shows that in 2018sealed areas covered 1.59% and built-up areas 0.8% of the territory of B&H. The 2013 census showed that the number of inhabitants in all five functional urban areas decreased compared to 1991, but despite that fact, the expansion of urban zones continues with a weaker or stronger intensity.So far, there has been no research on urban development based on the high-resolution layers UA and Imperviousness database in B&H, so that such research is the most significant contribution of this article.

Keywords: Urban Atlas; Imperviousness; CORINE LC; expansion; cities; B&H

Introduction

Socio-economic processes in the former socialist countries in the period of transition have resulted in accelerated growth of all capital cities in Central, Eastern and South-eastern Europe. That is why many researchers have expected processes of sprawl to be observed around the cities in result of changes in the mechanisms of urban development in these countries (Slaev & Kovačev, 2014). Post-socialist cities have gained new authority and functions since the political and fiscal decentralization shifted power and responsibilities to local governments. Substantial changes have occurred in the nature, role and functioning of government and of other institutions involved in spatial development and urban policy (Nedović-Budić et al., 2006).Urban expansion and suburbanization in South East Europe (SEE), is often fueled by rural-to-urban migration of poor, rural strata, who move to the big cities in search of livelihood (Leontidou et al., 2007). These rural-to-urban migrants often settle on the urban fringe because of lower land prices (Korcelli, 1990). In many cases, economic developments and shortcomings in institutional frameworks have re-

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sulted in the inefficient use of land in suburbs (Roose et al., 2013). Eastern European urbanization can best be characterised as hybrid: cities and city regions simultaneously manifest characteristics of convergent adaptation and path-dependency; they prove typical features of capitalist urbanization, but relics of the socialist past are still omnipresent (Taubenbock et al., 2019).

In the postsocialist states, the impacts of suburbanisation are only beginning to be felt at present (Hlaváček et al., 2019). Increased private (commercial or residential) construction or "post-socialist privatism" has various socio-spatial consequences visible in both the cities' altered appearance and identity as well as the quality of life in them (Nedović-Budić et al., 2006; Svirčić et al., 2019).

Researching suburbanization and urban sprawl in Belgrade and Sofia, Slaev et al. (2018) have identified several factors that are typical drivers as well as others, which are atypical. The higher rates of car ownership and incomes of certain social strata which accompanied the transition are the only local economic factors that were founded to correspond with the typical, global drivers of suburbanization and sprawl. The atypical factors, on the other hand, are attributable to drivers and conditions specific to SEE. Cultural traditions and housing preferences are probably the most important factor contributing to urban density. Grigorescu et al. (2012) in the study related to urban sprawl in Romania indicates a stronger connection with the socio-political factors over in the post-communist period as compared to the natural drivers which can be approached only as background in assessing land transformation.

Researching land cover changes in Budapest Lennert et al. (2020) summarized three "theorems": (1) Due to urban sprawl, the extent of artificial surfaces in the functional urban area will increase over time, irrespective of the economic and political system; (2) Land conversion will affect different types of agricultural, natural, and seminatural land use cover to varying degrees; and (3) The decline in agricultural, natural, and seminatural areas will not be a general phenomenon and will not cover all categories. Another important consideration is that suburbanization and sprawl can be understood as the initial phases in a greater cycle of urban enlargement. In the first phase of a cycle, suburban areas are subject to low-density growth (i.e. sprawl), but if the city continues to grow in this direction, the next phases result in an increasingly denser urban fabric (Slaev et al., 2018). Nevertheless, there are two features generally encountered when considering urban sprawl: the first one is related to the spatial discontinuity and low density of built-up areas, and the second notes usually an increase of built-up areas significantly greater than the population growth (Petrescu, 2019).

Theincreasing urban sprawl is causing land-use conflicts and is posing a major threat to sustainable land use. Therefore, there is an urgent need to assess the extent of urban sprawl in Europe in a consistent and comparable way and to provide relevant evidence that can aid the development of European policy with regard to built-up areas.

Addressing the issue, in 2009 the European Space Agency (ESA) started the Global Monitoring for Environment and Security (GMES) program releasing the Urban Atlas, a dataset on land use for all cities in Europe with a population of more than 100,000 inhabitants (Prastacos & Chrysoulakis, 2011). The spatial unit for assessing the spatial structures of urban sprawl and suburbanization are functional urban areas (FUAs). The first UA database refers to 2006 and contains 319 FUAs. The next UA database refers to 2012, containing 785 FUAs with more than 50,000 inhabitants, including West Balkan countries. The last UA 2018 database contains a full dataset for 788 FUAs and the 2012-2018 change product (CLMS, 2020).

As the first post-war census in B&H was conducted in 2013, after the database in Europe had already been formed, only the cities with more than 100,000 inhabitants (according to the 1991 census) have been included in the UA database. For example, in 1991, the city of Bijeljina had about 97,000 inhabitants and was not included in the UA, although according to the 2013 census it had 107,700.Taking into account this criterion, there were five functional urban zones: Sarajevo, Banja Luka, Tuzla, Mostar, and Zenica. The criteria for defining the area covered by the FUA are not related just to the administrative boundaries of cities or to the political boundaries of the entities and cantons in B&H, but also to the economic gravity zones and the labor market. According to EUROSTAT (2016), anFUA consists of a city and its commuting zone. FUAs, therefore, consist of a densely inhabited city and a less densely populated commuting zone whose labor market is highly integrated with the city. Thus the FUA Sarajevo, in addition to 9 municipalities belonging to the Sarajevo Canton, includes all municipalities belonging to the city of East Sarajevo (except Sokolac) and 2 municipalities of the Central Bosnia Canton (Kiseljak and Kreševo) and Zenica-Doboj Canton (Breza and Visoko). FUA Banja Luka includes the city area of Banja Luka and the municipalities of Laktaši, Čelinac, and Gradiška. The FUA Tuzla includes the city area of Tuzla and the municipalities of Živinice, Kalesija, and Lukavac. The FUA Mostar includes the city area of Mostar and the municipalities of Široki Brijeg, East Mostar, and Čitluk. The FUA Zenica includes the city area of Zenica and the municipalities of Busovača and Vitez.

The population in FUAs ranges from 153,123 (Mostar) to 543,189 (Sarajevo), and the total area from 865.5 km2 (Zenica) to 2750.9 km² (Banja Luka). The population density (population divided by total area) is 84 people/km² in Mostar and 219.3 people/km² in Tuzla. Following the depopulation trend in B&H, the population in all five FUAs reduced between the two censuses (Table 1). In addition to negative demographic trends, the war events in B&H in the period 1992-1995 significantly contributed to this. Zenica has the largest decrease of 20.14% and Banja Luka the lowest one, with 5.56%.

Table 1. Area, population, and population density of FUAs

FUAs	Area	Population		Decreasing	Pop. density 2013
	P (km²)	Census 1991	Census 2013	%	People/km²
Sarajevo	2636.2	619,546	543,189	-12.3	206.1
Banja Luka	2749.0	304,211	287,283	-5.6	104.5
Tuzla	1123.0	277,004	246,317	-11.1	219.3
Mostar	1821.9	169,373	153,123	-9.6	84.0
Zenica	865.3	193,341	154,409	-20.1	178.5

According to the EEA (2016), the main drivers of urban expansion are divided into demographic, socio-economic, political, technological, and geophysical. Each FUA has its own specifics that affect faster or slower expansion. On the example of FUAs in B&H, the demographic drivers of urbanization are not related to population growth but to internal migration in the rural-urban direction. The predominantly young population is leaving rural areas and settling in cities looking for betterliving conditions. Socio-economic driversare related to the growth of GDP, which increased by almost 4 times in B&H in the period 2000-2018, i.e. from 5.5 billion to 20.18 billion dollars (World Bank, 2021). In this regard, the population income growth is often associated with the construction of houses and holiday homes in the urban periphery. The political drivers of urbanization are modern legislation and promotion of the planned sustainable expansion of cities, as well as possible subsidies for the construction of new houses on the outskirts of the city. The technological driver of urbanization refers to technological development emerging in the 20th and 21st centuries through the increase in the number of cars, which relativizes the distance between the place of residence and the workplace. Combined with the high cost of housing in urban centers,it makes suburban areas more attractive. The number of registered vehicles in B&H increased from 895,425 in 2013 to 1,175,731 in 2019 (BiHAMK, 2020). Geophysical drivers are related to the topographic limits of urban sprawl and the steep relief that makes construction difficult, and alsoto the proximity of natural resources (especially mineral resources), fertile land, etc.

The aim of this paper is to determine the structure and spatial patterns of urban expansion in the largest FUAs inB&H. Understanding the urban growth phenomenon is among the major issues that public services have to deal with. As B&H is among the poorest countries in Europe, it is of great importance that urban development is both efficient and effective.The period 2000-2018 has beentaken for the CLC data, 2006-2018 for the Imperviousness data, while the data for the UA refer to the period 2012-2018.

Study area

Bosnia and Herzegovina is a country in the Western Balkans, with an area of 51.209 km² (Figure 1). The Dayton Peace Agreement from 1995 created a new state structure consisting of the Federation of B&H (FB&H) and RepublikaSrpska (RS) and since 2000 the Brčko District (BD). According to the last census from 2013, B&H has about 3.53 million inhabitants (ASB&H, 2016), which is a significant loss in comparison with the previous census from 1991, when it had 4.37 million inhabitants (-19.2%). The three main ethnic groups are Bosniaks (50.1%), Serbs (30.8%),and Croats (15.4%). B&H has one of the lowest densities of the urban population, with 49.2% of the total population living in urban areas (World Bank, 2021), comparing to the European average of 75% (Oueslati et al., 2015).

Figure 1. Location of B&H and FUAs
Basemap source: Openstreet Map
[click on figure to enlarge]

The process of depopulation in B&H is especially intense in the second decade of the 21st century. RS has been recording a negative population growth since 2002, and in the period 2013-2018 averaged to – 4,732 annually (RSIS, 2020). The FB&H had a negative population growth for the first time in 2013, while losses in the period 2013-2018 averaged to – 4,580 annually (FB&H BS, 2020). Official estimates of entity statistics agencies say that in the period 2013-2018 RS lost 23,277 and FB&H 22,898,which makes a total of over 46,000 inhabitants. According to the FB&H Bureau of Statistics, 24,154 citizens or 4,026 per year left B&H in the same period. The total demographic losses amount to almost 13,500 inhabitants per year, with a tendency for constant growth (Drašković et al., 2021). Population Situation Analysis has confirmed that B&H is the country with one of the lowest fertility in the world (1.25), high-level migrations and population aging as well as deeply rooted gender inequalities. By 2070, such demographic trends and inequalities will lead to a decline in total population by over 50% while demographic structure will be skewed towards the older population (with their share in the total population of over 40%) (ASB&H, 2020).

B&H is dominated by small settlements with more than 65% of urban settlements have less than 10,000 inhabitants. Due to the specificity of the relief, the population lives in a rather fragmented settlement system comprised of 6,141 settlements of uneven population density. Evident polarization in the urban system of B&H is reflected in the very dynamic monocentrism of the capital city and the regional centers, which is further intensified by the consequences of the war through the resettlement of a large number of refugees and displaced persons (Gekić & Bidžan-Gekić, 2019).Despite the general trend of depopulation, urban areas continued to expand. Two parallel socio-economic processes are dominant: urbanization and deagrarization. The population is concentrated around larger cities while rural areas are sparsely populated (Drašković et al., 2021).Although the economic development has been relatively slow, the largest cities in B&H have maintained substantial competitive advantages compared to provincial cities and towns in attracting national and foreign capitals. That phenomenon has attracted the people who lost their jobs in the former socialist enterprises and were seeking employment.In this regard, in five Central and Eastern European countries during the post-socialist period Schmidt et al. (2014) identified that larger cities which were better connected to the political elite and more economically integrated with global investment patterns experienced more extensive urban sprawl than their smaller and mid-sized counterparts.

Methods and data

Monitoring the urban expansion and its impact on the environment in Europe takes place through various programs and services, among which the most famous are Urban Atlas, CORINE Land Cover, and Imperviousness. These services are a part of the Copernicus system, one of the most important European programs for monitoring the surface of the Earth.The changes that appear on the surface are visible on satellite images, and over the course of time they can be compared, and thus the differences and directions of spatial development can be set out.

In the context of globalization and climate change, not only the urbanization process is fast, but the consequences due to the increase of imperviousness pose serious challenges related to the indication of risks (heatwave events, floods, pollution, etc.) (Lefebvre et al., 2016). Buildings and artificial covers modify the climatic conditions (including energy budget, radiation components, and wind conditions) in cities (Marković et al., 2013). The coolest surfaces are natural covers (water, vegetation), while the hottest surfaces are concrete pavements, asphalt, and rubber paving when exposed to direct solar radiation (Dezső et al., 2019).

The UA provides pan-European comparable land cover and land use data for FUA. The UA is mainly based on the combination of (statistical) image classification and the visual interpretation of very high satellite imagery. Multispectral SPOT 5 & 6, Formosat-2 pan-sharpened imagery with 2 to 2.5m spatial resolution is used as input data. The built-up classes are combined with density information on the level of sealed soil derived from the high-resolution layers (HRLs) Imperviousness to provide more detail in the density of the urban fabric. Finally, the UA product is complemented end enriched with functional information (road network, services, utilities, etc.) using ancillary data such as local city maps or online map services (EEA, 2017b).

The land use classification system in UA identifies 20 different land use classes, 17 are 'artificial surfaces' that is, developed/built-up areas, and 3 are non-developed/natural areas. Six artificial surfaces classes, the 'urban fabric', describe built up/density levels, they could be therefore considered land cover rather than land-use classes. There are 5 different classes for transport infrastructure (fast transit roads, other roads, railroads, ports, and airports) and 6 classes

for other uses (industrial/commercial/public facilities, mineral extraction/dump sites, construction areas, land without use, green urban areas and sports/leisure facilities). The database is in vector format (Prastacos et al., 2017).

The first data from the UA for B&H refer to 2012 and then to 2018 and the changes that occurred in the period 2012-2018. Comparing to the CLC database UAclasses are classified in more detail, so that the discontinuous urban area (CLC code 1.1.2) is divided into four subclasses, depending on the imperviousness density, from a high degree of urbanization (50%-80%) to a very low degree of urbanization (below 10%).

The HRL Imperviousness Density are raster-based datasets that provide information about impervious (sealed) surfaces (e.g. roads and built up areas). It consists two types of status products: Imperviousness Density (IMD), Impervious Built-up (IBU) and additional change layers. The status layers are available in 10 m (2018) and 20 m spatial resolution (2006-2015). The HRL Imperviousness provides a per-pixel estimate of impermeable cover of soil as an index for the degree of imperviousness (0-100%). Imperviousness change layers were produced as a difference between the corresponding reference dates and are presented as degree of imperviousness change (IMC). Sealing has effects on various natural processes and functions, such as hydrological processes, the quasi irreversible loss of soil functions, loss of habitats and biodiversity; the sealing of soil furthermore has implications on urban climate, e.g. the urban heat island effect (CLMS, 2020).Soil sealing is one of the greatest threats to the soil and its ecosystem services and is a common syndrome of land degradation around expanding urban areas. Sealed surfaces prohibit water infiltration and cause stronger surface run-off (Tobias et al., 2018). This increases the threat of floods, the pollution of waters, and decreases the amount of subsoil water and evaporation. The data demonstrate, moreover, how artificial patches and barriers fragment landscape more and more, endangering thereby biodiversity and decreasing green surfaces (Hardi et al., 2020). Urbanization with an increase of non-permeable surfaces and lack of natural drainage created additional flooding issues that did not previously exist and that never before there had been so many human assets that were in the way of floods like today (Prokić et al., 2019).

In 1985, the CLC databases and several of its programs were taken over by the European Environment Agency (EEA) with the aim of collecting, coordinating, and ensuring the consistency of information on natural resources and the environment. The first CLC project for B&H started in 1998 and was successfully completed in 2000. The result was the creation of the B&H CLC 2000 database, which included the identification of the types of surface cover at the level of the main classes, and also the second and third level subclass with a detailed description of the structural characteristics. Subsequently, the CLC 2006, CLC 2012, and CLC 2018 databases were created with the aim to monitor the dynamic changes in the land cover (Drašković et al., 2020). This vector-based dataset includes 44 land cover and land use classes. In 2019, the EEA published an updatedillustrated guide to the nomenclature of land cover types with a structural classification at three hierarchical levels and a differentiated level of detail (details at: EEA, 2019).

The UA has a legend designed to capture urban land use, including low-density urban fabric, and a resolution that is 100 times higher than CLC(Figure 2-3). The scale of CLC is 1:100,000 and the minimum mapping unit is 25 ha. The scale of UA is 1:10,000 and the minimum mapping unit is 0.25 ha for the artificial surfaces and 1 ha for the other surfaces.

Several of the land use classes identified in UA account for a very small percentage of the urban area

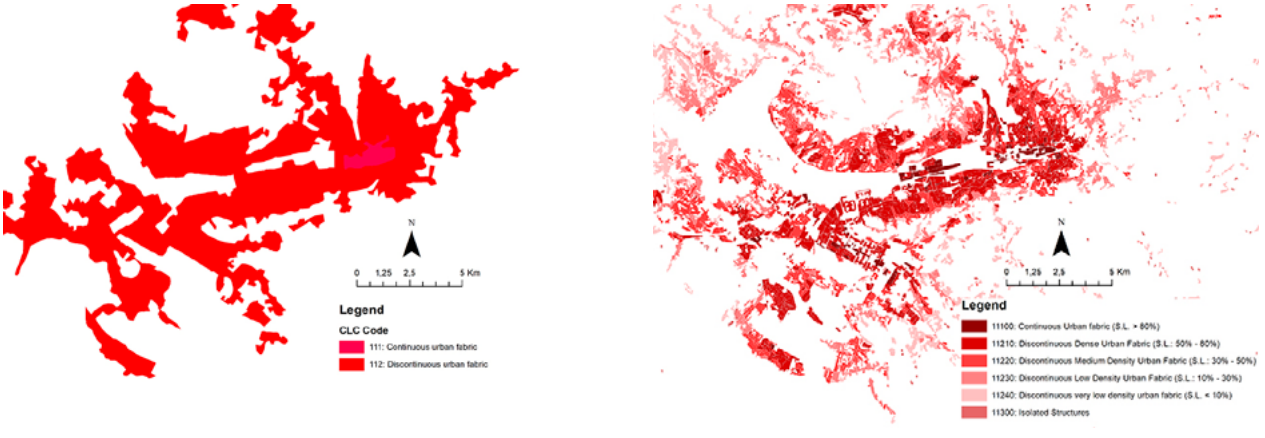

Figure 2 and 3. The difference between details level of CLC and UA dataset in Sarajevo urban area
[click on figure to enlarge]

Table 2. Land use UA reclassification

Class	Name	UA Code	Sealing degree
C1	Continuous urban fabric areas	11100	80-100%
C2	Discontinuous dense urban fabric	11210	50-80%
C3	Discontinuous urban fabric	11220, 11230, 11240, 11300	< 50%
C4	Industrial/commercial areas	12100	
C5	Transport infrastructure	12210, 12220, 12230, 12300,12400	
C6	Mine/Dump sites, Construction/ Land without use	13100, 13300, 13400	
C7	Green areas and sport facilities	14100, 14200	
C8	Agricultural + Semi-natural areas	20000	
C9	Forest	30000	
C10	Water and wetlands	50000	

are not so relevant for this research and a detailed analysis would not provide a meaningful insight on the form of the city. The 20 UA classes were therefore reclassified into 10 classes (Table 2). Three of the 10 classes represent urban fabric areas. The CLC class 1.1.2 (Discontinuous urban fabric) has been broken down into the following sub-classes in UA: 1.2.1.1.0 (Discontinuous dense urban fabric: sealing level 50% - 80%), 1.1.2.2.0 (Discontinuous medium density urban fabric: sealing level 30% - 50%), 1.1.2.3.0 (Discontinuous low density urban fabric: sealing level 10% - 30%), 1.1.2.4.0 (Discontinuous very low density urban fabric: sealing level < 10%) and Isolated structures (11300). Transport infrastructure (fast roads, other roads, railroads, ports, airports) were aggregated into one class and the same was done for green areas and sports facilities. For separation between Discontinuous urban fabric, HRL Imperviousness density is required.

