



RESEARCH ARTICLE

The Impact of (NON) Urbanization on the Environment and Public Health: A Case Study of The Urban Area of the City of Peja, Kosovo

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ABSTRACT

The rapid expansion of urban areas in cities is significantly impacting the environment, challenging the concept of sustainability. The urban area of the city of Peja is located in the western part of the Republic of Kosovo. Over the last two decades, there has been a noticeable trend of rapid urban growth in Peja. This paper, based on available data and information's, addresses the dynamics of urban growth in Peja, with a particular focus on (non) urbanization, whose impact is considered highly negative specifically for the environment. The paper also focuses on the comprehensive impacts of the different factors, including air, water, and soil. The expansion of the urban area is associated with negative effects especially related to the release of various pollutants into the air (including greenhouse gases), water, and soil. It describes the main components that are affected both qualitatively and quantitatively by the urban growth of Peja. The paper, featuring authentic and recent data, provides a solid basement that supports related efforts to addressing climate change, millennium development goals, and the general concept of integrated natural resource management and sustainable development.

INTRODUCTION

Throughout history, human communities have always needed a high quality of life preconditions. To achieve this goal, humans require shelter (homes) and the necessary infrastructure for their activities. Residential structures (caves, huts, individual and collective houses) served daily various functions, such as protection from different natural hazards (rain, snow, frost, floods, landslides, erosion, etc.), wild animals, and even threats from enemies. The first settlements were more dispersed, partially due to the smaller population and limited life demands. As human needs grew and communities became more advanced, changes in the spatial distribution of inhabited areas began, leading to more concentrated and urbanized areas. An urban area is a continuously developing area that contains all the necessary infrastructure for a balanced living standard. The urban environment is crucial in determining the quality of life in urban areas and the broader environmental impact (Torrey, 2004). Urbanization is an indicator of the movement of human communities from rural to urban areas, driven by better living conditions (social and economic) offered by urban areas. Thus, urbanization refers to the overall increase of population and the increased level of industrialization. There is a strong correlation between urbanization and the environment, with complex interrelations (Sánchez-Rodríguez et al., 2005). Urbanization creates more opportunities but naturally presents more challenges. It not only destroys and fragments habitats but also alters the environment itself (Wayne et al., 2020). Urbanization also offers some

benefits, especially in well-planned urban areas with proper transportation and community living spaces designed to reduce pollution problems. The opportunities for the community living in urban areas include employment, education, healthcare services, easier access to transportation, and a higher standard of living. However, these benefits come with significant environmental challenges. Urbanization is a process that leads to the growth of cities due to industrialization and economic development (Rai, 2017). Kaur (2017) states that urbanization is the increase in the percentage of people living in cities and towns. Data from literature show that at the beginning of the 20th century, 10% of the world's population lived in cities, whereas in the first half of the 21st century, it is shown that 50% of the world's population lives in cities. The United Nations (2014) projects that by 2050, the urban population will increase by 2.5 billion and exceed 60% of the world's population. Khursheed & Sethuram (2011) also highlight that in the next ten years, about 50% of the population will live in urban areas. According to the European Environment Agency (EEA), by 2050, 67% of the population will live in urban areas. According to Kaur (2017), third-world countries are experiencing a significant demographic transition from a rural, agrarian society to an urban, industrial society. Currently, such a trend is also evident in the Republic of Kosovo. The Republic of Kosovo had a population of 1,780,021 (KAS, 2011), while according to the 2024 census, the population was 1,586,659 (KAS, 2024). In urban areas, 38.3% of the population lives, while in rural areas, 61.7% (KAS, 2011). In the study area (the city of Peja), 50% of the population lives in the urban area (city). Until 1999, Peja's urban area was characterized by low-rise buildings, mostly up to P+5, concentrated along the main roads. However, post-1999, the urban area, the structure of buildings, and their height have fundamentally changed in terms of spatial positioning and building height. This development often negatively impacts life and the living environment. In Peja's urban area, there are instances of exceeding planning and design standards (e.g., Administrative Instruction MESP-Nr. 08/2017 on Technical Norms for Spatial Planning) (MESP, 2017), causing buildings of different heights to become barriers not only to neighboring structures but also to the quality of the environment and community life. These structures create barriers to lower or similar-height rise buildings through micro-climatic environment resulting in: shadows, air flow disruptions, light blockages, moisture retention, and hindrance of sunlight, all of which are as result of deviation from standard design norms. Figure 1, illustrates an example of the building's regulative parameters.