By collecting and analyzing the satellite images from different periods, the situation on the ground can be compared and the differences and directions of spatial development can be set out. UA, IMD, and CLC changes of data for the five FUAs were extracted using GIS software in order to visualize and quantify changes. The data are exported to Microsoft Excel and classified by the type of change. By using the Sort & Filter and Subtotal Sum tools, the individual sum of classes and changes by periods are calculated. Through the processing of this data, we get a spatial and temporal insight into all the processes that take place in the field.

Results and discussion

According to CLC 2018 artificial areas in B&H cover 1.7% and urban fabric (in CLC nomenclature code 1.1) cover 1.27% of the territory. IMD 2018 database shows that the sealed area covers 1.59% of the territory.The differences between the two databases could be a result of different spatial resolution and classification nomenclature. Namely, IMD has a higher resolution and excludes some CLC subclasses: railway tracks not associated with other impervious surfaces (i.e. outside built-up area), dump sites, mines, quarries, peat extraction areas, construction sites without discernible evolving built-up structures,etc. Built-up areas are a sub-group of the sealed areas. The term refers to areas where above-ground building constructions can be found. IBU 2018 database for B&H shows that build-up areas cover 0.8% and non-built ones 99.2% of the territory.The IMD is a raster displaying the degree of imperviousness (1-100%) for the five FUAs and for the reference year 2018 in 10m spatial resolution (Figure4-8).

According to the IMD 2018 database, Sarajevo has the largest imperviousness area (102.45 km^2) and Zenica the smallest one (28.99 km^2). However, when the imperviousness area is shown in relation to the total area of FUA, then Tuzla is in the first place (5.7%) and Mostar isthe last (2.07%). According to the IBU 2018 database, Sarajevo has the largest built-up areas (53.24 km^2) and Zenica the smallest ones (13.24 km^2). In relation to the total area, Tuzla is again in the first place (3.89%) while Mostar is the last (1.04%) (Table 3).

However, the difference between IMD and IBU classes should be emphasized because IMD covers all imperviousness zones (e.g. roads and industrial zones) while IBU includes only the populated areas, which means that built-up are part of imperviousness areas. For example, the FUA Sarajevo has 3.89% of imperviousness areas of all densities, and 2.02% of built-up zones.IMD has been used in the reclassification of urban areas within the UA. Table 4 provides an overview according to the imperviousness density on the basis of which the subclasses UA 11100 (IMD> 80%), 11210 (IMD 50-80%), 11220 (IMD 30-50%), 11230 (IMD 10-30%) and 11240(IMD <10%) are obtained.

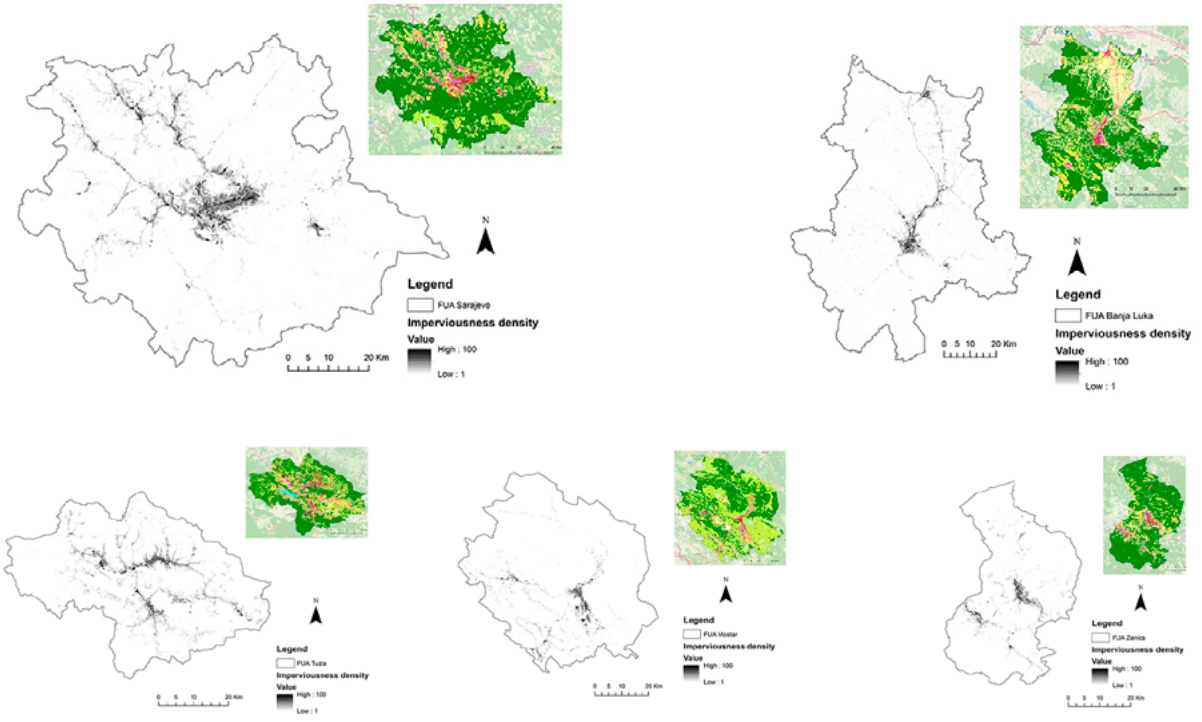

Figure4 to 8. Degree of Imperviousness and UA maps of the FUAs (the forest is shown in green, the agricultural land in yellow, and the urban areas in red)
[click on figure to enlarge]

Table 3. IMD 2018 and IBU 2018 total areasfor FUAs

	Sarajevo		Banja Luka		Tuzla		Mostar		Zenica	
	km²	%	km²	%	km²	%	km²	%	km²	%
IBU 2018	53.24	2.02	33.94	1.23	43.67	3.89	18.94	1.04	13.24	1.53
IMD 2018	102.45	3.89	65.82	2.39	64.01	5.70	37.75	2.07	28.99	3.35

Source: own work based on IMD 2018 and IBU 2018 database

Table 4. Detailed Imperviousness densityof FUAsshown by percentages

FUAs	Area	IMD>80%		IMD 50-80%		IMD 30-50%		IMD 10-30%		IMD<10%	
	km²	km²	%	km²	%	km²	%	km²	%	km²	%
Sarajevo	2636.2	14.76	0.56	28.38	1.08	30.16	1.14	25.25	0.96	3.90	0.15
Banja Luka	2749.0	11.79	0.43	16.90	0.61	18.83	0.68	15.45	0.56	2.85	0.10
Tuzla	1123.0	6.39	0.57	13.92	1.24	20.21	1.80	19.85	1.77	3.66	0.33
Mostar	1821.9	6.05	0.33	11.63	0.64	11.14	0.61	8.06	0.44	0.57	0.03
Zenica	865.3	3.54	0.41	7.10	0.82	9.14	1.06	8.04	0.93	1.18	0.14

Source: own work based on IMD 2018 database

Based on the UA data in most cities the artificial/developed land accounts for less than 30% of total land (often just 10%-20%) while the remaining is classified as natural areas (agricultural, forests, etc.) (Prastakos et al., 2017). In the case of FUAs in B&H, artificial surfaces represent 13.63% of the total area in Tuzla, which is related to the highest population density, while in other cities they account for less than 10% of the area (Table 5). The distribution of urban fabric among the three land use density classes (C1, C2, C3) differs between the cities. The continuous urban fabric is concentrated in the core of the cities, with densities diminishing as the distance from the center increases. The continuous urban fabric and discontinuous dense urban fabric (C1 and C2) are the most compact in Mostar and the largest widespread segregated urban zones are in Banja Luka and Tuzla. On the other hand, the highest value of discontinuous very low, low, and medium-density urban fabric (C3, <10%-50%) are noticed in Tuzla and Zenica.

Table 5 shows the distribution of urban subclasses according to the UA classification nomenclature. Sa-

rajevo has the largest continuous and dense discontinuous urban area, which is expected, given the number of inhabitants. In Zenica, these subclasses cover the smallest areas. However, when it comes to the percentage share of dense urban areas in the total urbanized area, then Mostar has the highest percentage of C1 (1.7%) and C2 (18.1%) and thelowestpercentage of very low urbanization density (32.7%). Banja Luka has the lowest density of urban fabric with 46.9% of the territory with a very low urbanization density (11240).

Table 5. Urban fabric subclasses distribution in FUAs

FUA 2018	11100		11210		11220		11230		11240		11300		Artificial	
	km²	%	km²	%	km²	%	km²	%	km²	%	km²	%	km²	%
Sarajevo	1.8	1.2	17.1	11.4	23.1	15.5	41.6	27.8	57.2	38.3	8.5	5.7	222.5	8.4
Banja Luka	0.4	0.2	9.5	5.8	18.9	11.5	35.9	21.8	77.1	46.9	22.6	13.8	227.9	8.3
Tuzla	0.5	0.5	4.6	4.4	12.2	11.6	45.8	43.3	40.8	38.6	1.7	1.6	153.1	13.6
Mostar	0.9	1.7	9.3	18.1	9.0	17.6	10.5	20.5	16.7	32.7	4.8	9.4	92.9	5.1
Zenica	0.4	0.9	2.8	6.0	7.7	16.2	15.0	31.5	20.1	42.2	1.6	3.3	68.6	7.9

Source: own work based on UA 2018 database

Mostar has a dense urban core due to the old part of the city, where oriental architecture with narrow streets predominates. On the other hand, Banja Luka is a modern city, most of which was built after the devastating earthquake in 1969, and that is why the later expansion of the city was strictly regulated by spatial plans.Among other cities, Sarajevo has relatively high values of urban density, also thanks to the oriental urban core while Tuzla and Zenica have medium density.The main factors that determined the urban development in B&H have been the following ones: rebuilding of infrastructures, houses, and buildings, the change of economic model from the socialist to the capitalist system, and displacement of the population from one entity or region to another.

Urban sprawl

A number of definitions of urban sprawl have been suggested in the English literature, but there is no general agreement about what defines urban sprawl (Wilson et al., 2003). EEA has described sprawl as 'the physical pattern of low-density expansion of large urban areas, under market conditions, mainly into the surrounding agricultural areas' (EEA, 2006; EEA, 2017a). Also, urban sprawls are transition zones with indefinite borders between rural and urban areas (Karakayaci, 2016). Urban sprawl can be defined as urban development with low-density housing, both residential and commercial, segregated land-use, high level of automobile use combined with a lack of public transport, which is in high demand for land (Johnson, 2001).A systematic evaluation of the existing definitions of urban sprawl showed that most definitions have three dimensions in common (Jaeger et al., 2010): (1) the expansion of urban areas; (2) the scattering of settlement areas, that is how densely clumped or widely dispersed the buildings and patches of built-up areas are within the landscape (area-intensive growth); (3) low-density development (i.e. high land uptake per person).

Table 6 provides an overview of the basic types of land cover according to the UA nomenclature. It can be seen that in all FUAs, urban areas are increasing, and agricultural land and forests, and semi-natural areas are decreasing.

Table 7 shows that urban zones are most widespread at the expense of agricultural land. In 4 out of 5 cities, over two-thirds of the expansion take place over agricultural land in the suburban zone, which is a permanent loss of agricultural land. Thanks to geophysical characteristics, in the area of Banja Luka, as much as 88.39% of new urban areas have been built on former agricultural land. Tuzla has a similar percentage with 82.35%. Both cities are located in the lowland of the Peripannonian region where agricultural land predominates. Zenica and Sarajevo, located in the Bosna River Valley, also have urban sprawl

Table 6. FUAs by main classes (km²)

	Sarajevo		Banja Luka		Tuzla		Mostar		Zenica	
Years	2012	2018	2012	2018	2012	2018	2012	2018	2012	2018
Artificial surfaces	216.5	222.5	224.6	227.9	151.9	153.1	89.7	92.9	67.5	68.6
Agricultural areas	525.3	521.0	1070.1	1067.8	348.8	348.1	239.6	239.8	177.1	176.7
Forest and (semi-) natural areas	1891.2	1889.4	1443.3	1441.7	606.2	605.2	1484.5	1480.7	617.4	616.8
Water and wetlands	4.2	4.3	13.0	13.6	16.2	16.7	9.0	9.3	3.4	3.4

Source: own work based on UA Change 2012-2018 database

Table 7. Structure of urban fabric sprawl to other land cover types

FUA	Other artificial (12, 13, and 14) to urban fabric		Agricultural land to urban fabric		Forest and semi-natural to urban fabric		Total
	km²	%	km²	%	km²	%	km²
Sarajevo	0.351	15.85	1.52	68.65	0.343	15.49	2.214
Banja Luka	0.030	1.37	0.395	88.39	0.022	4.83	0.447
Tuzla	0.039	1.76	0.28	82.35	0.021	6.18	0.34
Mostar	0.138	6.23	0.289	33.76	0.429	50.12	0.856
Zenica	0.025	1.13	0.252	76.83	0.051	15.55	0.328

Source: own work based on UA Change 2012-2018 database

at the expense of agricultural land with 76.83% and 68.65%, respectively. In Mostar alone, this percentage is significantly lower, with 33.76%, because the urban sprawl takes place mainly over the karst environment, i.e. grassland (34.81%) and forests (15.30%), which in total makes 50.12%.

In the area of Sarajevo, 15.85% of new urban zones have been built over artificial surfaces, almost half of which (7.27%) has been built on the locations of previously registered construction sites. East Sarajevo, a new city that has been developing rapidly in the last two decades, has a significant share in this. Urban zones have been expanded at the expense of forests (12.74%) and semi-natural areas (2.8%) with a total of 15.49%. This is partly due to topographic limits, given that the Sarajevo valley is limited to urban expansion, so it takes place not only on agricultural land but also on other artificial areas and thanks to deforestation. After Sarajevo, the city that expanded the most was Mostar with 0.856 km², and Zenica expanded the least with 0.328 km².

The last column in Table 7 shows the amount of urban expansion in absolute terms. If parameters such as the area and population of the FUA are included, we will obtain coefficients that give a more realistic overview of the intensity of urban sprawl. The coefficient k1 shows the relationship between urban sprawl and the area of FUA ($P_{urban\ sprawl}$ / P_{FUA}) and is given in ‰. The coefficient k_2 shows the amount of urban sprawl per 100,000 inhabitants ($P_{urban\ sprawl}$ /Population/100,000). Compared to the FUA area, Sarajevo and Mostar expand the fastest with k1 values of 0.84 ‰ and 0.47 ‰, followed by Zenica with 0.38 ‰, Tuzla with 0.3 ‰, and Banja Luka with 0.16 ‰. In relation to the number of inhabitants, Mostar expand the fastest with ak2 value of 0.56, followed by Sarajevo with 0.4, Zenica with 0.21, Banja Luka with 0.15, and Tuzla with 0.12.

Figure 9 shows the absolute and relative values (k_1 and k_2) of urban sprawl. Sarajevo has the largest expansion in absolute terms, which is expected given that it is the largest urban zone, with twice as many inhabitants as Banja Luka and Tuzla or three times as many as Mostar and Zenica. When it comes to the relative values of urban sprawl in relation to the number

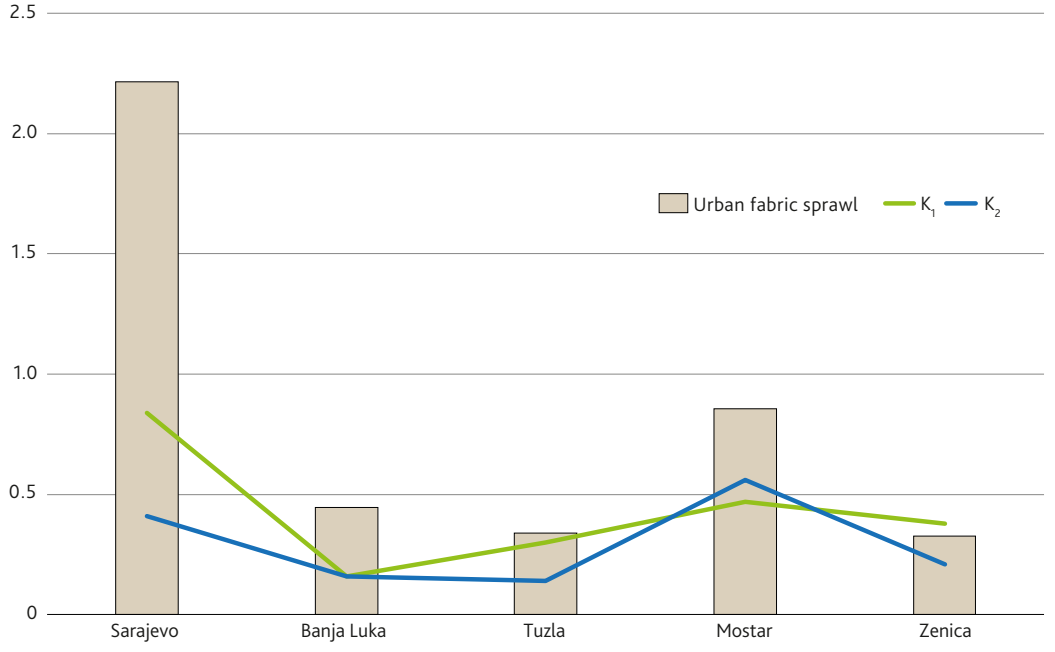

Figure 9. Absolute and relative values of urban sprawl

of inhabitants, Mostar records the highest intensity, and Tuzla and Banja Luka the lowest one. The reasons for the rapid expansion are related to the gravitational influence of Mostar on the Herzegovina region.

Sarajevo, as a capital, attracts predominantly Bosniaks, arriving not only from Bosnia but also from the Sandžak region in Serbia and Montenegro. The data from two censuses show that the share of Bosniaks in the Sarajevo Canton population increased from 50.8% to 83.8%. The city of Mostar attracts Croats (33.9% in 1991 and 48.4% in 2013) from west Herzegovina. In the Banja Luka region, the share of Serbs in the population increased from 64.6% in 1991 to 88.6% in 2013.

According to the CLC Changes database, the urban sprawl was most intense during the period 2000-2006, when the refugee return process in B&H was at the largest level. New settlements were built for returnees as well as for those who wanted to stay in the new locations. The total urban sprawl in B&H was 62.86 km². New settlements were built mostly at the expense of agricultural land, which was converted into a discontinuous urban area in the amount of 58.83 km² (or 93.6% of the total area of expansion).

The next six-year period, from 2006-2012, significantly differs from 2000-2006. Residential sprawl—the main driver of artificial development in the previous period—almost disappeared from the landscape. In the period 2006-2012, the sprawl is driven mostly by extension of mines, quarries and waste dumpsites and also by construction (EEA, 2017c). Other reasons for reducing the intensity of change include the largely completed refugee return process in B&H, as well as the global economic crisis that affected the stagnation of the economy and the decline in artificial land growth (Drašković et al., 2020).

The stagnation of the urban sprawl continued in the period 2012-2018. Only 0.35 km2 of the new discontinuous urban area was recorded throughout the country. In this period, a trend of rapid population decline was observed. From year to year, there have been fewer and fewer newborns and more and more young people leave the country and go to developed western countries.

Thus, according to the CLC database, it is noticeable that FUAs urban sprawltook place at the expense of agricultural land mainly during the period 2000-2006. The largest expansion was in Sarajevo with 13.1 km², followed by Tuzla with 9.28 km² andZenica with 3.33 km². Banja Luka and Mostar had the smallest sprawlwith 2.48 km² and 1.69 km² respectively. In the other two periods, there is almost no urban expansion (Figure10). The fact that small changes are not visible in the CLC database due to the low resolution occurs an additional reason for the reduced intensity of urban expansion. It is especially difficult to notice individual construction or zones of small construction sites, so urban expansion is often not registered in these cases.

Statistically significant differences show that the Urban Atlas 'sees' small and sparse features better than CORINE (Petrişor&Petrişor, 2015).Inthe case of this research, the CLC database is partially com-

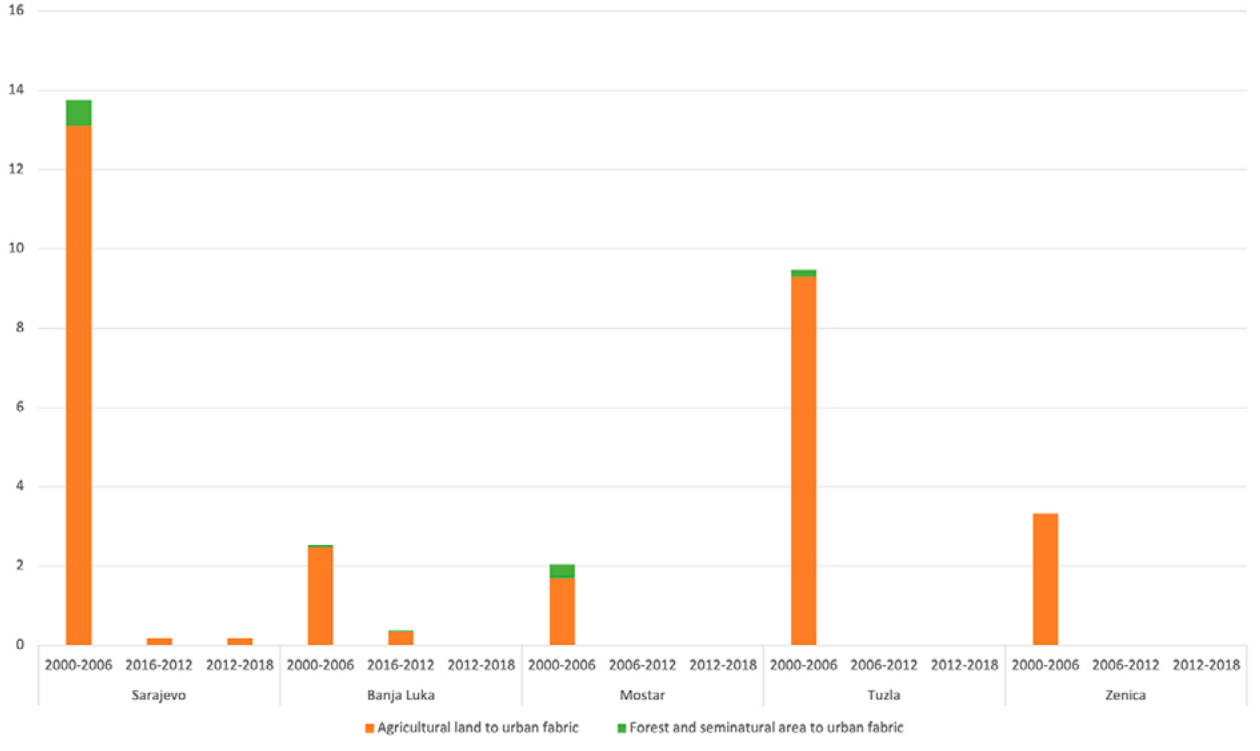

Figure 10. Urban sprawl over other classes according to CLC Changes database (km²)

patible with the UA database. Namely, these two databases overlap only in the period 2012-2018 when, according to the CLC database, no urban expansion was recorded in any FUA. On the other hand, higher UA resolution recorded the spread given in Tables 6 and 7, which was not registered by the CLC database.

The rapid growth and uncontrolled development of municipalities can make the development of a given settlement unsustainable; spatial conflicts can arise, the functions of individual plots may be in conflict, and the costs of transport and technical infrastructure may be unsustainable (Pach, 2016). The process of maintaining sustainable urban development requires greater regulation of local governments and stricter planning. There are numerousenvironmental risks limiting the extensive growth of settlements.A serious issue is the insufficient capacity of technical infrastructure such as sewerage and wastewater treatment.

Conclusion

According to the Urban Atlas database, the largest functional urban areas in B&H continue to expand despite the declining population. The urban sprawl has taken place mainly at the expense of agricultural land. Sarajevo, as the capital, represents the largest urban zone with the fastest expansion. During the period 2012-2018, it expanded to a new area of 2.214 km², which is more than all four other FUAs combined. This trend is also a characteristic of other countries in the region. The reasons for this process could be found in rural-to-urban migrations, the higher income andnumber of motor vehicles, cultural traditions, and housing preferences, etc.The similarity between B&H and neighboringpost-communist countries refers to the process of transition from one economic system to another, relatively slow economic development, infrastructure construction, etc. The biggest differences relate to internal migration based on the process of post-war ethnic homogenization and thelack of employment opportunities in smaller cities.

Tuzla and Sarajevo have the highest population density, the highest percentage of areas over 50% of imperviousness density,and the most built-up areas with 3.89% and 2.2%, respectively. According to the structure and distribution of urban zones, the city of Mostar has the densest urban core thanks to its oriental architecture with compact buildings and narrow streets. In addition, after Sarajevo, Mostar has the fastest expansion in relation to the area its FUA occupies. On the other hand, Banja Luka has a low density of the city center, i.e. the urban area is spread over a large area with more than half of it with very low density, below 10%. Also, Banja Luka has the slowest expansion compared to other FUAs. In relation to the number of inhabitants, Mostar has the highest intensity of expansion, followed by Sarajevo, while Banja Luka and Tuzla have the slowest expansion.

The CLC database shows that the highest intensity of urbanization was in the period 2000-2006. In the following two periods, the expansion of urban zones almost disappeared. However, it should be noted that the CLC database has a 100 times lower resolution compared to UA, so it is more difficult to register small changes in the urban sprawl.

Having in mind the demographic forecast, the number of inhabitants in B&H will further decrease, so that the urbanization will be slower. Only an accelerated economic development can be the driver that will maintain the current intensity of urbanization. It is an opportunity to focus more on better solutions in the process of urban planning.It is necessary to balance the urban expansion in order to prevail the so-called 'over-domination' of the centre,taking the environmental issues into account as well.

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The Influence of Home and School Environments on Alcoholic Beverages, Tobacco and Marijuana Consumption by Adolescents in Prague and Brno

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Abstract

Excessive use of alcoholic beverages, tobacco or marijuana is problematic not only for adults, but in some countries, it is a significant problem for children. However, the reasons for differences in children's risk behavior, as well as the reasons for risk behavior itself, are not yet fully understood. In this article we focused on the association between the quality of the school and home environment (and their surroundings) as perceived by children themselves and their risk behavior in relation to the use of selected substances. We worked with group of 343 9th grade primary school pupils in different types of neighborhoods. The results of our research show that at least some aspects of the quality of the physical environment have an impact on children's risk behavior.

Keywords: health risk behavior; school environment; family and individual factors; adolescence

Introduction

The quality of the environment we live in, as well as its individual person perception, has a significant influence on our health. Relations between environmental characteristics and risky behaviors are very complex and complicated. The growing interest in this topic has been reflected by lots of expert studies, not only medical, but also psychological, health-political or social-epidemiological ones. Also geographical studies focusing on the quality of the physical (built) environment and health have aroused public interest lately (Krieger & Higgins, 2002; Handy et al., 2002; and others). As results of the studies show, the characteristics of the environment and living conditions in a particular area influence health and health behaviour of the population and may be related to their health-risk behaviors.

Poor physical and social environment aspects (home or school environments and their surroundings) are often topics of interest for experts in relation to health-risk behaviours of adolescents (Jang & Johnson, 2001; Duncan, 2002; Galán et al., 2021). Addiction research confirms that early and intensive addictive substance abuse by adolescents leads to numerous physical, social and mental problems, not only during the adolescence but also later in the adulthood (Newcomb, 1997). Experts agree that it is not possible to focus only on studying home quality and the quality of social relationships in families, but also on school quality and environments (Leatherdale & Manske, 2005; Reynolds et al., 2019). As for adolescents, it is just this case that school environments, relationships with classmates or social relationships are often as-

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sociated with drug abuse (Hawkins et al., 1992; Ensminger et al., 2002; Spilková, 2015).

In this article, we have used the latest published data of the European School Survey Project on Alcohol and Other Drugs (ESPAD, 2020) and our own field research in the form of a survey questionnaire, which we carried out at selected schools in two biggest cities in Czechia - Prague and Brno. We have tried to analyze some of the relations between the environment in which children and adolescents live and study and substance abuse in the context of the Pan-European ESPAD project's results. Our main goal was to find out whether and, if so, which aspects of the environment affect students the most. In our study, we have followed up on the first national study focusing on the influence of the physical environment, namely the types of housing developments, on health-risk behaviours of Prague adolescents (Dzúrová et al., 2015). This study has focused on studying risky behaviours of young people through the quality of their homes and school environments within several different types of housing developments in Prague. We have followed up on this pilot research, we further modified it and included the second largest city in the Czech Republic - Brno.

Data and methods

This study has used data that we collected from the survey questionnaire which was carried out in two largest Czech cities - Prague and Brno - between November 2018 and October 2019 using the Google Forms tool. There were two inclusion criteria for the research groups: 1) respondents were pupils of the 9th grade of primary schools, and 2) only two classes at one school could participate in the research. Questionnaires were filled in online by the 9th grade pupils from a total of 19 primary schools - 10 from Brno, 8 from Prague (one pupil did not report his/her school). There were two criteria for the school selection: 1) schools were selected according to the predominant type of housing developments while different types of housing developments were included approximately evenly, and 2) according to the locations in Prague and Brno (considering whether the schools were located on the outskirts or in the city centers).

The research was carried out after it had been presented to the principals of the selected schools (or prevention methodology or educational counselors) and after they had agreed to it. The participation in the research was voluntary and anonymous. Both factors were emphasized to the principals of the schools where the project took place, and also at the beginning of each questionnaire which were presented to pupils.

A total sample of 343 pupils filled in the questionnaire. At the time of the questionnaire completion, 54% of the pupils were 15 years old, 39% were 14 years old, 6% were 16 years old. 3 respondents reported ages that did not correspond to the ages of the 9th grade pupils, namely one respondent was 13 years old and two pupils were 17 years old, which was not clarified. Two students did not report their ages. The ratio of girls vs. boys was 53.4% vs. 46.6%. Out of a total of 343 completed questionnaires, 186 were from Prague, 156 from Brno and in one questionnaire the question on the school location was missing.

There were 47 questions altogether in the questionnaire. The first part of the questionnaire focused on demographic issues such as age, gender, family financial situation (from the respondent's point of view), parents' education and the pupil's relationship with friends, parents and, if there are any, siblings. The second part of the questionnaire included questions focusing on who the respondent lived with, how he/she got to school, what he/she thought about the school and its environment and about his/her place of residence and its environment. The questionnaire was based on the Likert scale where respondents choose their answers from a predefined scale of answers. One of the key points of the questionnaire was the question on the types of housing developments in which the respondents' places of residence were located. In order to understand this question better, pupils were given six illustrative pictures with the names of residence categories (Fig. 1). They had to choose which of the pictures most closely resembled the place where they lived. They could choose from the following categories: block of flats, old city apartment house, new city apartment house, old detached house, new detached house and terraced house. The types of housing developments were selected with regard to the most common housing developments in Czech cities. Table 1 shows the percentage of the respondents by types of housing developments in their places of residence.

A total of 28.0% of respondents take usually 5 minutes to get to school, 40.2% of pupils take 6-15 minutes, 21.0% take 16-30 minutes, 8.7% take 31-60 minutes and 2.0% of pupils take more than one hour to get to school. While in Brno 75.6% of pupils take 15 minutes to get to school, in Prague it is only 61.8%. The big (but not surprising) difference between Prague and Brno is in the percentage of pupils who take more than half an hour to get to school - there are only 5.1% of them in Brno and 15.6% in Prague.

Figure 1. Types of housing developments including survey pictures
Source: Pictures 1, 3 and 5 - license CC0, pictures 2, 4 and 6 – author pictures

Table 1. Percentage of respondents based on types of housing developments at their places of residence

Type of housing developments	Brno	Prague	Total
New city apartment house	9..6%	8.1%	8.7%
New detached house	11.5%	23.1%	17.8%
Block of flats	30.8%	22.0%	26.2%
Terraced house	20.5%	9.1%	14.3%
Old city apartment house	19.9%	20.4%	20.1%
Old detached house	7.7%	17.2%	12.8%

Note: Due to rounding, the sum does not add up to 100.0%
Source: Own research

The following part of the questionnaire focused on the frequency and intensity of tobacco, alcoholic beverages and marijuana consumption by respondents and their closest relatives. The aim was not only to find out whether and to which extent pupils used selected substances, but also whether their consumption was affected or not by the consumption of the same substances by their close ones. For this reason, the question on how they got the substances was also included in the questionnaire. The last part of the questionnaire included questions on health and physical activities.

Concerning the families' financial situation, 58.3% of respondents answered that their financial situation is rather average, 27.1% of respondents reported their families as rather rich and 7.3% as very rich. A total of 6.7% of respondents think that their families' financial situation is not very good and only 0.6% of respondents think that it is not good at all. More than one quarter of pupils have parents with high school diplomas, 18.7% with university degrees, 14.9% have a father with a university degree and a mother with a high school diploma. 85.7% of respondents have siblings (including step-siblings).

Differences in the frequency of answers to the same questions in the questionnaire between a subgroup of pupils with no risky behaviours and a subgroup of pupils with at least one risky behaviours were evaluated using a chi-square test in a contingency table and expressed as Odds Ratio with a 95% confidence interval.

Results

In terms of risky behaviours, three risks were evaluated - (1) alcohol consumption, (2) smoking and (3) marijuana consumption. Before evaluating, it was first important to determine the extent to which the consumption of selected substances will be considered risky. In this respect, we relied on the WHO and SZÚ recommendations. Daily cigarette smoking (that is at least 1 cigarette per day) was considered risky tobacco consumption. As for alcohol, its consumption was considered risky if a pupil replied that he/she had drank 5 or more glasses of alcohol on at least three separate occasions in the last 30 days (one glass of alcohol means either 0.5 l of beer, 0.2 l of wine or 0.05 l of spirits). Pupils who had used the substances at least 6 times in the last year were considered risky users of marijuana or hashish. We also found out how many types of risky behaviours were identified concerning a pupil - whether none, one, two or even all three types. We also found out the respondents' perception of the quality of the internal and external environments of their homes and schools they attended.

With a sample of 343 respondents who filled in the questionnaire, 273 respondents were considered with no risk of alcohol, tobacco or marijuana consumption, 70 respondents with at least one risky behaviour (of whom 39 only used one risky substance, 17 two and 14 three substances). In other words, about 20% of the pupils who filled in the questionnaire took at least one of risky substances. The most common were alcohol (46 pupils) and tobacco (40 pupils). We identified 29 students at-risk for marijuana consumption.

If we compare the number of high-risk substance users among pupils in Prague and Brno (Figure 3), the situation in the capital city is worse off. In Prague, we classify 15.1% of pupils as at-risk tobacco users, in Brno it is 7.7%. The difference between the two cities is statistically significant (OR 2.141, CI 1.050-4.368). 17.2% of Prague pupils and 9.0% of Brno pupils consume alcohol at a risk level. This statistical difference is also significant (OR 2.122, CI 1.088-4.140). There is no big difference as for marijuana, 9.7% of respondents from Prague and 7.1% of respondents from Brno are among risky users. This difference is statistically insignificant.

As for pupils who attend schools in Prague, the situation is more serious in terms of the number of risky behaviours. Although the difference in the number of pupils based on the number of risky behaviours between Prague and Brno did not reach statistical significance, Figure 2 shows that in Prague the percentage of pupils with risky behaviours is higher than in Brno. Out of the total number of 186 respondents, 23 of them reported one risky behaviour, 11 of them reported two risky behaviours and 11 of them reported three risky behaviours. The questionnaire was filled in by 156 pupils from Brno schools, of whom we reported 16 with 1 risky behaviour, 6 with 2 risky behaviours and 3 with three risky behaviours.

Table 2 summarizes the percentage of respondents' risky behaviours based on types of housing developments. The most pupils with risky behaviours live in new detached houses. Risky users of all three types of substances are most common among inhabitants of new detached houses, 21.3% of the pupils living in this type of housing development are risky alcohol consumers, 18.0% of the pupils smoke cigarettes and 13.1% of the pupils use marijuana. The lowest number of the pupils with no risky behaviours is among the pupils who live in this type of house. On the other hand, among the pupils who live in terraced houses, there occur the least risky users of all types of the substances, there are also the most pupils with no risky behaviours at all and there were even no respondents with all three risky behaviours.