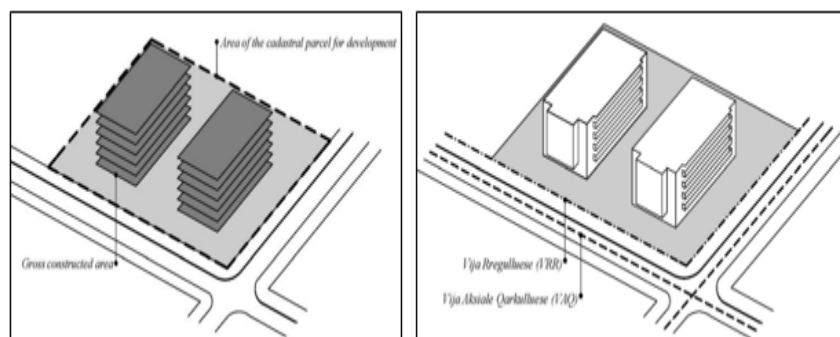


Figure 1. Building regulative parameters; surface index, regulatory line, circulatory axis
(Source: MESP, 2017)

Study Area

Peja, as a city firstly was mentioned in the year 1202. In historical literature, Peja had various names such as Siparantum (Ptolemy's work Geography), Ipek, Pek-Pekia, and Peja (MDP, 2020). According to the 2024 census, the Municipality of Peja has 82,661 inhabitants (KAS, 2024). The climate is continental-mediterranean (Pllana, 2015). The average annual temperature is 11.6 °C, with average annual rainfall from 800 mm in the plains to over 1000 mm in mountainous areas. The predominant winds flow from the south/ west to west at an average annual speed of 1.3 m/s, while solar radiation is approximately 1958 hours per year (IHMK, 2020). The hydrological network is represented by the Lumbardh River, which delineates the urban area of Peja. The average annual water flow is 10.21 m³/s (MESPI, 2020). The city of Peja (Figure 2) belongs to the type of compact settlement. According to the Peja Municipal Development Plan 2020-2028 (MDP, 2020), the urban area of Peja is primarily characterized by three types of housing: individual, collective, and mixed-use residential buildings. Low-rise buildings occupy the largest part of the urban area, up to 93%.



Figure 2. The physical-geographical position of Peja (Sources: MDP, 2006-2025; adapted by the authors, 2024)

LITERATURE REVIEW

Today, there is a wide range of written and electronic literature globally that addresses the issues related to the impact of urban areas and urbanization on the environment. Rapid urbanization, a global phenomenon especially in Countries under development, has been characterized by the rapid migration of people from rural to urban areas and from small to bigger urban areas (Cities), has been continually of interest to researchers (Grimm et al., 2008). Over time, urban transition has brought a significant environmental change, leading to concerns about sustainability (Seto et al., 2011). Torrey (2004) emphasizes the interconnection between the urban population and the environmental issues. Urban residents alter their environment through food consumption, traffic flow and using natural resources! On the other hand, urban consumption leads to pollution and degradation, which negatively impacts their public health. Some research studies suggests that indicators of health problems, such as infant mortality rates, are higher in rapidly growing Cities compared to those with slower growth trends (Brockerhoff & Brennan, 1998).

According to Uttara et al., (2012), urbanization is a process that leads to the growth of cities due to industrialization and economic development, this resulting in specific spatial changes. Wayne et al., (2020) highlight that the negative effects of urban area expansion/ urbanization, can be minimized through proper urban planning and design (based on standards). The city of Peja covers an area of 60,258 hectares and has a population of 96,450 (MDP, 2020). According to the Institute for Spatial Planning (IPH, 2018), Peja's urban area has been grown between 2000-2012- 2018 (Figure 4).