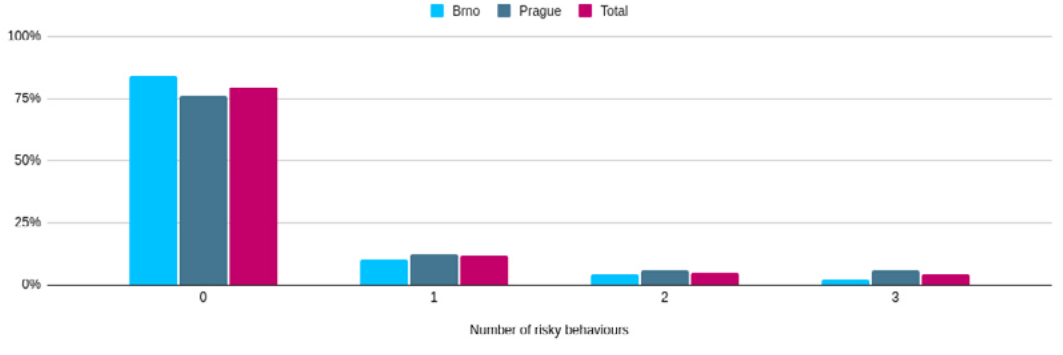

Figure 2. Percentage of pupils based on city categories and the amount of risky tobacco, alcohol and marijuana consumption

Note: The only pupil who did not report his/her place of residence did not behave risky and is included only in the "Total" column

Source: Own research

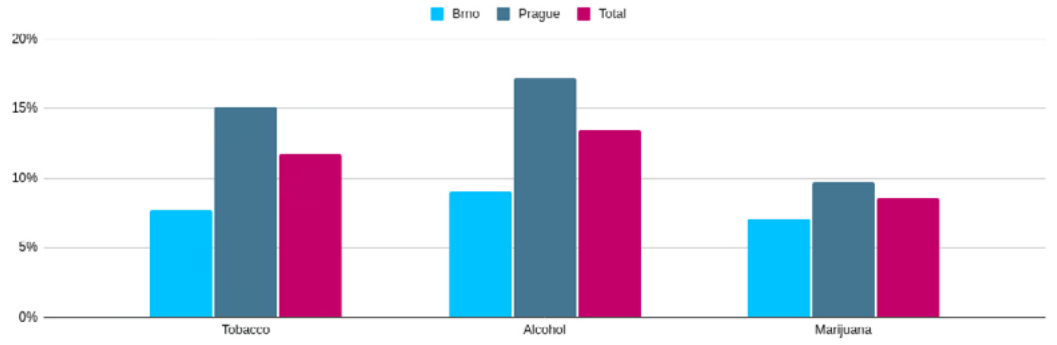

Figure 3. Percentage of respondents at-risk consuming tobacco, alcohol or marijuana
Source: Own research

Table 2. Percentage of respondents at-risk consuming tobacco, alcohol or marijuana, based on types of housing development

	N = 343	Tobacco		Alcohol		Marijuana	
		Abs.	(%)	Abs.	(%)	Abs.	(%)
New city apartment house	30	3	10.0	5	16.7	3	10.0
New detached house	61	11	18.0	13	21.3	8	13.1
Block of flats	90	12	13.3	14	15.6	6	6.7
Terraced house	49	1	2.0	3	6.1	3	6.1
Old city apartment house	69	7	10.1	7	10.1	6	8.7
Old detached house	44	6	13.6	4	9.1	3	6.8

Source: Own research

The main aim of this study was to find out whether and, if so, how the risky use of selected addictive substances by primary school pupils is related to their places of residence and school attendance. **We set a null hypothesis that at-risk alcohol, tobacco and marijuana consumption is not related to places of residence and places of school.**

Pupils could choose from five different answers to the question "How do you like going to school?": I like very much, I like, I quite like, I dislike, I don't like at all. Table 3 summarizes results. We have found out statistically significant difference between subgroups of pupils with and with no risky behaviours in answers "I like" (OR 0.413, CI 0.188-0.907) and "I don't like at all" (OR 3.231, CI 1.497-6.971). In other words, pupils who like going to school are less likely to use risky substances by 60% than other pupils. On the other hand, pupils who dislike going to school are more than three times likely to use risky substances than other pupils. The answer "I like very much" was only reported by pupils with no or one risky behaviours. Pupils living in new detached houses like going to school best. 32.8% of them replied to the question "How do you like going to school?" by choosing answers I like very much or I like, on the other hand, the smallest percentage of the same answers was reported by pupils living in old apartment houses (18.8%).

The 93.4% of pupils living in new detached houses replied to the question "Do you think that the place

Table 3. Percentage of responses to the question "How do you like going to school?" of respondents with (at least one) and with no risky behaviours

	Pupils with (at least one) risky behaviours N=70	Pupils with no risky behaviours N=273	OR (95% CI)
I like very much	1..4%	5.9%	0.233 (0.030-1.786)
I like	11.4%	23.8%	0.413 (0.188-0.907)
I quite like	45.7%	47.6%	0.926 (0.547-1.569)
I dislike	22.9%	16.1%	1.542 (0.810-2.938)
I don't like at all	18.6%	6.6%	3.231 (1.497-6.971)

Source: Own research

you live is good to live?". Pupils living in new and old apartment houses are not very satisfied. However, the level of satisfaction is still high, about 77%. We have found out a significant difference among groups of pupils with risky and with no risky behaviours in their answers to this question as "Yes, it is a very good place" and "It is quite a good place". These answers were reported mostly by pupils with no risky behaviours, on the contrary, the answer "Yes, it is a good place" was mostly reported by pupils with at least one risky behaviour. However, the statistical evaluation of the differences among pupils with risky and with no risky behaviours did not give a consistent result in terms of a biologically plausible gradient (Table 4).

Table 5 summarizes answers to the question whether pupils feel safe where they live, across categories based on the risk of substances consumption. Pupils who always feel safe where they live are about 50% less likely to use addictive substances, pupils who usually feel safe where they live are, on the contrary, about two times more likely to use addictive substances. The difference was not so statistically significant for the answers "sometimes" and "never".

Table 6 summarizes the results of responses to the question whether the respondents consider the selected facts in the surroundings of their places of residence as problematic. These facts include:

1. riots due to racial, ethnic or religious differences
2. mess, rubbish, broken glass in the streets, pavements, courtyards
3. drugs or excessive alcohol consumption
4. violence, vandalism and criminality
5. heavy traffic, traffic jams
6. abandoned and unmaintained properties in the surroundings
7. bad environment and lack of green spaces
8. lack of playgrounds and other sports grounds

Most pupils with no risky behaviours consider heavy traffic (31.5%), drugs or excessive alcohol use (26.0%) and mess (24.2%) in the surroundings of their places of residence as highly or very problematic. Pupils with at least one risky behaviour reported the same problems, but in a different order. The majority of pupils reported drugs (32.9%), mess (30.0%) and traffic (27.1%) as the most negative issues. However, there was no statistically significant difference among answers to this question reported by pupils with and without risky behaviours.

Next, pupils had to aswer the question if they considered the selected facts (the same as in Table 6) in

Table 4. Percentage of responses to the question "Do you think that the place you live is good to live?" of respondents with and with no risky behaviours

	Pupils with (at least one) risky behaviours N=70	Pupils with no risky behaviours N=273	OR (95% CI)
Yes, it is a very good place	21..4%	35.2%	0.503 (0.270-0.937)
Yes, it is a good place	65.7%	48.0%	2.078 (1.201-3.593)
It is quite a good place	5.7%	15.0%	0.343 (0.119-0.992)
It is not a very good place	4.3%	0.7%	6.067 (0.994-37.039)
It is a bad place	2.9%	1.1%	2.647 (0.434-16.156)

Source: Own research

Table 5. Percentage of responses to the question "Do you feel safe where you live?" of respondents with and with no risky behaviours

	Pupils with (at least one) risky behaviours N=70	Pupils with no risky behaviours N=273	OR
(95% CI)			
Always	41..4%	57.1%	0.530 (0.311-0.904)
Usually	50.0%	33.0%	2.033 (1.194-3.462)
Sometimes	7.1%	8.4%	0.836 (0.306-2.284)
Rarely or never	1.4%	1.5%	0.975 (0.107-8.860)

Source: Own research

Table 6. Percentage of respondents who answered that they consider the following facts in the surroundings of their **places of residence** as highly or very problematic

	Pupils with (at least one) risky behaviour	Pupils with no risky behaviours	OR (95% CI)
Riots due to racial, ethnic or religious differences	8..6%	14.7%	0.546 (0.222 – 1.345)
Mess, rubbish, broken glass in the streets, pavements, courtyards	30.0%	24.2%	1.344 (0.751 – 2.404)
Drugs or excessive alcohol consumption	32.9%	26.0%	1.392 (0.789 – 2.455)
Violence, vandalism and criminality	22.9%	19.4%	1.230 (0.653 – 2.317)
Heavy traffic, traffic jams	27.1%	31.5%	0.810 (0.451 – 1.455)
Abandoned and unmaintained properties in the surroundings	12.9%	16.5%	0.748 (0.346 – 1.614)
Bad environment and lack of green spaces	17.1%	21.6%	0.750 (0.378 – 1.489)
Lack of playgrounds and other sports grounds	14.3%	14.3%	1.000 (0.472 – 2.118)

Source: Own research

the surroundings of their **schools** as highly or very problematic as well. Table 7 summarizes the results. A statistically significant difference between pupils with and without risky behaviours was reported regarding mess in the surroundings of their schools (OR 2.076, CI 1.221–3.532) and violence or vandalism (OR 2.094, CI 1.215-3.609). Pupils who consider mess, rubbish, violence, vandalism and criminality in the surroundings of their schools as highly or very problematic are about two times more likely at-risk to consume alcohol, tobacco or marijuana. As for other questions, there were no significant differences.

Table 7. Percentage of respondents who answered that they consider the following facts in the surroundings of their **schools** as highly or very problematic

	Pupils with (at least one) risky behaviour	Pupils with no risky behaviours	OR (95% CI)
Riots due to racial, ethnic or religious differences	21..4%	19.0%	1.159 (0.608 – 2.211)
Mess, rubbish, broken glass in the streets, pavements, courtyards	55.7%	37.7%	2.076 (1.221 – 3.532)
Drugs or excessive alcohol consumption	44.3%	46.2%	0.927 (0.547 – 1.573)
Violence, vandalism and criminality	42.9%	26.4%	2.094 (1.215 – 3.609)
Heavy traffic, traffic jams	35.7%	35.5%	1.008 (0.583 – 1.744)
Abandoned and unmaintained properties in the surroundings	17.1%	23.4%	0.676 (0.342 – 1.336)
Bad environment and lack of green spaces	22.9%	27.1%	0.797 (0.429 – 1.479)
Lack of playgrounds and other sports grounds	17.1%	19.4%	0.859 (0.431 – 1.712)

Source: Own research

Discussion

Factors that impact substance abuse are divided into risky and protective categories (Jessor, 1991; Brooks et al., 2012; Dzúrová et al., 2015). They occur at the individual (e.g. gender, age, lifestyle, value orientation etc.) and spatial levels (e.g. quality and structure of the family environment, the school environment and perception, the influence of the group in which a person exists, cultural patterns and regulations of given social groups etc.). Additionally, there are other conditionalities of risky behaviors that belong to the group of "geographical factors" with a focus on the quality of the youth home environment and schools that pupils attend.

Multiple use of addictive substances does not have a uniform and stable definition in the scientific literature, and the methodological procedure of how to work with the relevant concept and how to measure it is not uniform as well (Dzúrová et al., 2015). Authors use in their studies either indicators of the number or amount of substances used simultaneously, from which they subsequently form various indices. Further, they examine the age of an individual at which he/she experiments

with addictive substances and try to find out what circumstances determine such behavior (Kokkevi, 2012). R. Jessor (1994) defined the syndrome of the so-called risky behavior in his studies in the early 1990s. According to him, such behavior manifests itself in several forms, often mutually intertwining.

In our study, we examined the influence of various potential risk factors on three groups of substance abuse: alcohol, tobacco and marijuana. In the Czech Republic, it is not allowed to sell alcohol and tobacco to people under the age of 18, it is possible to sell marijuana only on prescription and it is illegal to sell hashish. Still, a significant percentage of children and adolescents under the age of 18 have access to these substances, and some of them even use them regularly. Regulation of alcohol, tobacco and electronic cigarette consumption in the Czech Republic is one of the weakest in Europe. It is Germany that is the most liberal in indicators such as taxation, sales restrictions and advertising according to The Nanny State Index (2021). Low regulation is directly related to the availability of these substances among (not only) adolescents. As a result, alcohol and tobacco are more affordable for pupils in our country than in countries where the article is far more expensive due to high taxation. According to the ESPAD's (2020) survey carried out in 35 European countries in 2019, 60% of respondents report the availability of tobacco as "pretty easy" or "very easy", 78% of respondents report the availability of alcohol and 32% of respondents report the availability of marijuana. In the Czech Republic, however, the availability of these substances is considered even higher – 71% of respondents report tobacco availability as "pretty easy" or "very easy", 88% report alcohol availability and 47% report marijuana availability. According to these facts, we can say that the Czech Republic belongs to the countries where the prevalence of these substances abuse by adolescents is rather high. At the same time, however, it is evident that the high consumption is caused not only by their availabilities. In our questionnaire, we also asked about specific sources of risky substances, however this question was not obligatory and not all respondents answered it. Almost 60% of high-risk users answered the question "Where do you get alcohol from?" that they got it from their siblings or friends and 45% bought it themselves in a shop or restaurant. About 16% of respondents got alcohol from their parents. Considering the fact that these are only risky users and that the so-called occasional drinking (small toasts at family celebrations and similar social events) is not reflected, this fact is for consideration.

The attitudes of the pupils declared in the questionnaire should be seen with the knowledge that not everyone had to tell the truth in all questions. This is one of the usual limitations of questionnaires, in that electronically filled questionnaires do not differ from paper ones. For a possible further research it would be good to extend it by interviewing students, but in our case this was already beyond the scope of the research. In our case, we used the Google Forms tool. This method offers some advantages over paper questionnaires, such as simpler and faster processing of the results or the possibility to make some questions mandatory. On the other hand, as with paper questionnaires, there is the possibility of students discussing among themselves what they fill in. The fact that students might have technical problems with the questionnaires and not know how to fill them in has not been confirmed in practice. Students also managed to complete the questionnaire during the class period (45 minutes) without any problems.

Our survey shows that pupils who behave risky as for alcohol, tobacco or marijuana consumption like going to school far less than students who do not behave so. There is an inverse proportion - the more addictive substance they use, the less they like to go to school. This may also be related to relationships that children have with their classmates and friends at schools, the way how their friends behave and especially, whether they also behave risky as for substance abuse. When a pupil gets "bored" at school, he/she is not motivated enough to study, which may be one of the reasons for "playing hooky". Thus, they may experiment with alcohol, tobacco or marijuana. They can be even more encouraged to do so by their classmates or friends with the same motivation, they can also get addictive substances from them or together with them, so these substances are easily available to them. Dvořáková (2006) mentioned that mainly boys adopt behavioral patterns from their older classmates– "bucks", who play hooky, or from former pupils, who gather in the vicinity of schools and consume alcohol and cigarettes. Problem children from schools join such gangs and then experiment with alcohol and cigarettes as well. On the other hand, if a pupil has good relationships at school, he/she receives support from his/her classmates and teachers and likes going to school, which can have a positive impact on them in many ways. As Resnick et al. (1997) pointed out, pupils who have good relationships with their teachers are less likely to use alcohol and drugs than those who do not have close relationships with their teachers. A good teacher can play an important role in preventing addictive substance use. If children trust their teacher, they will also believe more easily that they should not use such substances.

Ideally, children should always feel safe at school. If children feel safe at school only sometimes, rarely or even never, it is completely unacceptable and it is necessary to find the causes and make changes. If pupils feel "mostly" safe at school, it can be caused, ac-

cording to them, by a trouble, such as poor relationships with classmates and, in extreme cases, bullying or other inter-social problems, which can lead to a higher risk of substance abuse. And that is why the respondents who answer that they "usually" feel safe at school are more likely to behave risky.

Another important factor can be the child's family environment and relationships - if parents (or other family members with whom a pupil grows up) can motivate their children to like going to school, such children are less likely to use addictive substances. If a family does not offer a good environment for raising a child or if parents pay little attention to their preschool child, he/she may lag behind their classmates after entering the first year of elementary school. If such a negative issue is not dealt with quickly, it is possible that school will stop being "entertainment" for the child and later it will lead to playing hooky and using addictive substances.

Regarding school surroundings, pupils consider mess and rubbish and also violence and vandalism in the surroundings of their schools as the main problems which mainly pupils with risky behaviors have to face. More than half of our respondents with risky behaviors reported mess and rubbish as problems, 43% reported violence and vandalism as problems. Even more of them considered drugs and alcohol as problems, however there was not a significant difference between perception of pupils with and without risky behaviors. Concerning other observed factors, there were no significant differences between pupils with and without risky behaviors as well. Results of research by D. Dzúrová et al. (2015) differ minimally from our research in this part. According to their research, pupils perceive the biggest problems around their school to be mess and rubbish, drugs and excessive alcohol consumption, as well as violence and vandalism. However, this research also brings an interesting comparison of the prevalence of risk factors and risk behavior syndrome by school surroundings characteristics. In the case of the proportion of green spaces around the school, there is an inverse relationship in terms of the risk of cigarette or marijuana use, i.e. the more green spaces around the school, the less students use these substances at risk. However, this is not the case for alcohol and the dependence is also not clear for the amount of traffic around the school.

Pupils with at least one risky behavior reported less satisfaction with their schools than their classmates with no risky behaviors, namely in 6 out of 8 aspects, in 2 remaining aspects the percentage of pupils who are not satisfied with their school was almost the same in both categories. It seems that risky behaviors occur if pupils are not satisfied with their schools (both school attendance and school building), but the home environment is reported by those pupils as in the rest of a sample. Generally, pupils reported their home environments and the surroundings as better than their school environments and the surroundings, both pupils with and without risky behaviors. Differences in percentages of dissatisfied pupils were smaller concerning school and home environments than concerning buildings themselves.

Regarding individual aspects of places of residence and their surroundings, pupils with no risky behaviors were again more satisfied – they mostly reported their places of residence as very good to live and they always feel safe in the surroundings of their homes. The research has shown that pupils living in new detached houses belong to the category of the most risk factors. On the contrary, pupils living in terraced houses belonged to the category of the least probability on any risky behavior (there were even pupils who have never behaved risky). Respondents living in terraced houses were the least likely to use addictive substances - both overall and also for each risky substance. There were significant differences – while only 2% of respondents living in terraced houses are risky tobacco users, respondents living in new detached houses make up only 18%. The same goes for alcohol which is used at-risk by 6% of pupils living in terraced houses and 21% of pupils living in new detached houses. Both those findings may be related to the fact that the financial situation of people living in new detached house in Prague and Brno, regarding current real estate prices, is better than of people living in terraced houses (which are often old), and also children who live there have more money that they can spend on addictive substances. In this respect, not only the housing development structure was important, but also the fact that the study was carried out in large cities. In smaller towns, housing development structure is different (e.g. more terraced houses, different prices of buildings, etc.) and the situation may be diverse.

Conclusion

Although the numbers of alcohol, tobacco and marijuana users among Czech teenagers are high, according to the ESPAD (2020) research there have been some positive trends in the past years. The number of teenage Czech smokers aged 15 is declining, and the same trend is among alcohol and marijuana users. Some sub-indicators, such as the prevalence of high regular consumption of spirits or wine, have stagnat-

ed or increased slightly, but, according to these data, the overall development is favorable. This is probably related not only to legislative changes and price increase but also to changes in social perceptions of addictive substances. Many people have stopped considering particularly alcohol and tobacco as standard parts of their lives, and as advertisements for these substances and their featuring e.g. in movies have been limited, young people do not have such a need of using them. However, the subjective perception of the availability of most of these substances, which has been very high in the Czech Republic for a long time, has not declined yet.