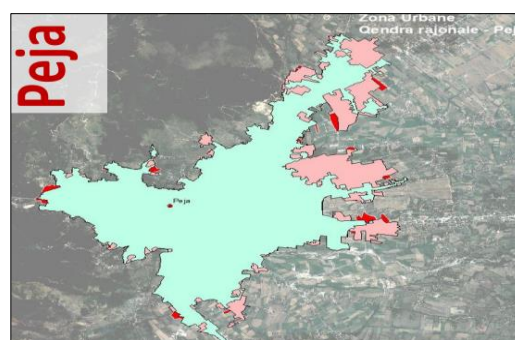


Figure 3. Urban area of the city of Peja (IPH, 2018)

The year 2000, is considered the baseline or "Zero year" (Figure 4A) from which results that the urban area of the city of Peja was 985 hectares. By the year 2012, this area was increased by 231 hectares, or 23.4%, compared to the year 2000. Thus, in 2012, the urban area of Peja was 1217 hectares (Figure 4B), indicating an annual growth of approximately 19.25 hectares/ per year (assuming this value remained constant over the years). By the year 2018, the urban area of Peja (Figure 4C) was grown to 1238 hectares (compared with year 2000), which is a 252-hectare increased area or 25.55% growth; but only 1.72% increased rate compared to 2012. Those small urban development for the last period (2012-2018) might be as result of controlled development through urban planning.

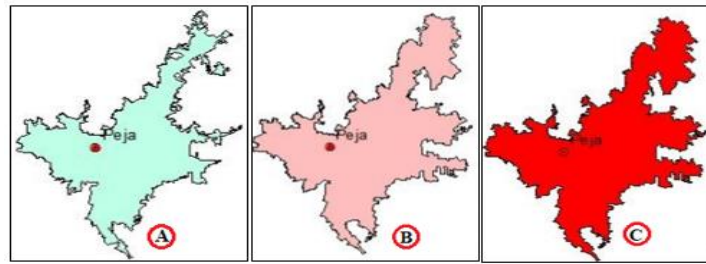


Figure 4. Urban area of Peja; A) in 2000, B) in 2012, and C) in 2018 (IPH, 2018, modified by the author)

Based on Figures 3 and 4, it is shown that the urban area has expanded primarily in the northeast direction of Peja, specifically towards the cities of Istog and Klinë. According to field research conducted for this study, the urban expansion is a linear model, closely related to the road infrastructure, including the regional road Pejë-Gjurakoc- Mitrovicë, the national road Pejë-Klinë-Prishtinë. Alongside these roadways, the community has predominantly built low-rise individual residential houses (up to three floors, rarely higher), which are used not only for housing but also for business activities especially grand floor, and other model are commercial buildings.

Research field also indicates that alongside these roadways, there is a considerable number of various types of businesses with different service-oriented activities, such as auto-repair services, grocery stores, fashion shops, gastronomy, car showrooms, building and sanitary material stores, shopping centers and fuel stations. This development and growth from a socio-economic perspective represent progress as it contributes to improving the overall living standard of the community. However, on the other hand, this urban expansion results in the occupation of huge area mostly agricultural land characterized with not adequate land use and lack of proper infrastructure. All this leading to irreversible impacts on the environment pollution and degradation. Figure 5 illustrates a trend of land use occupation as an effect of the urban area's expansion!

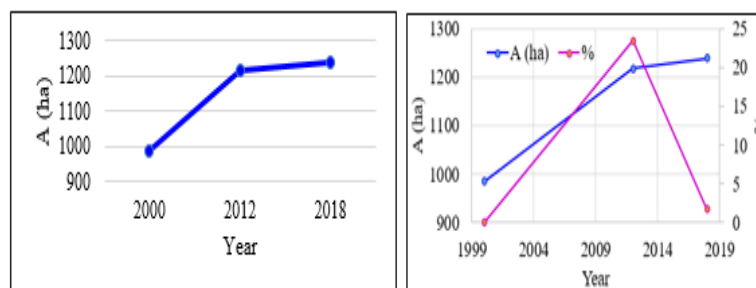


Figure 5. Trends of urban area growth of the Peja city (Source: authors)

METHODS AND MATERIALS

Research development: the research involved a systematic review and analysis of literature. This included identifying, evaluating, processing, and synthesizing relevant literature for the purpose of the study. **Data Collection:** a significant number of researches and publications, both written and electronic version; has been used a wide range of reliable scientific databases such are: Web of Science, Scopus, JSTOR, Google Scholar, PubMed, and ResearchGate. Legal acts, development strategies, urban plans, statistical data, and environmental reports prepared by institutions of the Republic of Kosovo were analyzed too, and as result many relevant data and information's were integrated into this paper. Some of the studied literature and parts from research articles were cited in this paper. Additionally, study cases and projects, providing quantitative or qualitative data and information's on the impact of urbanization on the environment were consulted for potential comparison analyses too.