In conclusion, we can say that some results of our study support the possibility of a relation between at-risk alcohol, tobacco and marijuana consumption and a place of residence, respectively a place of school. Therefore, we do think that both parents and school representatives, but also local government representatives at the municipal level (city district) should pay due attention to both the quality of housing developments and the school environment and the surroundings in order to prevent this undesirable issue. The results of our study are in accordance with the previous findings in the study carried out by the team led by prof. Dzúrová, which states that great attention should be paid to the urban renewal and redevelopment projects focusing on economic, physical, but also social renewal of specific parts of a city. We all know the positive benefits of such investments in health, quality of life and health inequalities (e.g. Dzúrová et al., 2015).

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Handling Slum Settlement Based on Community Participation and Socio–Cultural Change: Perspective of Sustainable Development of Makassar City, Indonesia

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Abstract

Urbanization in the dynamics of development in Makassar City has an impact on increasing population, poverty, social change, acculturation of community culture, marginalization, differences in lifestyle, socio-economic inequality, complexity of space use, slum settlements, and a decrease in environmental quality. This study aims to analyze: (1) Community participation and socio-cultural changes work as determinants of handling urban slum settlements, (2) The influence of community participation, improving the quality of infrastructure, improving the quality of the environment, and changing the socio–cultural community on the sustainability of city development, and (3) Formulate a model for handling slum settlements, community participation, and community social culture towards the sustainability of urban development. This study uses a qualitative-quantitative approach sequentially. Data were obtained through observation, Focus Group Discussions (FGD), surveys, and documentation. The results showed that community participation, improving the quality of infrastructure, improving the quality of the environment, and socio–cultural changes simultaneously affected the sustainability of Makassar City development. Furthermore, the implementation of the program to improve the quality of slums followed by community participation and accompanied by socio-cultural changes will encourage the creation of equitable development, improve the quality of slum settlements, and improve community welfare towards the creation of social cohesion, increase community productivity, and harmonization of community life towards sustainability development of Makassar City, Indonesia.

Keywords: Community Participation; Slums Settlements; Socio–Cultural Change; Sustainable Development

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Introduction

Urbanization in the dynamics of urban development in developing countries has an impact on increasing the need for land to meet the needs for housing development and urban infrastructure. This condition is a challenge for the community and government in meeting the needs of housing, infrastructure, transportation, and other socio-economic activities (Gong, et al., 2014; Zeng, et al., 2017; Pratomo, et al., 2020). The fairly, high trend of population growth is closely related to land use change, the complexity of spatial use, community poverty and slum settlements. The complexity of spatial use, poverty, and the development of slum settlements are positively associated with a decrease in environmental quality (Surya, et al., 2020a). Slum settlements are, also places where the cultural mix of different communities, so that their handling will require empowerment support that is oriented towards improving the welfare and independence of the community (UN–Habitat, 2003; Surya, et al., 2020b).

The community involved in the development process is a reflection, of community participation in planning and acting as the main actor in implementation program. Community involvement in program planning and implementation, namely at the formulation, design, implementation, and post-implementation stages as a unitary development system (Sindleryova, et al., 2019). This means that the community will participate if the implementation of the development program is in accordance with the aspirations and needs of the community itself. Thus, the implementation of strategic policies and programs will require cooperation and participation of development actors (Friesen, et al., 2018). Furthermore, the community will critically understand the problem, the need for handling, propose solutions, and participate in program implementation (Samper, et al., 2020; Surya, et al., 2020c). This means that community participation coupled with socio–cultural changes and being responsible for program implementation will accelerate the handling of slum settlements towards improving environmental quality, reducing poverty, and achieving community homogenization and sustainable development of Makassar City.

Study area

The geographical location of the area, Makassar City is at the coordinates 119°18'27.97" – 119°32'31.03" East Longitude and 5°00'30,18" – 5°14'6,49" South latitude. Slum settlements in Makassar City are distributed in 127 locations and occupy an area of 729 ha with three typological categories, namely (i) slums on the wa-

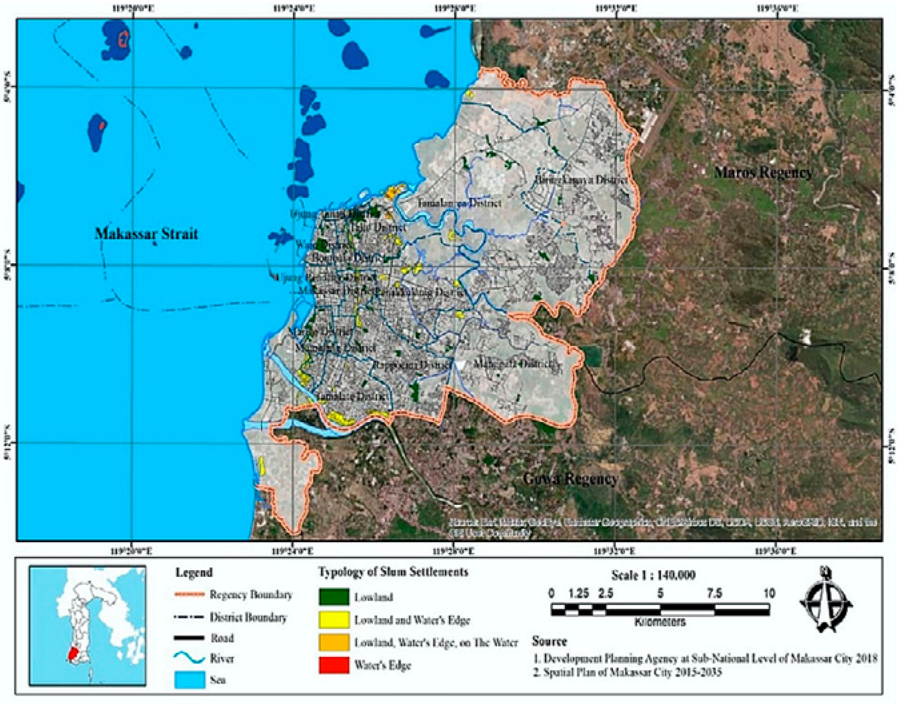

Figure 1. The location of the slum settlements in Makassar City as the object of study

ter, (ii) slums on the waterfront, and (iii) slums in the lowlands. Several things can be explained related to the data, among others: (1) Slum settlements that develop based on their dominant size are located in the Tamalate District occupying an area of 177,91 ha or 24.4%; (2) Slum settlements that have developed in the Tallo District area occupy an area of 119.1 ha or 16.3%; (3) Developing slum settlements in the area of Panakkukang District covering an area of 68.95 ha or 9.5%; (4) Developing slum settlements in the area of Rappocini District covering an area of 59.74 ha or 8.2%; (5) Slum settlements that developed in the Tamalanrea District covering an area of 46.21 ha or 6.3%, and (6) Slum settlements that developed in the Biringkanaya District covering an area of 43.13 ha or 5.9% (BPS Makassar City, 2020). The selection of study locations was based on the following considerations: (1) Characteristics and typology of developing slum settlements have different urgency for handling in terms of physical, economic, and social aspects; (2) The complexity of spatial use due to the existence of slum settlements has a positive association with environmental quality degradation; (3) Slum settlements that develop on illegal land are dominated by the urban poor; and (4) The level of income and work orientation of the community shows differences in terms of community participation in handling slum settlements. Furthermore, the research location is presented in Figure 1 below.

Material and Method

Method of Collecting Data

Observation

Observations in this study were used for data needs, including: (1) Community participation data, namely community involvement and community contributions, both individually and institutionally in the implementation of slum settlement programs; (2) The environmental quality of slums is related to the potential sources of pollution and their impacts; (3) the quality of the infrastructure that has been carried out in the field, and (4) the socio-cultural changes of the community, in relation to the social system and cultural patterns of the community in handling slum settlements. Furthermore, the instruments used in the observations were field notes, a base map of the location of slums, periodic notes, and checklists. The data obtained through the researcher's observations are then used to describe the role of the community and the socio–cultural changes of the community in the slum settlement program that has been implemented.

Focus Group Discussion (FGD)

The Focus Group Discussion (FGD) in this study was conducted six times with 15-20 participants for each implementation. FGD is a systematic process of collecting data and information about a very specific problem through group discussions (Irwanto, 2006). The FGD stages carried out in this study included: (1) Determining the number of groups related to the topics discussed, in this case each group representing the characteristics and typology of slum settlements; (2) Determination of group composition, in this case based on the function and role of each community group; (3) Determination of the location of the FGD implementation, at a neutral location; (4) Seating arrangements to facilitate interactive communication, and (5) Appointing facilitators who represent community elements. The focus of the FGD implementation was used to capture the aspirations and views of the community related to six important things, namely (i) the mechanism applied in the formulation of the slum settlement planning program, (ii) program implementation, (iii) evaluation of the program implementation of the relationship with the condition of the residential environment, (iv)) the value of the benefits obtained after the implementation of the program, (v) the contribution of the community in the implementation of the program, and (vi) the role of community institutions in the implementation of the program. The main topics formulated in the FGD implementation were community participation in handling slum settlements, and community involvement for each process and stage. Furthermore, the FGD process was also used to assess the socio-cultural changes of the community related to attitudes, knowledge, and behavior after the slum settlement program was implemented. The results of the FGD implementation by researchers were used to analyze community involvement at the planning, implementation, evaluation and monitoring stages as well as the value of the benefits obtained by the community in handling slum settlements in Makassar City.

Questionnaire

Data collection through questionnaires was carried out from June to November 2020. Questionnaires were distributed to 127 slum locations spread across 15 districts in Makassar City. Filling out the questionnaire in this study was guided by researchers and enumerators. Respondents who filled out the questionnaire in this study were determined based on the following criteria: (i) facilitators involved in handling slum settlements, (ii) administrators of commu-

nity institutions, (iii) community leaders, (iv) district and village government officials, and (iv) community living in slums. Furthermore, the determination of respondents in this study used a purposive sampling technique determined by the researcher based on certain characteristics. Withdrawal of samples refers to Cochran (1977). Furthermore, the formulations used in determining respondents are as follows.

$$n = \frac{\frac{t^2pq}{d^2}}{1\frac{1}{N}\left(\frac{t^2pq}{d^2} - 1\right)}$$

Where n is the minimum number of samples, N is the population size, t is the level of confidence (used 0.95 so that the value of t = 1.96), d is the level of error (used 0.05), p is the proportion of certain characteristics (group) q is 1 – p, and 1 is a constant number. The number of samples in this study was set at 400 samples.

Data Analysis Method

In order, to answer the second question, namely how big is the influence of community participation, improving the quality of infrastructure, improving the quality of the environment, and changing the socio–cultural community on the sustainability of city development. Furthermore, to examine the effect of community participation (X_1), improving the quality of infrastructure (X_2), improving the quality of the environment (X_3), socio cultural change (X_4), on the sustainability of city development (Y), referring to the questionnaire data obtained in the field, then analyzed using multiple regression methods and correlation analysis. The analysis formula used is as follows.

$$Y = a + b_1X_1 + b_2X_2 + b_nX_n$$

$$r_{xy} = \frac{\sum xy}{\sqrt{\left(\sum x^2\right)\left(\sum y^2\right)}}$$

Where Y is the dependent variable, a is the constant b_1, b_2, b_n is the regression coefficient X_1, X_2, X_n, is the independent variable. Correlation analysis in this study uses product moment correlation, where rxy is the correlation coefficient between X and Y, x is the deviation from the mean for the value of the variable X, y is the deviation from the mean for the value of the variable Y, xy is the sum of the multiplications between the values of X and Y, x^2 is the square of the x value, and y^2 is the square of the y value. Furthermore, in order, to how is the model for handling slum settlements, community participation, and socio–culture of the community towards the sustainability of urban development, using SEM analysis. The application of SEM in this study refers to several exogenous variables, including: First, the construction of slum settlement management is measured by indicators, namely improving the quality of environmental roads (X_1), environmental drainage (X_2), clean water services (X_3), waste water and sanitation. (X_4), and waste management (X_5). Second, the construct of community participation is measured by indicators, namely community participation (X_6), involvement in program formulation (X_7), contribution of ideas (X_8), program implementation (X_9), and responsibility for program outcomes (X_{10}). Furthermore, the constructs of endogenous latent variables include: (1) The socio-cultural latent variables of the community are measured by indicators, namely attitudes (y_1), knowledge (y_2), and behavior (y_3); (2) The latent variables of urban development sustainability, measured by indicators, namely environmental (y_4), economic (y_5), and social (y_6). The SEM analysis method uses the following formulation:

$$\eta = \alpha + B\eta + \Gamma\xi + \zeta$$

$$\eta - B\eta = \alpha + \Gamma\xi + \zeta$$

$$(I - B)\eta = \alpha + \Gamma\xi + \zeta$$

$$\eta = (I - B)^{-1}\alpha + \Gamma\xi + \zeta$$

Where α is the intercept vector, B and Γ is the coefficient matrix and $\zeta = \zeta_1\ \zeta_2\ \zeta_m$ is the error vector in the structural equation, element B presents variable influence η and variable η other, and elements Γ present a direct influence of variables ξ in variable η. It is assumed that ξ not correlated with ζ and I – B is nonsingular. Furthermore, is the intercept vector m x 1, η is the endogenous latent variable m x 1, B is the coefficient matrix of the endogenous latent variable m x m, Γ is the coefficient matrix of the exogenous latent variable m x n, ξ is the exogenous latent variable vector n x 1, ζ structural model error vector.

Result and Discussion

Community Participation and Socio–Cultural Change in Handling Slum Settlement

The slum settlement that has developed in Makassar City is influenced by three main factors, namely (i) community poverty, (ii) the inability of the community to find decent work, and (iii) inequality of land tenure. Land ownership and land tenure play an important role in meeting the basic needs of the community, the quality of the urban environment, housing conditions, and environmental health (Dachaga & de Vries, 2021; Surya, et al., 2021a). Field facts that have been found indicate that the slum management program implemented so far has only focused on the physical aspect, namely improving the quality of infrastructure and its implementation is still partial. This condition illustrates that the social and economic aspects as an integral part of the slum settlement system have not been optimized for handling. The handling of slum settlements is complex and related to social, economic, environmental and infrastructure conditions, so it requires an integrated approach as an integrated urban system (Mahabir, et al., 2016; Surya, et al., 2020d). Thus, improving the quality and repair of slum areas requires synergy between the community and other development actors towards changing the quality of community life (Meredith & MacDonald, 2017). Furthermore, community participation in handling slum settlements in Makassar City is presented in Table 1 below.

Table 1 shows community participation in handling slum settlements in Makassar City. Interpretations that can be put forward to these results include: First, community participation in relation to improving environmental quality shows differences based on

Table 1. Comparison of community participation in handling slums settlement in Makassar City

Parameter	Slum Level of Settlements		
	Heavy Slum	Moderate Slum	Light Slum
Planning Program	Public understanding and knowledge of the planning program is relatively low.	Community participation in the formulation of planning programs is quite intensive and is carried out through surveys of their own villages and mapping of programs for dealing with slum neighborhoods.	The community, both individually and institutionally, is very proactive in program formulation and problem mapping for the needs of handling slum neighborhoods.
Program Implementation	Community participation in program implementation is very low.	Community participation in program implementation is quite intensive, both institutionally and individually.	The role of the community is very positive in implementing the program and formulating achievement targets.
Environmental Condition Evaluation	Community participation in environmental pollution control is very low.	The role of the community is quite good in the process of evaluating and handling the needs of the slum settlement environment.	The community is directly involved in solving environmental problems in which they live.
Benefit Value	Public awareness of the maintenance of development results is very low.	Community involvement is very good regarding the maintenance of the infrastructure that has been built.	Community involvement and responsibility in maintaining the results of program implementation is very positive.
Community Contribution	Community contributions in the form of energy, ideas, and materials are very low.	Community involvement in giving ideas and ideas for environmental management is quite positive.	The contribution of the community in terms of manpower, materials, and ideas for handling the environment is very positive.
Institutional Role	Institutional participation does not play a role due to limited understanding of the program being implemented.	The role of the institution is very active in organizing the community in handling the settlement environment.	Institutional participation in dealing with and solving environmental problems is very positive.

Source: Primary data and analysis results

the level of slums in the settlements. These differences are closely related to knowledge, culture, and community response to program implementation. The results of the Focus Group Discussion (FGD) illustrate that community participation has a direct relationship with socio-cultural conditions. Thus, the program for handling slum settlements, which are dominated by poor people with poor environmental conditions, will require facilitation and assistance based on community empowerment and participation by considering socio-cultural conditions towards improving environmental quality and community welfare in a sustainable manner (Surya, 2015a; Hasanawi, et al., 2019; Surya, et al., 2021b). Furthermore, the factors that influence community participation in the implementation of the slum settlement program are (i) internal factors, namely age, education level, type of work, income level and length of stay, and (ii) external factors, namely communication and leadership in this case the function and role of institutions that are less than optimal in socialization activities have an impact on the weak level of trust and community participation in program implementation. Furthermore, settlements in the category of heavy slums which are dominated by fishing communities are strongly influenced by the work orientation of the community as fishermen who depend on water resources, in the sense that the culture of the fishing community is closely related to the socio-economic relations that are built, namely the patron-client relationship. This means that the dominant pattern of community life still depends on business owners with positive associations on community participation in the implementation of slum settlement programs implemented by the government. Furthermore, settlements with heavy slum categories which are dominantly inhabited by fishing communities are strongly influenced by the work orientation of the community as fishermen who depend on water resources for their lives, in the sense that the culture of the fishing community is closely related to the social relations that are built, namely the patron-client relationship. Meanwhile, settlements with medium and low slum categories are dominated by urban industrial workers, in the sense that the community is not bound by time, so it is very easy to move both individually and institutionally. The main characteristics usually associated with informal settlements are irregular land ownership, self-built housing, low levels of infrastructure and lowincome population (UN–Habitat, 2003). Furthermore, socio-cultural conditions and job characteristics greatly influence community participation and response to the implementation of the slum management program (Surya, 2015b; Mohanty, 2020).

Second, the understanding and level of knowledge that is quite low on the benefits of the program is closely related to the factors of poverty, leadership, and the social structure of the community. This means that community participation in the implementation of the program is closely related to the value of the benefits obtained economically, so that the community considers that the slum settlement program is not their responsibility either individually or institutionally. The poor who live in slum settlements will take the initiative if their needs are met (Lombard, 2014). Thus, the improvement of slum settlements will work well if the social networks of residents and community cohesiveness remain intact and the implementation of government programs is more towards improving their standard of living (Rashid, 2009; Surya, et al., 2018). Third, the slum settlement program that has been implemented by the government is more dominant in improving the quality of infrastructure. That is, programs that are economic in nature and solving social problems that are less touched as a unified system that is integrated with people's lives cause community participation in handling slum settlements to be less than optimal. Thus, it can be concluded that the slum settlement program that does not touch the basic needs of the community socially and economically causes weak community participation in the implementation of the slum settlement program in Makassar City. This means that an integrated slum management system is needed through a strategic program that is carried out comprehensively and in an integrated manner towards solving economic, social problems and improving environmental quality (Archer, 2009).

The handling of slum settlements carried out by the government in Makassar City in addition to encouraging increased community participation also contributes to socio-cultural changes. This condition is characterized by changes in social structures and social systems. Furthermore, changes in community culture are marked by changes in behavior and community responses to support environmental quality improvement. This means that the slum settlement program implemented through infrastructure intervention and the fulfillment of socio-economic facilities has changed the attitudes and behavior of the community, both individually and institutionally. This condition is marked by an increase in the aesthetics of the residential environment and public awareness to live clean in their activities, as well as an understanding of their rights and obligations towards their residential environment. This means that government intervention through slum settlement programs is one of the causes of socio-cultural changes towards improving the quality of people's lives. Furthermore, the facts found in the field indicate that the formation of community institutions is closely related to the system of values and norms that are known,

understood, respected, and obeyed by all community members living in slum settlements. This means that customs and habits have been institutionalized in such a way and are believed by the community as the basis and reference for action and if they are not implemented, something bad will happen to members of the community or the whole community. This tradition is especially developed in communities living in coastal and river areas with the belief that values, and norms are the basis for avoiding natural disasters and dangers that will threaten people's lives.

The results of interviews conducted illustrate that the function of community institutions in slum settlements in Makassar City plays an important role in building trust in strategic programs implemented by the government. If it is based on the type of institution that develops, it illustrates that the existence of these institutions plays a role in regulating community behavior in relation to the situation and conditions of people living in slums. Community trust, social capital, and social ties between residents, play an important role in overcoming social problems that develop in the dynamics of the people who inhabit slum areas (Obaitor, et al., 2021). The basis and parameters for assessing the function and role of community institutions in slum settlements in Makassar City are: (1) Crescive institutions, namely institutions that accidentally grow from the customs and traditions of the community; (2) From the point of view of acceptance, it is categorized into social sanctioned institutions which are accepted by the whole community; and (3) The value system accepted by the community becomes the basic institution. Furthermore, there are two categories of socio-economic life that develop in the dynamics of the development of slum settlements in Makassar City: First, the subsistence economy, this system is dominantly adopted by fishing communities and people whose main activity orientation is as port workers. The characteristics inherent in the social relations that are built are kinship, mutual, cooperation and brotherly relations. This condition is shown in the pattern of social interaction that is close in nature as a community unit. That is, in people's lives tend to be bound by traditions that are hereditary in nature. Second, the commercial economy, this system is dominant in people who occupy slum areas with the category of light slums. The orientation of the community's economic activities is dominant in the service sector, construction workers, and small and medium enterprises. The inherent characteristics and social relations that are built are relatively loose and more towards the lifestyle of urban communities. The economic system of the people in slum areas with categories of heavy slums and medium slums is at the subsistence economic level and is dominated by the urban poor. This means that the pattern of economic activity and the level of community income are classified as very low for the two typologies of slum settlements, in the sense that the income earned is only used to meet the needs of daily life and has difficulty meeting proper housing facilities and the condition of settlement infrastructure that does not meet minimum service standards.

The facts found in the field show that the activities of the people who still rely on their lives as fishermen are not only because of the need for a living, but also because of the historical ties that are still preserved. In general, three patterns of life can be explained, namely (i) appearing on the surface in an atmosphere of socio-economic activities conditioned by the life of fishermen by relying on nature as a source of life, (ii) the dominant form of settlement on stilt houses, (iii) the basis of life that becomes the glue social relations are the environment of traditions, religious beliefs, and socio-cultural ties. Furthermore, the characteristics of slum settlements that develop in Makassar City which can be explained include: (1) Slum settlements that develop in commercial activities are dominated by immigrants with ethnic diversity. The relationship between ethnic and community that is built is more towards economic relations and the main occupations of the community are developed, namely the urban informal economy, construction workers, and casual workers. (2) Slum settlements in industrial activities are dominated by immigrants as industrial workers and occupy residential facilities (rental flats) prepared by the government. The social interactions that are built are reciprocal and mutually beneficial. (3) Slum settlements located in the port area. These settlements are inhabited by migrants and local communities and the provision of community housing facilities is built independently with illegal land status. The main occupation orientation of the community is port workers and casual workers. The social relations that are built are reciprocal. The main problems that are often faced by the community are social conflicts, urban flooding, environmental pollution, and the condition of residential buildings that are unfit for habitation. (4) Slum settlements located on riverbanks and coastal areas that occupy illegal land. The main occupations of the community are fishermen, port workers, and odd jobs. The social relations that are built are symbiotic mutualism and (5) Slum settlements that develop in suburban areas are dominated by local communities and immigrants. The orientation of the community's main activities are building construction workers, day laborers, garbage scavengers, and the urban informal sector. Furthermore, the socio-cultural characteristics of the community before and after experiencing changes are presented in Figure 2.

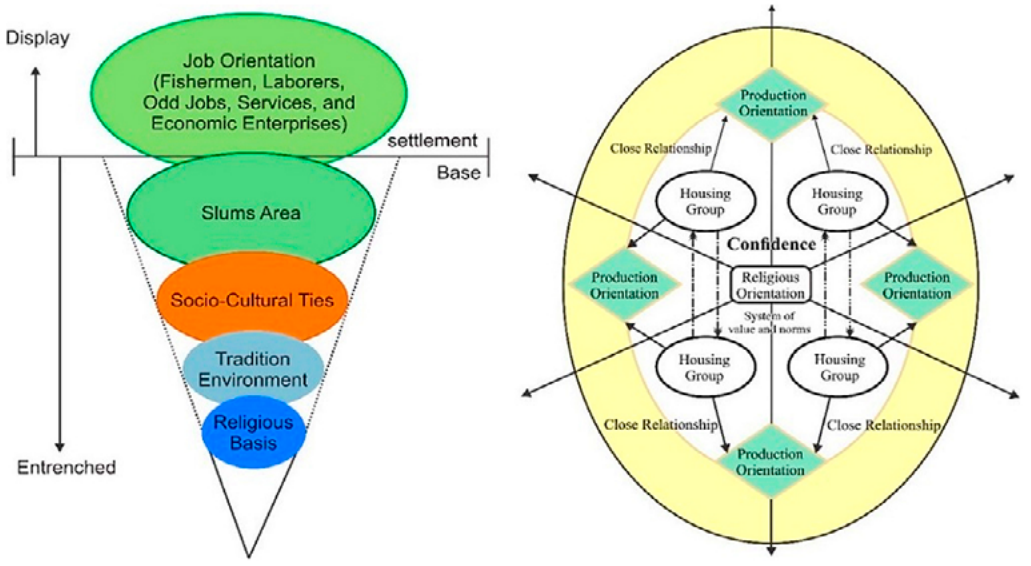

Figure 2. The display pattern of the socio-cultural life of the community in slum settlements in Makassar City. (A) Before the change; (B) After the change

Figure 2A shows the appearance of the socio-cultural life of the community before undergoing changes. Interpretations that can be put forward to this condition, among others: (1) The adhesive element of community kinship relations in slum settlements in Makassar City is a belief system (religion) that is still attached and feels its ability is limited in dealing with its environmental situation; (2) Belief in the existence of a supreme ruler of the universe system is considered to have a direct connection with the pattern of people's lives (myths against natural rulers). These beliefs are then formulated in controlling people's daily lives related to a series of behaviors and procedures related to the highest authority, which if violated by the community they believe will bring disaster to their lives. These results confirm that the values and norms held by the community are still traditional. Durkheim, (1986), mentions that religion arises from social sentiment. Religious feelings or emotions arise in the human mind as a result, of social sentiments. The form of social sentiment arises as a result, of feelings in every member of society who are influenced by collective assumptions. This means that the community's response, both individually and collectively, has fostered a belief in something that is sacred and is believed by the community to have a negative impact on their daily lives if it is not implemented. Thus, it can be concluded that the emergence of culture which is interpreted in tradition is basically not independent but is related to the orientation of people's livelihoods as a unified system.

The facts found in the field illustrate that the pattern of community activity that develops is related to settlement grouping and production orientation in slum settlements in Makassar City which can be explained, among others: (1) The grouping of settlements that are oriented towards informal economic activities through the intervention of built infrastructure contributes to the increase in community welfare efforts by 34.82%. This condition occurs due to the ease of accessibility, mobility, and access to consumers. (2) The grouping of settlements that are oriented towards industrial activities through the intervention of settlement infrastructure development contributes to the ease of community movement patterns towards an increase in welfare by 22.32%. (3) The grouping of settlements that are oriented towards activities in the service sector through the intervention of infrastructure development support contributes to the improvement of community welfare by 23.76%. (4) The grouping of settlements that are oriented towards productive economic enterprises (small and medium enterprises) through infrastructure intervention contributes to the increase in community welfare by 19.1%. These results illustrate that the grouping of settlements based on the orientation of production activities developed by the community through infrastructure development interventions has a significant effect on the pattern of life and the level of community welfare and its effect on reducing the level of slum settlements in Makassar City. Furthermore, the social system and community behavior are closely related to the level of community participation in handling slum settlements. This means that the handling of slums requires comprehensive efforts, both physically, economically, and socioculturally. Thus, changes in behavior, attitudes, motivation, responsibility, and community participation will encourage the successful implementation of handling slum settlements in Makassar City. Restructuring the handling of slums,

which is followed by socio-cultural changes and integrated with the handling of infrastructure, will encourage an increase in the welfare of the community (Jones, 2017; Purwanto, et al., 2017). Thus, changes in behavior, attitudes, and community responsibilities play an important role in the sustainability of the handling of slum settlements (Teferi, & Newman, 2017).

Figure 2B, shows the mixing of community cultures in slum settlements in Makassar City. Interpretations that can be put forward to the results include: First, the entry of migrants triggered by the development of new functions and other economic activities. This condition directly has an impact on the socio-cultural changes of the community, in terms of the traditions that have been implemented so far have experienced a declining appreciation. Population movements that occur directly condition the relationship of reciprocal communication between the existing ethnic groups. As a result, individuals in community groups are faced with cultural elements of the immigrant population who enter infiltratively. Furthermore, the interaction between individuals of different ethnicities causes each, individual to experience a social process (the process of interaction and adaptation). Second, the social contacts that occur between local communities and migrant residents in slum settlements are more towards the relationship between individuals in groups based on the principle of meeting economic needs. This condition illustrates that there are social relations that are built more towards mutually beneficial economic relations (symbiotic mutualism).

Third, the presence of migrants in slum areas in Makassar City begins with the presence of those who do not have houses and the local community responds by providing accommodation facilities (contract houses). This fact illustrates the articulation process that occurs between local communities and migrants with the principle of mutual benefit (immigrants get a place to live and the local community gets additional income from the cost of the rental contract). The entry of immigrants does not necessarily change the pattern of socio-cultural activities of the local community, what happens is that there is an attitude of mutual acceptance between one another and fosters togetherness between them and fosters mutual trust which in turn creates close relationships between individuals in community groups. The entry of migrants into community settlements causes socio-cultural changes through the process of acculturation and assimilation which is characterized by the spread of different cultural elements. This means that the existence of certain ethnicities is a motivation for people to improve their common welfare and work as laborers, craftsmen, and formal workers in urban commercial and industrial activities. Thus, it can be concluded that the socio-cultural conditions of the community will always experience changes when the environmental situation also changes. In turn, changes in the external environment in the community and psychological factors, social and economic togetherness will create integration between residents as a unified social system in the community (Negru, et al., 2016). Furthermore, community participation in han-

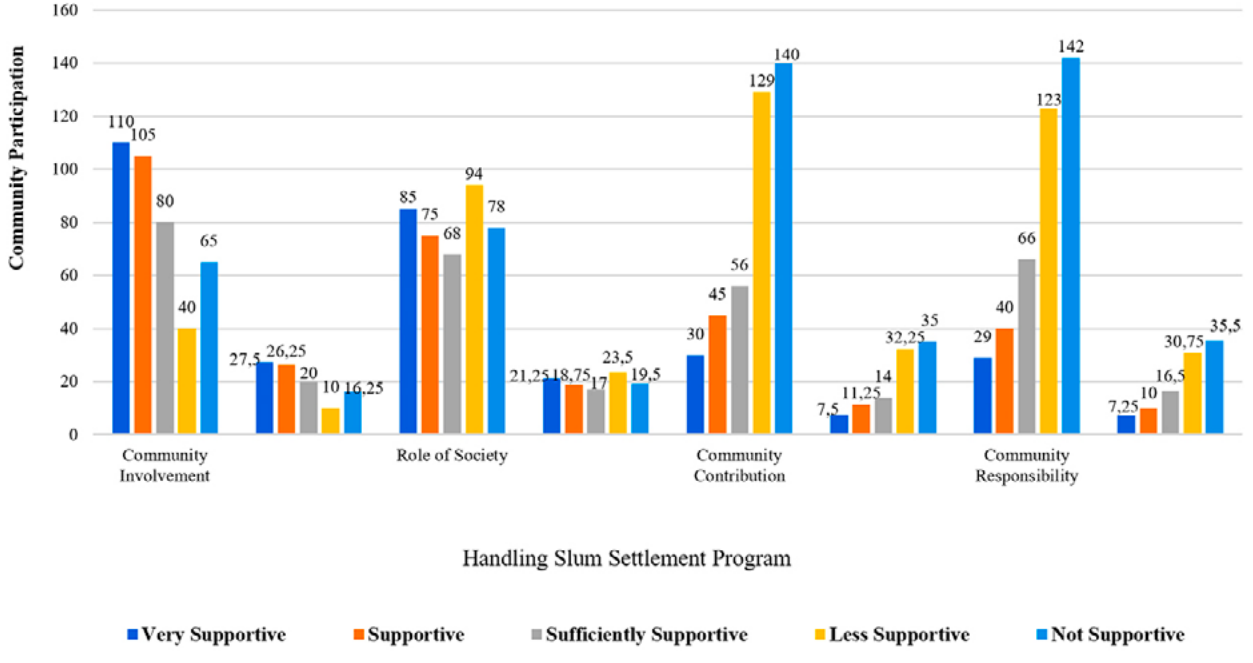

Figure 3. Community participation in the slum settlement program

dling slum settlements in Makassar City is presented in Figure 3.

Figure 3 shows community participation in the slum settlement program in Makassar City. Interpretations that can be put forward to the results, among others: First, community involvement in the slum settlement management program illustrates 53.75% in the supportive category, 20% in the moderately supportive category, and 26.25% in the not supportive category. This figure confirms that community involvement in the handling of slums is quite positive in relation to the implementation of physical programs in the field as workers. Second, the role of the community in the slum settlement program illustrates 40% in the supportive category, 17% in the moderately supportive category, and 43% in the not supportive category. This figure confirms that the community will, play a role in handling slum settlements, if the program implemented is in direct contact with the needs of the community. Third, the community's contribution to the slum settlement program shows 18.75% in the supportive category, 14% in the moderately supportive category, and 67.25% in the not supportive category. This figure confirms that the weak role of the community in implementing the program is more due to lack of understanding and inadequate knowledge, so that people tend to accept the programs implemented by the government.

Fourth, the community's responsibility for the results of program implementation is 17.25% in the supportive category, 16.5% in the moderately supportive category, and 66.25% in the not supportive category. This figure confirms that community responsibility for the results of program implementation in relation to maintenance and utilization tends to be low on development outcomes. These four things illustrate that community participation which tends to be low is more influenced by lack of understanding and knowledge of program implementation. This means that community participation tends to be low due to the role of the community who were not involved in the formulation of the program from the start. Local knowledge and public participation are an important part of sustainable development in terms of preventing conflicts of interest and ensuring that community interests are met (Wah Ho, 2020; Choi et al., 2021). Furthermore, the community's response to the quality and availability of slum infrastructure in Makassar City is presented in Figure 4.

Figure 4 shows the quality and availability of slum infrastructure in Makassar City. Interpretations that can be put forward to the results include: First, the ease of accessibility shows that 41.75% is categorized as supportive, 17% is categorized as moderately supportive, and 41.25% is categorized as not supportive. This figure confirms that improving the quality of infrastructure contributes to the ease of population mobility to reach socio-economic activities. Second, the quality of the slum road network illustrates 43.5% in the supportive category, 17% in the moderately supportive category, and 39.5% in the not supportive category. This figure confirms that the road network currently built with paving block surface conditions and concrete rebates provides benefits for the socio-economic activities of the community in addition to increasing the aesthetic value of the slum neighborhood. Third, the fulfillment of clean water needs shows 18.75% in the supportive category, 11.5% in the moderately supportive category, and 69.75% in the not supportive category. This figure confirms that the com-

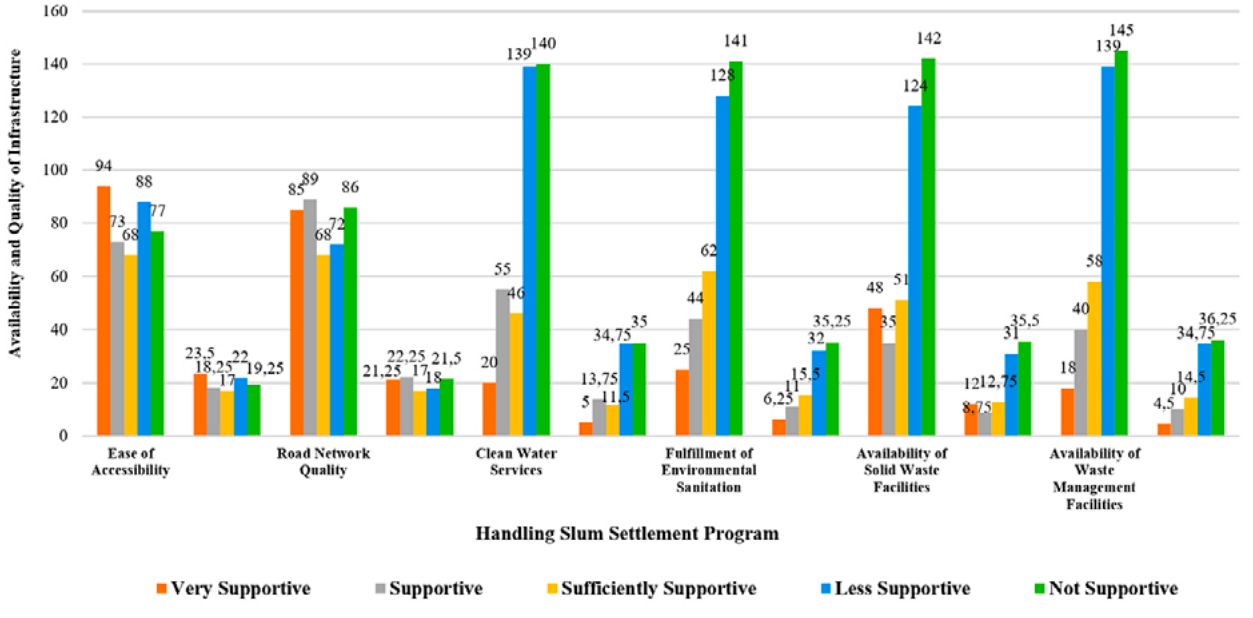

Figure 4. Quality and availability of slum settlement infrastructure

munity's clean water service system as a basic need has not been met both in terms of the flowed discharge and from the existing connection system, as a result, people who are located, in slum settlements predominantly use deep groundwater wells and river water to fulfill their needs for bathing, washing, and the outhouse. Water, sanitation, and hygiene (WaSH) are prerequisite to human health and development, since clean water is essential for human's daily living especially for drinking water (Surya, 2015c).