RESULTS AND DISCUSSIONS

Theoretically, urbanization is considered as complex process, because is a multidisciplinary field. People continue to move towards urban areas continuously. In this context, urban areas face various types of challenges. As observed in this study, urban area of Peja is facing different urban challenges

too. The rapid growth of the urban area, produces series of environmental problems, such are: uncontrolled occupation of agricultural land with constructions, impacts on air and water pollution, land degradation, and microclimatic changes. Finding a comprehensive, effective, and sustainable solutions to urban challenges remains a difficult task because of development dynamics and problems complexity.

Air pollution-the urban growth of the cities has many positive aspects but also negative ones. This study highlights that the urban growth of the city of Peja and its negative effects on air quality. Two main identified factors are urban construction and gas emissions from vehicles. Human activities release a wide range of gas emissions into the environment including: carbon dioxide, carbon monoxide, ozone, sulfur oxides, nitrogen oxides, lead, air pollutants vapors from organic compounds and many other pollutants. The air in the urban area is being polluted due to many developed human (anthropogenic) activities in the city of Peja, especially during the last decade. The construction process of numerous buildings produces dust and inert waste from the different building materials used for different purposes, and also to this degradation and pollution contributes also traffic and transport systems, characterized with may active vehicles in the traffic, releasing pollutants into the air within the relatively small urban perimeter. It was identified that as a result, air pollution can pose various public health risks. Air quality is described according to the Air Quality Index (AQI), which is based on the concentration of pollutants present in the air at a specific location. The air quality standards for the territory of the Republic of Kosovo are referred to in Administrative Instruction No. 02/2011, which provides limited values for parameters: particulate matter (PM10 and PM2.5) and four types of gases: NO₂, SO₂, O₃, and CO. In Table 1, are shown the results of air quality monitored for the city of Peja (KEPA, 2022). According to the data in Table 1, is shown that at the Peja city, daily limit values measured for one year were exceeded for 41 days regarding parameter PM10.

Table 1. Variation of air pollutant parameters.

Station	PM10	PM2.5	O ₃	SO ₂	NO ₂	CO	The number of days with excesses for PM10
	Unit (µg/m ³)						
Pejë	29.11	21.18	60.24	3.96	17.64	0.7	41

Water pollution-urban waste, is known that the direct discharge of urban and industrial waste water and other pollution elements from traffic (including metal particles, rubbers, and oil spills on roads and parking lots) are among the concerns identified in Peja's urban area, posing risks to the quality of both surface and groundwater. Groundwater is affected by construction activities too, especially those involving buildings with basement floors below the ground surface. Such construction activities in the urban area in most cases disrupts the flow and direction of groundwater current lines. Also lack of drainage system for atmospheric water rains (which in the last decade are more intensive) additionally affects water pollution. The continuous increasing demand for water in the urban area has led to a huge number of wellbeing drilled for water extraction (for sanitary needs and irrigation), has resulted in the over- extraction of groundwater aquifers and a subsequent drop in groundwater levels. The Administrative Instruction (MESPI, 2022) No. 02/2022 provides guidelines for preserving and protecting water quality, including conditions, methods, parameters, and limit values for waste water discharge into public sewerage networks and water bodies (<https://gzk.rks-gov.net/ActDetail.aspx?ActID=58967>).

Noise Pollution-within the urban area, there has been noted a substantial increase of noise pollution. This is generated by the rising number of vehicles in traffic, the lack of barriers to minimize noise pollution, industrial and construction activities, and urban social functions, all these together leads to psychological and physical disturbances for city inhabitants with direct impact on public health. Noise emission levels in the Republic of Kosovo are regulated by Administrative Instruction No. 08/2009 on permissible noise emission levels from pollution (MESP, 2009).