Fourth, the fulfillment of environmental sanitation obtained an overview of 17.25% in the supportive category, 15.5% in the moderately supportive category, and 67.25% in the not supportive category. This figure confirms that the community's environmental sanitation system in slum settlements is very limited, as a result, people use rivers as a place to dispose of their feces, and the impact on the health of the settlement environment. Fifth, the availability of solid waste facilities illustrates that 20.75% in the supportive category, 12.75% in the moderately supportive category, 66.5% in the not supportive category. This figure confirms that limited waste facilities in slum areas cause people to use drainage channels, rivers, and the local environment as waste disposal media and a small number of people handle their household waste in the conventional way, namely burning and dumping in the ground. These conditions then have an impact on the quality of the living environment, disruption of water flow in drainage channels and pollution of river water quality. Sixth, household waste management obtained a picture of 14.5% in the supportive category, 14.5% in the moderately supportive category, and 71% in the not supportive category. This figure confirms that the handling of household waste in slum areas has not been handled properly. This means that household waste is directly channeled to the local environment and channeled directly to water bodies, thus having an impact on environmental pollution, and decreasing river water quality. The six factors whose values are related to slum settlement infrastructure illustrate that only road infrastructure is fulfilled, while the other four factors, namely clean water services, environmental sanitation, solid waste, and household waste in relation to the handling of slum settlements in Makassar City have not been effective in implementation and does not provide benefits to improving the quality of the settlement and community environment. Communities in informal settlements accept the risks posed by garbage, poor sanitation, wastewater, and lack of clean water supplies and their impact on the health of the community and the quality of the settlement environment (Ólafsdóttir, 2021; Irda Sari et al., 2018). Furthermore, the influence of community participation, improving the quality of infrastructure, improving the quality of the environment, and changing the socio-cultural community on the sustainability of Makassar City development is presented in Table 2 below.

The results of Table 2 which can be explained include: (1) community participation has a positive effect on the sustainability of urban development, (2) the quality of infrastructure has a positive effect on the sustainability of urban development, (3) the environmental quality index has a positive effect on the sustainability of urban development, and (4) socio-cultural changes have a positive effect on the sustainability of urban development. Thus, it can be con-

Table 2. Summary of test results for the significance of multiple regression coefficients

Correlation			Coefficient	Error	t-count	t-table
			β	Sbi		
Community participation towards sustainability of city development (ryx_1)			0.182	0.056	2.893	1.94
Improving the quality of infrastructure towards sustainability of city development (ryx2)			0.139	0.054	2.856	1.94
Improving the quality of the environment towards sustainability of city development (ryx_3)			0.408	0.093	4.185	1.94
Sosio–culture change towards sustainability of city development (ryx_4)			0.406	0.097	4.273	1.94
Source variant	**Sum of squares (JK)**	**Free Degrees (db)**	**Average of the sum of the squares (RJK)**		**F-count**	**F-table α = 0.05**
Regression Residue	21,648 0,548	4 8	8,556 0.084		89,815	7.82
Total	21,648	12	-		-	-
R	R2	db1	db2		F-count	F-table
0.878	0.771	4	8		89,815	7.82

Source: Analysis results

cluded that community participation, infrastructure quality, environmental quality index, and socio-cultural changes of the community simultaneously affect the sustainability of Makassar City development with a coefficient of determination of 77.1%. These results confirm that community participation, improving the quality of infrastructure, improving the quality of the environment, and changing the socio-cultural community that are carried out in an integrated and comprehensive manner will have an impact on the success of handling slum settlements towards sustainable development in Makassar City. Thus, it is very important to integrate a planning system followed by a strategic program from the government in order, to support the handling of informal settlements and improve the quality of the urban environment (Ferronato, & Torretta, 2019; Surya, et al., 2020e; Akmal, & Jamil, 2021). Thus, the settlement of slum settlements in Makassar City in the future will require periodic monitoring and evaluation to ensure the accuracy of the quality and targets of activities through the support of active community participation. This means that the acceleration of the handling of slum settlements is very important to be integrated with strengthening the capacity of the government and the community which is carried out jointly for each stage of activity, including encouraging changes in community behavior and public awareness to be responsible for the utilization and maintenance of basic infrastructure facilities for settlements. Furthermore, the results of the SEM analysis are presented in Figure 5.

Figure 5 shows the estimation model for the handling of slum settlements, community participation, and socio–cultural changes in the community towards the sustainable development of Makassar City. Interpretations that can be put forward to the model include: First, the construct (latent variable) of the slum settlement sector, community participation, and socio-cultural changes have a positive effect on the sustainability of Makassar City development. The results of the chi-squares test show a value of 123.520 with a probability of p = 0.132 > 0.05, df = 94, gfi = 0.871, cfi = 0.776. This figure confirms that the model built is categorized as a fit model. Second, the total influence of community participation on the variable handling of slum settlements is 0.62.41 or 62.41%, community participation on endogenous variables of socio-cultural change is 0.4761 or 47.61%, and community participation on endogenous variables of urban development sustainability is 0.4624 or 46.24.

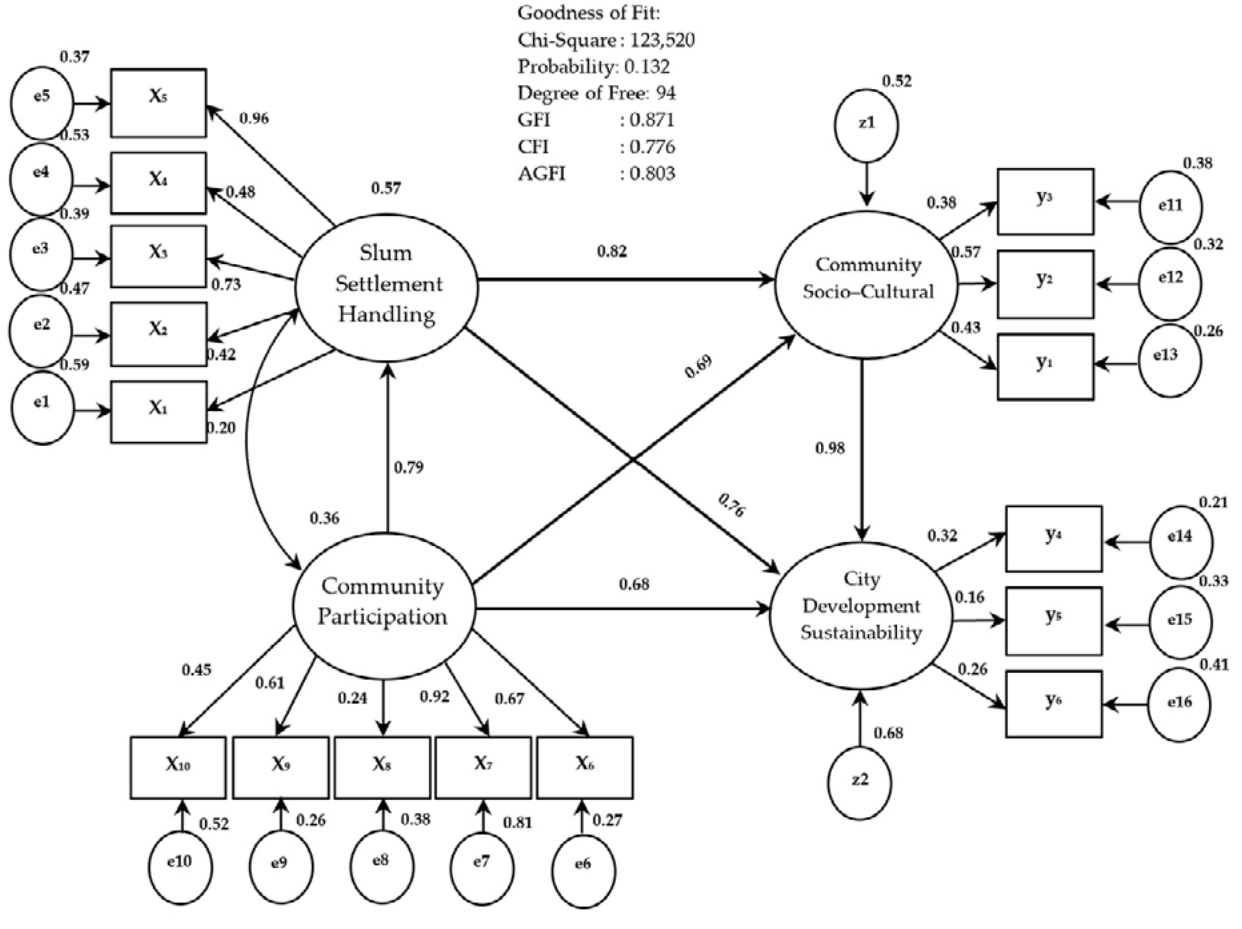

Figure 5. The estimation model for the handling of slum settlements, community participation, and socio-cultural changes in the community towards the sustainable development of Makassar City

Third, the total influence of the construction of slum settlements on the endogenous variables of socio-cultural change is 0.6724 or 67.24%, the handling of slums on the endogenous variables of urban development sustainability is 0.5776 or 57.76%. The fourth effect of the total endogenous variables of socio-cultural changes on the endogenous variables of urban development sustainability is 0.9604 or 96.04%.

The orientation of the sustainable development of Makassar City in relation to the handling of slum settlements in the future is focused on four categories, including: (1) Handling of slum settlement infrastructure is focused on improving the quality of environmental roads, environmental drainage, clean water services, waste management and the provision of environmental sanitation and hygiene provision of waste facilities; (2) Community participation is focused on several things, namely increasing community roles, community involvement in program formulation, contribution of community thoughts and ideas, involvement in program implementation, and community responsibility for maintaining program outcomes; (3) The socio-cultural changes of the community in dealing with slum settlements are focused on several things, namely changing attitudes, increasing knowledge, and changing people's behavior, in the sense of creating an environmentally conscious culture; and (4) the sustainability of urban development is focused on three main things, namely environmental sustainability, economic sustainability, and social sustainability. The implementation of the strategic program in addition to having an impact on improving the quality of slum settlements, creating equitable distribution of development, and improving community welfare towards the creation of social cohesion, community productivity, and harmonization of people's lives in Makassar City. Thus, it is necessary to evaluate the slum settlement program that has been implemented in Makassar City.

Slum Settlement Hadling in Makassar City

Participatory processes refer to processes that actively involve the role of the government, the private sector, and community institutions which are based on traditional values and optimize the use of community social capital to support program implementation (Nassar & Elsayed, 2018; Surya et al., 2021b). Furthermore, in order, to foster the motivation of the poor to participate, policy support is needed that refers to the aspirations of the community and is carried out through a process of deliberation and consensus based on mapping the problems of the slum settlement environment which is carried out by the community independently and mutually agreed by both individuals and institutions. Furthermore, the handling of slum settlements in Makassar City is aimed at building public awareness of their rights, obligations, and responsibilities towards the environmental conditions in which they live. Thus, the solution to achieve the target of handling slum settlements in the future in Makassar City is very important to involve the role of the community which is integrated with strategic programs from the government optimally in order, to achieve sustainable development goals (SDGs), namely (i) poverty reduction, (ii) ease of obtaining decent work, (iii) reduction of socio-economic inequalities, and (iv) sustainability of slum settlement management towards sustainable city development.

Social–culture changes in the community related to the handling of slum settlements in Makassar City will require strategic steps, including: (1) Changes in people's attitudes in responding to changes in the environmental situation. This means that changes in people's attitudes are needed as a form of adaptation in the form of real community actions to maintain and maintain the environmental conditions in which they live; (2) Increasing public knowledge, through socialization efforts that are carried out continuously and carried out based on initiatives from the community, both individually and in the form of institutions; (3) Changes in people's behavior to handle and control environmental pollution towards the fulfillment of healthy and sustainable environmental standards. These three things require consistent efforts and policy support from the Makassar City government.

Sustainability of Makassar City Development

The handling of slum settlements is related to the sustainability of Makassar City development, in its implementation, it is oriented to three basic principles, namely: (1) The principle of equality between generations as the basic principle of sustainable development oriented to the completion of the handling of slums; (2) The principle of justice in the sense of ensuring economic access and distribution of natural resources to overcome poverty problems that are integrated with improving the quality of the slum settlement environment; and (3) the principle of responsibility in the sense of ensuring a minimal geographic shift in environmental impact through compensatory measures. That is, in the context of urban development and the fulfillment of housing needs for the urban poor, it is developed towards improving environmental quality and is inclusive. Furthermore, the city development policy in the form of a spatial plan functions as an instrument of regulation, implementation, and control which is carried out through several basic principles, including: (1) Responsibility to implement and implement sustainable urban and settlement development; (2) Right to carry out urban development policies and

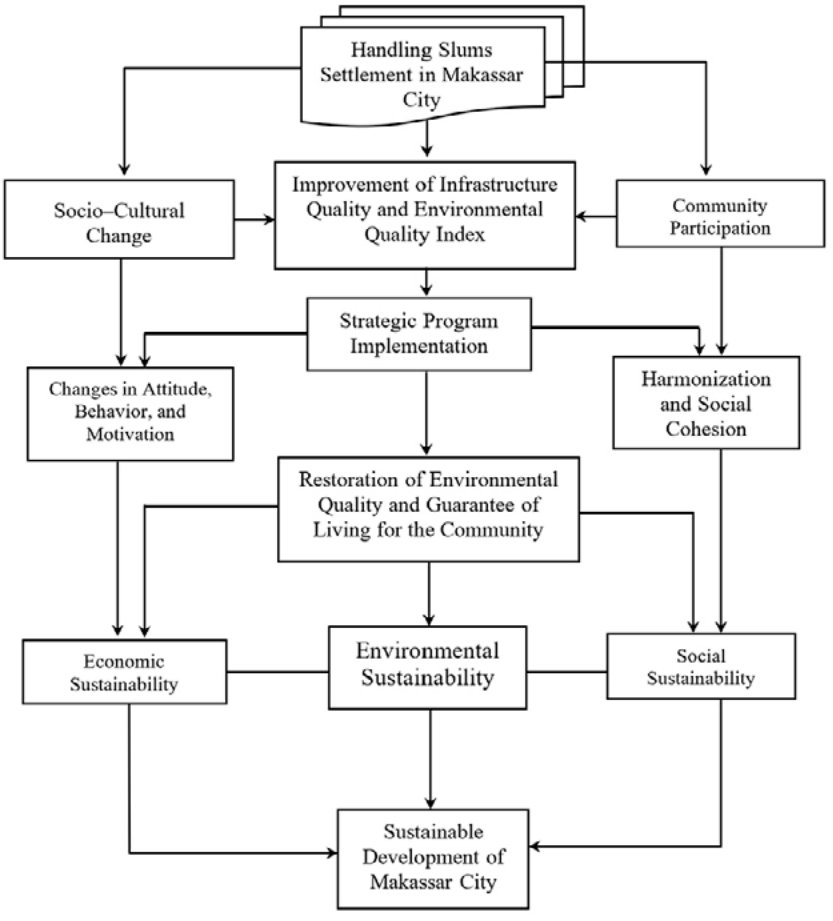

Figure 6. Handling of slum settlements and sustainable development of Makassar City

programs with reference to the broad public interest; (3) Risk, in the sense that city development decision making is oriented towards environmental, economic and social sustainability; (4) Revenue, in the sense that the implementation of city development policies and programs refers to the strategic program and is in direct contact with the value of the benefits that will be received by the community; and (5) Relations, in the sense of building cross-sectoral development coordination in order to realize sustainable urban development. The Makassar City development sustainability scheme is presented in Figure 6 below.

Conclusion

Community participation in handling slum areas is closely related to socio-cultural conditions and community work orientation. The level of understanding and knowledge that is quite low about program implementation is positively related to poverty, leadership, and community social structures. Furthermore, the community will participate in the implementation of the program if the value of economic benefits is obtained. Programs that do not touch the basic needs of the community socially and economically lead to weak community participation. Community–based development programs will encourage a sense of ownership of the program voluntarily and are responsible for the results of program implementation. Thus, to motivate the poor who live in settlements to participate, it is necessary to absorb aspirations through a process of deliberation and consensus and refer to the results of mapping the problems of the slum environment carried out by the community independently and mutually agreed by both individuals and institutions.

The orientation of the sustainable development of Makassar City in relation to the handling of slum settlements in the future is focused on four categories, including: (1) Handling of slum settlement infrastructure is focused on improving the quality of environmental roads, environmental drainage, clean water services, waste management and the provision of environmental sanitation and hygiene provision of waste facilities; (2) Community participation is fo-

cused on several things, namely increasing community roles, community involvement in program formulation, contribution of community thoughts and ideas, involvement in program implementation, and community responsibility for maintaining program outcomes; (3) The socio–cultural changes of the community in dealing with slum settlements are focused on several things, namely changing attitudes, increasing knowledge, and changing people's behavior, in the sense of creating an environmentally conscious culture; and (4) the sustainability of urban development is focused on three main things, namely environmental sustainability, economic sustainability, and social sustainability.

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Perception and Satisfaction of Residents with the Impact of the Protected Area on Sustainable Tourism - the Case of Deliblatska Peščara Special Nature Reserve, Serbia

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Abstract

In the Deliblatska Peščara Special Nature Reserve (SNR) there are a large number of natural and social factors that affect the development of tourism. Such are: rare and endangered endemic flora and fauna that are important in the procedures of species protection, ecosystem, wetlands, socio-cultural heritage, the possibility of developing specific forms of tourism and other factors. The SNR has a relief that is present only in this protected area – dunes. This type of sand has influenced the specific flora and fauna that cannot be found in other areas. There are 18 settlements in the reserve that have significant cultural, monumental and archaeological heritage. The research aims to determine the satisfaction of residents with the function of the SNR in sustainable tourism development using a quantitative methodology and SPSS software. The responses from 510 residents indicate their satisfaction with the development of sustainable tourism in the SNR through ecological, economic and institutional sustainability of this tourism destination.

Keywords: sustainable tourism; Deliblatska Peščara Special Nature Reserve; residents' satisfaction; protected area

Introduction

Sustainable tourism development is defined as a positive impact on all subjects of tourism development, i.e. the development that contributes to the ecological, economic and socio-cultural sustainability of a tourism destination (Spangenberg, 2002; Trišić et al., 2021). Thus, it is necessary to examine the impact of tourism on nature and the improvement of its elements (Ceron & Dubois, 2003; Stojanović et al., 2021). Economic sustainability refers to different benefits for residents through the development of tourism forms that clearly define their role. Different forms of tourism contribute to higher employment of residents, local products and services can be better promoted and available to tourists, the satisfaction of residents and tourists contributes to higher tourists' visits and therefore, to higher tourist con-

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sumption (Trišić et al., 2020; Obradović et al., 2021; Obradović & Stojanović, 2021).

Positive attitudes of tourists and residents towards the development of tourism that improves social and cultural values of a tourism destination indicate that positive socio-cultural impacts of sustainable tourism development have been achieved (Bello et al., 2016; Stojanović et al., 2018). Sustainable tourism development can contribute to the benefits for tourists, residents, managers, the state and the tourism destination, through economic, environmental, institutional and socio-cultural sustainability (Font et al., 2003; Štetić et al., 2019; Obradović et al., 2021; Obradović & Stojanović, 2021).