Temperature Increase-urban areas, especially those that exceed standard planning and design norms or are without continuous planning such is Peja, has negative impact in the local microclimate conditions. Poorly planned high- rise construction buildings, developed infrastructure, and mass

concrete structures of the built components; absorbs solar radiation throughout the day and release heat during the evening, affecting directly the urban microclimate conditions. Such situation was concluded for Peja's urban area based on data collection and observations conducted for this study.

Traffic and transport-the urban area of Peja has a road network and traffic flow that affects the urban environment, manifesting noise, air and water pollution through gas emissions, and their increased impact on the atmosphere with direct impact on climate changes. Traffic and transport are considered a significant pollutant especially through NO₂. This is as result of increased number of vehicles and the community's demand for transportation services especially inside urban area. Pollution from traffic and transport is directly related with public health too.

Heating fuels-the large community within the urban contributes to increasing the demand for more energy and heating, especially for low rise buildings. It has been observed that the urban area of Peja significantly contributes to air quality degradation due to heating fuel consumptions because there are not alternative solutions still developed (lack of central heating).

Manufacturing Industry-within the urban area, the manufacturing sector generates CO pollutions. A response to reduce and minimize emissions from various pollution sources in Peja's urban area should include: promoting and using clean technologies, environmentally and renewable energy, electric transportation, and similar components that have minimal negative impacts on the air pollution.

Urbanization and natural resource utilization-the urban growth in Peja has increased the demand for natural resources. Due to the high density in the urban area, changes in the living environment, living standards (lifestyle), and increased consumption of natural resources such as water, fossil fuels, energy, and other natural products, all this together results on the growing trends in resource utilization. Service providers for water and energy indicates that the urban growth in some situations leads to shortages of drinking water, power outages, and other social welfare issues as a result of urbanization.

Urban Waste-it was observed that with the expansion of the urban area, the volume of generated urban waste of all types has increased, while the capacity for its collection, treatment, and recycling remains low on the city of Peja. Consequently, those developments negatively impact not only in the inner urban area but also in the urban periphery. Urban waste often creates an unpleasant visual image, emits foul odors, resulting with polluted water often leaking and naturally affecting aquatic environments.

Urbanization on the ecosystem-the urban area has influenced the destruction, modification, and recreation of new habitats related directly to the ecosystem. Urban waste discarded along the banks and beds of the hydrological network (River "Lumbardhi" in Peja) decrease the oxygen level during decomposition, worsening the health of aquatic flora and fauna. Native habitats are lost or forced out of the urban area. Bridges and other structures have become additionally nesting sites for various bird species. These species, which cannot be easily controlled in terms of their health, can become carriers and transmitters of various diseases to the urban community.

Construction Activities-were identified as key contributors to the high concentration of pollution particulates in the air as product of operation of the construction machinery which are producing also: noise, and other related complex components with direct impact on the environment pollution and degradation, and all this on public health.

CONCLUSIONS

This study highlights that the growth of the urban area of the city of Peja, despite the benefits it brings to the community undeniable negative effects related to the environment and public health. This presents a significant challenge, not only locally but also nationally and globally, requiring more proactive, coordinated, and multidisciplinary approach to address this issue for coming days and years. The findings of this study recommend: urban planning, construction, and management based on the concept of integrated and sustainability. The study suggests facing and overcoming the complex challenges arising from the growth of urban area through policy development, investments, and the implementation of environmentally friendly practices and standards. Key recommendations include:

- Investment in green infrastructure: increased investment in green infrastructure to promote environmental care and development.
- Promotion encouraging of the use of electric vehicles and electrical transport systems.
- Pollution control: prioritizing the control of pollution sources, drafting and implementing strategies, and sustainable urban plans based on national and international regulative frameworks.
- Treatment of informal areas: local governments should act swiftly to stop the expansion of informal areas towards their incorporation to urban development plans.
- Waste management and recycling: through reducing urban waste generation, implementing recycling systems, and enforcing legal and economic instruments, supporting and promoting environmental education to protect public health.
- Institutional coordination: better coordination and cooperation are required among institutional mechanisms at all levels and different stakeholders.

Overall conclusion is that this issue should be considered through joint efforts from all stakeholders in line with environmental protection and management through urbanization process, progressively and effectively.

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