If we examine the impact of tourism on sustainable tourism development in protected natural areas as specific tourism destinations with natural and cultural heritage, it is essential to study residents' attitudes and satisfaction (Sæþórsdóttir & Hall, 2021) with the condition of sustainability in a specific tourism destination (McCool et al., 2001; Twining-Ward and Butler, 2002; Buckley, 2003; Queiroz et al., 2014; Lee & Hsieh, 2016; Agyeiwaah et al., 2017; Vučetić, 2018; Obradović et al., 2020).

Eagles (2002) emphasizes the importance of the following tourism factors for the sustainable development of tourism within protected areas: ecosystem, land, vegetation, water, air and wildlife. These are the resources by which proper management and monitoring (Maksin et al., 2018) can preserve space and species, improve protection systems and models and with which the development of adequate sustainable tourism activities can be planned within these destinations with sensitive ecosystems (Hall, 2009; Jojić-Glavonjić, 2018). In addition to the basic tourist attraction, the development of sustainable tourism can be influenced by other factors such as space protection (Pavić et al., 2016), space use intensity, carrying capacity, the role of the local community in tourism development, socio-cultural impacts, tourism contribution to the local economy, control development, waste management and others (Chin et al., 2000; Choi & Sirakaya, 2006; Schianetz & Kavanagh, 2008; Chávez-Cortés & Maya, 2010; Tanguay et al., 2013).

The aim of the research in this paper is to examine the extent to which the residents of seven significant settlements from the area of the SNR are satisfied with the state of sustainable tourism development. Also, the aim is to identify weaker aspects of sustainability according to the obtained results, based on the appropriate measures planned to improve sustainable tourism. Applying quantitative methodology the authors analyze the responses of 510 residents who expressed their perceptual attitudes towards sustainable tourism using a five-point Likert scale in the questionnaire. Residents' responses may indicate the importance of protected natural areas for preserving ecological (Aquino, 2019), economic, sociocultural, and institutional sustainability (Sharpley, 2000; Asmelash & Kumar, 2019; Trišić, 2020). The results of the survey can be used to develop strategies for sustainable tourism development, future research on the importance of protected natural areas for the development of tourism destinations and the improvement of sustainable tourism conditions in protected natural areas.

Data and methods

Study area

The SNR is located in the south-eastern part of Vojvodina (north-eastern Serbia) and it covers a habitat of about 35,000 ha, of which 34,829 ha is the SNR (Kovačev, 2014). This nature reserve covers from 44°45' to 45°02' N, and from 20°55' to 21°20' E (Štetić et al., 2021). Unusually large fluctuations in air temperature have been recorded there both during the year and during the day (Kovačev, 2014).

This protected area is characterized by a very rare duna relief, unique only to this protected area. Sand, which is a significant component of the soil here, has influenced the development of special flora and fauna, some of which are endemic and cannot be found in other protected areas in Vojvodina (Banat paeony, Pančić wormwood, bulrush, dwarf-steppe almond, sandy immortelle and juniper tree) (Popović et al., 2012; Štetić et al., 2021). Diverse and rare flora and fauna, the existence of wetlands and dunes are significant natural factors that can positively influence the development of nature-based tourism.

In the area of the reserve, there is a famous hunting ground "Deliblatska Peščara" with a total area of 31,036.55 ha, which represents enormous tourism potential. There are capacities in the area of the reserve that enable the development of ecotourism, excursion, rural, nautical, wine, sports, hunting and educational tourism. That can be possible with the accommodation capacities of the School-Recreational Center "Čardak" (130 beds) and hunting lodges, camps and rural households in Šumarak, Dubovac, Deliblato, Skorenovac and Kovin.

The SNR is also a unique protected area because it includes 7 health trails, intended for users of sports and recreational tourism, educational, eco and health tourism. The total length of the trails is about 50 km (Štetić et al., 2021).

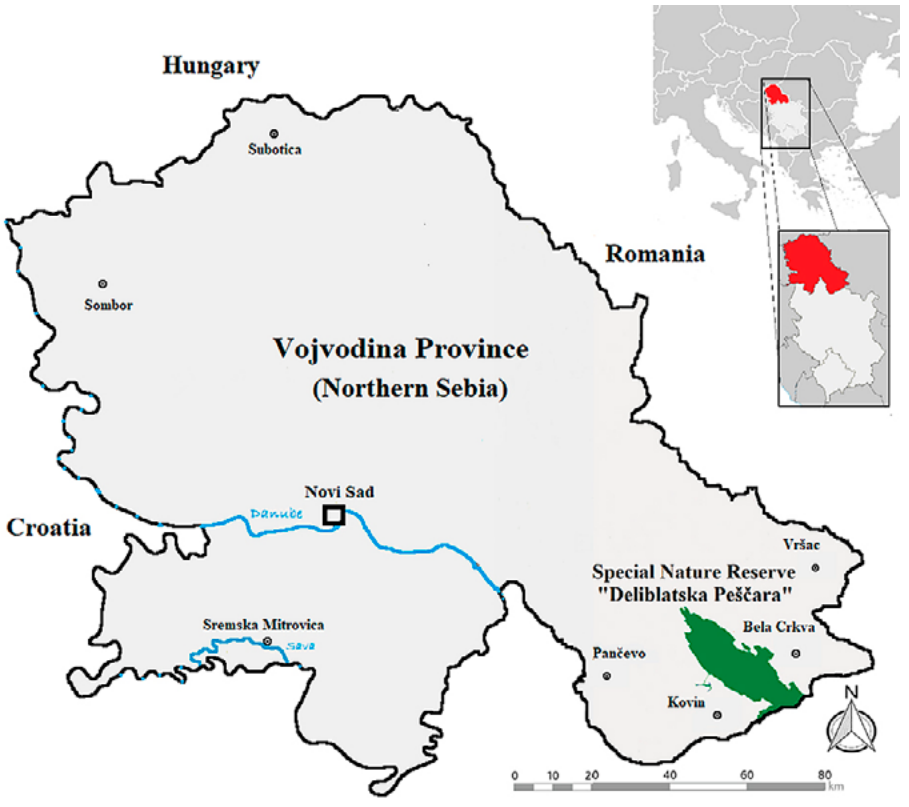

Figure 1. Location of Deliblatska peščara Special Nature Reserve with a position in the Republic of Serbia and in respect to the European Union
Source: digitalized by authors

By analyzing all the natural and traffic factors mentioned above, we can conclude that the SNR has a favorable geographical position and good traffic connections with cities in Vojvodina and with the surrounding countries (Figure 1).

Some settlements near the reserve have significant cultural, monumental and archaeological heritage such as Dolovo, Deliblato, Grebenac, Dubovac, Pločica, Banatski Karlovac, Alibunar and Izbište. The population of the settlement that covers the area of the reserve has a rich cultural tradition and folklore. Customs, local handicrafts, gastronomy, wine routes, original folk melodies and events, national diversity, language and religious affiliation, are significant socio-cultural tourism potential in this protected area (Štetić et al., 2021).

Methods

In this paper, the perception and satisfaction of residents with the state of sustainable tourism development in the SNR are analyzed. The survey included an examination of attitudes about the values and significance of twenty selected items for the state of sustainable tourism within this special nature reserve (Chin et al., 2000; Choi & Sirakaya, 2006; Moore & Polley, 2007; Schianetz & Kavanagh, 2008; Sowinska-Świerkosz & Chmielewski, 2014; Torres-Delgadoa & Saarinen, 2014; Banos-Gonzales et al., 2016; Lee & Hsieh, 2016; Sanchez et al., 2020).

Sample

The research used questionnaires with 20 statements on the state of sustainable tourism within the SNR, grouped into four dimensions of sustainability (environmental, economic, socio-cultural and institutional). Also, the questionnaires contain four questions concerning the direct satisfaction of residents with sustainable tourism development (Tables 2 and 3). The research models served to constitute the statements and questions in the questionnaire Scholtz et al., (2015), Cottrell et al., (2013), and Asmelash and Kumar (2019).

Data Collection Procedure

Written and online questionnaires were used in the survey. Residents' answers using a written questionnaire were collected in the field in personal contacts. Social networks were used to collect respons-

es through online questionnaires, in order to obtain as many responses as possible from the residents of different ages and to comply with epidemiological measures to prevent the spread of COVID 19. The survey was conducted during April and May 2021. Quantitative methodology was applied using the Statistical Package for the Social Science (SPSS). Cronbach's Alpha analysis was used to test the reliability of the samples to measure all four dimensions of sustainability and the degree of satisfaction of the population with sustainable tourism development. Finally, the value of residents' satisfaction with the dimensions of sustainability was examined using regression analysis (Cottrell et al., 2013; Obradović et al., 2020).

Data Analysis

Using the analysis of attitudes and satisfaction of residents, the importance of certain natural, socio-cultural, communicative, receptive, economic and other factors within the tourism destination for the development of sustainable tourism was examined (Mearns, 2011; Rio & Nunes, 2012).

The statements and questions were adapted to the survey of residents' perceptions and satisfaction with sustainable tourism development in the SNR. The respondents spoke about environmental, economic, socio-cultural, and institutional sustainability through 20 statements and four separate questions related to personal satisfaction. They expressed their satisfaction with sustainable tourism development in the questionnaire on a five-point Likert scale. Grade 1 indicates absolute disagreement, grade 5 indicates absolute agreement with the proposed statement, while grade 3 represents a neutral attitude (Maple et al., 2010; Puhakka & Siikamäki, 2012; Scholtz et al., 2012; Dolnicar & Grün, 2013; Kruger et al., 2013; Rasoolimanesh & Jaafar, 2016).

Results and discussion

The total sample included 510 respondents. The survey of residents was conducted in 7 settlements located in the area of the SNR. The survey related to the SNR was conducted in the following settlements: Dolovo (130 respondents), Deliblato (125), Dubovac (85), Mramorak (78), Gaj (61), Šumarak (19) and Malo Bavanište (12). The socio-demographic structure of the respondents can be seen in Table 1.

Table 1. Structure of Respondents

Gender	Frequency	Percent	
Male	230	45.09	
Female	280	54.91	
Total	510	100.0	
Education	**Frequency**	**Percent**	
Primary Education	42	8.23	
Secondary Education	345	67.65	
College Education	84	16.47	
Higher Education	39	7.65	
Total	510	100	
Age Structure	**N**	**Min**	**Max**
	510	18	69
	Mean	**Std. Dev.**	
	37.56	16.234	

Source: Author's calculation

Analyzing the data in Table 1, it can be concluded that women are in the majority (54.91%). The average age is 37.56 (in the range of 18 to 69). Most respondents have secondary education 67.64%, a total of 8.23% have primary education, college education has 16.47%, while higher education has 7.65%. The majority of respondents are employed (86.4%), then the unemployed (9.7%), students (5.1%) and retired (1.2%).

The quantitative methodology included testing the reliability of variables, in order to test the dimensions of sustainability and satisfaction of the population with the sustainable development of tourism in the SNR. The indices were computed as variable means comprising each dimension (independent variables). The results of the respondents' answers according to 20 set statements grouped into four dimensions of sustainability, can be seen in Table 2.

Analyzing the data in Table 2, it can be concluded that the results of the regression analysis application indicate different attitudes of respondents towards the four dimensions of sustainability. The ecological dimension (3.74) and Socio-cultural dimension (3.28) have the highest values. Among the highest-rated statements in these two dimensions are: "There are facilities, services and activities available to tourists and the local community in the protected area" (4.11) and "There are tourist facilities without impacts on the environment" (3.69) in Ecological dimension; and "Tourists are interested in home products and crafts" (4.15), "Tourists are interested in historical sites" (4.02), "Tourists visit local cultural facilities and events" (3.67) and "Tourists are in contact with the local community" (3.54) in Socio-cultural dimension. The lowest values (below 3.0) have statements in the Economic dimension, specifically the claims: "Protected area tourism contributes to the employment

Table 2. Respondents' perceptions of the dimensions of sustainable tourism

Items	SNR (n=510)	
Dimensions of Sustainable Tourism	**α**	**Mean**
Institutional Dimension	0.631	3.17
Tourists are guided through the protected area by trained guides and representatives of the local population		3.11
Tourists in the protected area can see the local brands (wineries, ethno houses, handicrafts, local enterprises, etc.)		3.25
In the protected area, the manager's instructions on nature protection and tourist activities are followed		3.10
Tourists are provided with information that reflects the history of the reserve, population and settlements		3.21
Ecological Dimension	0.681	3.74
There is the joint role of tourists and locals in protecting the area		3.44
There are facilities, services and activities available to tourists and the local community in the protected area		4.11
There are tourist facilities without impacts on the environment		3.69
Economic Dimension	0.531	2.84
Tourism of the protected area benefits the local community		3.12
Tourism of the protected area supports the local economy		3.09
Tourism in the protected area contributes to the employment of the local population		2.11
Local products are available to tourists		3.51
Tourists support the payment of tickets to the protected area		3.22
Protected area tourism contributes to the employment of women		2.03
Socio-cultural Dimension	0.603	3.28
Tourists are interested in home products and crafts		4.15
Tourists are in contact with the local community		3.54
Tourists are interested in local traditions and customs		3.02
Tourists visit local cultural facilities and events		3.67
Tourists are interested in historical sites		4.02
Tourists are interested in joint tourist activities with the local population		2.54
Due to tourism, the crime rate is lower		2.05
Items measured on a 5-point Likert agreement scale α - Cronbach Alpha Reliability		

Source: Author's calculation

of women" (2.03) and "Tourism in the protected area contributes to the employment of the local population" (2.11). The Institutional dimension represents the average value (3.17), while the statements with the highest value are: "Tourists in the protected area can see the local brands (wineries, ethno houses, handicrafts, local enterprises, etc.)" (3.25), and "Tourists are provided with information that reflects the history of the reserve, population and settlements" (3.21).

The Cronbach Alpha scores were 0.63 for the Institutional dimension (4 items), 0.68 for the Ecological dimension (3 items), 0.53 for the Economic dimension (6 items), 0.60 for the Socio-cultural dimension (7 items), and 0.62 for the satisfaction index for the SNR (Table 3). The Economic dimension has relatively lower reliability but it is accepted as valid in the research. Cotrel et al., 2007 point out that an "α" lower than 0.60 can be accepted as reliable in studies, in which there are 6 or fewer items examined. From the above mentioned, in this study, all examined variables in all four dimensions of sustainability can be considered reliable.

From the data in Table 4, it can be concluded that the total mean value of the examined satisfaction of residents with the development of sustainable tourism in the SNR is 3.73. The highest values have the statements: "I am satisfied because this area is an important destination due to tourism" (4.41) and „I am satisfied because sustainable tourism in this area is important to me" (4.11). The lowest value has the satisfaction of residents with the impact of tourism on their quality of life and family (2.84). By applying regression analysis, it can be determined whether each

Table 3. Scale items for the satisfaction index

Satisfaction Index	The SNR (n=510)	
	α	Mean
	0.621	3.73
I am satisfied because tourism in the protected area produces benefits for me and my family		3.56
I am satisfied because sustainable tourism in this area is important		4.11
I am satisfied because this area is a significant destination due to tourism		4.41
I am satisfied because the quality of my life and the life of my family has improved owing to tourism in this area		2.84

Source: Author's calculation

dimension of sustainability contributes to the satisfaction of residents with sustainable tourism development. (Cottrell et al., 2007; Sharpley, 2014; Vargas-Sánchez et al., 2015; Obradović et al., 2020). The assumption was supported with all four-dimensional scores as significant predictors of residents' satisfaction with tourism (Huayhuaca et al., 2010; Obradović et al., 2020) accounting for 32% of the variances explained (R2=0,321) (Table 4).

Table 4 shows the data obtained after applying regression analysis of residents' responses and their attitudes towards the stated claims and satisfaction with the four dimensions of sustainability. It can be concluded that each dimension of sustainability significantly contributes to satisfaction of residents with sustainable tourism development.

Table 4. Regression analysis of the SNR on residents satisfaction

Satisfaction with tourism items	The SNR (n=510)	
	β[1]	*p*-value
Institutional dimension	0.156	0.001
Ecological dimension	0.223	0.001
Economic dimension	0.149	0.001
Socio-cultural dimension	0.196	0.001
[1]Standardised β value used R^2=0,321		

Source: *Author's calculation*

Conclusion

The paper examines the perceived attitudes and satisfaction of residents with the state of sustainable tourism. The respondents expressed their views on institutional, environmental, economic and socio-cultural sustainability. After applying the quantitative methodology and analyzing the obtained results, it can be concluded that each of the four dimensions of sustainability has a higher or lower impact on the satisfaction of residents with the state of sustainable tourism (Table 2). The ecological dimension of sustainability was rated the highest marks. Their opinions indicate that residents particularly value the state of nature as well as the activities for nature protection. This result provides an opportunity to increase tourist traffic by planning the development of nature-based forms of tourism, among which the most important may be ecotourism, scientific tourism, trips, sports, birdwatching, hiking, trekking, etc. Comparing these results with those obtained by Obradović et al., (2021) and Obradović and Stojanović (2021), tourism destination sustainability can undoubtedly be achieved if the local population is actively involved in the planning of nature-based tourism.

Socio-cultural sustainability is also assessed as significant by the residents. The activities that indicate the interest of tourists in local events, domestic products and cultural and historical heritage are singled out as lower-rated. The individual values of socio-cultural sustainability (Table 2) show that planned measures for sustainable tourism should include local heritage and customs in the tourism offer and interaction of local community representatives and tourists through various tourism activities. This SNR possesses many tourist attributes that can be a good model for the development of cultural, wine, gastronomic, and event tourism.

Comparative analysis with the results of research Obradović et al., (2021), Obradović and Stojanović (2021), indicates that the local population plays a significant role in the mentioned activities. By considering residents attitudes about sustainable tourism, it is possible to devise local community management strategies. They can result in strengthening the socio-cultural Sustainability of this tourism destination. We can improve the institutional sustainability of this destination by enriching the tourism offer with local products, intensifying the management processes in this nature reserve, referring to the improvement of protection measures with the aim of nature conservation. The results of the economic dimension enable us to plan those activ-

ities that will result in economic benefits for residents through the planned tourism development measures.

The impacts on women's employment and economic impacts on individuals and their families single out as less rated items of economic sustainability. The reason for such influences lies in tourist consumption and tourist traffic. Higher tourist spending can be a direct result of higher tourist visits to this tourism destination. This can be achieved by proper planning and promotion of tourism in this nature reserve, which aims to preserve nature and its natural and social elements. The increasing tourist movements create conditions for higher incomes from tourism and new jobs for the local population. In this survey, the residents stated that the development of sustainable tourism is important for them. Certain items have lower values, which is the basis for the development of planned measures for the development of sustainable tourism forms. The previously performed comparative analysis indicates a coincidence with the research results in this paper. The local population is perfectly aware of the importance of sustainable tourism. Also, the local population can identify certain weaknesses in tourism development, which can be corrected by proper planning of tourism development. Therefore, one of the conclusions of this paper should be that the role of the local population in sustainable tourism development is essential. The authors will focus their future study on examining the possibilities of developing various activities that can best improve individual dimensions of sustainability. When the development of tourism achieves environmental, economic, sociocultural and institutional benefits for all tourism entities, it can be concluded that all the postulates that tourism can be categorized as sustainable are met. Such a tourism destination represents an exceptional national tourism potential for 21st century tourism.

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