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[Poster]

Perceptions of Air Pollution in Belgrade: A Survey Analysis

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Abstract: This paper addresses the issue of air pollution in Belgrade through an analysis of citizen's perceptions of air quality, based on an online survey. The aim of the study is to highlight the importance of air quality in urban environments and, based on the results obtained in the survey, to determine the extent to which the citizens of Belgrade are aware of this environmental issue and the potential impact of air quality on public health. In addition to the survey research, the methodology also included an analysis of relevant air – quality data obtained from the competent national agency. A comparative analysis was conducted using data for the summer and winter periods for the pollutants PM_{2.5}, PM₁₀, NO₂ and CO. The results indicate higher concentrations of particulate pollutants during the winter period, demonstrating a correspondence between the analytical findings and the perceptions of the majority of respondents, who identified winter as the period of more intense air pollution. The findings are also consistent with respondent's views regarding the main sources of air pollution.

Keywords: air pollution, Belgrade, public opinion, environment, health impact

Introduction

Air pollution represents one of the major environmental and health problems of modern society, particularly in large urban areas. With the development of industry, population growth and the increasing use of motor vehicles, air quality in cities has become an increasingly important environmental issue (Ram Mahala, 2024; Tsekeri et al., 2025). Belgrade, as the capital and largest city of Serbia, faces a pronounced air-quality problem that may negatively affect human health and the environment. In recent years, air pollution in Belgrade has attracted increasing attention from the public, media and experts (RERI, 2024).

The purpose of this research was therefore to examine the main sources and causes of air pollution and its consequences for the population and the environment. A survey among citizens was conducted to examine their perception on the degree of air pollution, their familiarity with the problem, perceived health effects and habits or measures that may contribute to reducing pollution. The survey results provide a better understanding of public awareness of this problem and of the extent to which citizens are prepared to contribute to environmental protection. In addition, measured air-quality data were used to compare public perceptions with the observed situation during selected winter and summer conditions in Belgrade.

Methods and data

The research paper concerning air pollution in Belgrade was conducted using an online survey and an assessment of public opinion. A total of 263 participants took part in the research. The aim of the survey was to determine how familiar citizens are with the problem of air pollution, what the causes of air pollution are whether air pollution causes difficulties, what an individual could do to address this problem, and what opinions and attitudes people hold regarding possible solutions.

To determine the observed state of air quality in Belgrade, verified data collected at automatic monitoring stations of the Serbian Environmental Protection Agency for the calendar year 2024 were used (SEPA, 2024). The extended analysis focused on the Novi Beograd monitoring station and compared one selected winter day (31 January 2024) with one selected summer day (19 July 2024). The parameters considered were: NO₂, PM_{2.5} and PM₁₀, and CO. This simple seasonal comparison was used to obtain a clearer picture of differences between winter and summer pollution and to examine whether measured conditions corresponded with the perceptions expressed in the survey.

Results and discussion

According to the data obtained from the first two survey questions, the majority of respondents were female (70.7%), while the largest proportion of respondents was in the 18–25 age group (62%). Regarding familiarity with the problem of air pollution, the average response was 3.94, indicating that citizens are, to a considerable extent, aware of this problem. The largest proportion of responses was five stars, selected by 35.7% of respondents, indicating that they considered themselves fully familiar with the problem of air pollution. Respondents were also asked to indicate their opinion of how polluted they considered the air in Belgrade to be. The average response was 4.57, leading to the conclusion that, in the respondents' opinion, the air is highly polluted. The largest proportion selected five stars (66.5%). The analysis of responses to this question leads to the conclusion that air pollution is perceived as a major environmental problem and challenge, affecting many human activities and, in particular, human health.

What do you think are the main causes of pollution?

263 responses

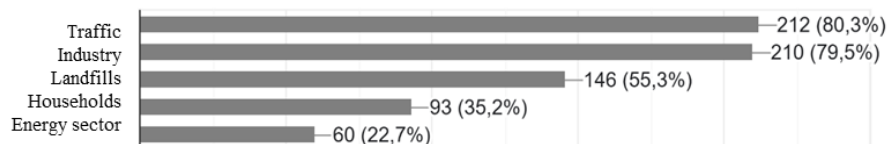


Figure 1. What do you think are the main causes of pollution?

Regarding the main sources of pollution, a large proportion of respondents identified traffic and industry. The next most frequently identified source was illegal waste disposal sites. In addition, a significant number of respondents identified households as major sources of air pollution, particularly emissions released into the atmosphere during winter. The energy sector ranked fifth, with 22.7%. Pollution on an annual basis was also considered. The response receiving the most votes was the middle of the heating season, December–February, with 60.2%. This response led to the conclusion that air pollution is perceived as most severe during winter, partly because meteorological conditions can facilitate the accumulation and prolonged retention of polluted air. The “whole year” option was selected by 28% of respondents.

Regarding difficulties experienced under conditions of increased concentrations of various pollutants, the most frequently reported difficulties were respiratory problems, selected by 43.9% of respondents. Respondents also reported headaches, dizziness and migraines, as well as throat irritation, fatigue, discomfort while breathing and watery eyes.

Respondents were also given the opportunity to select which measures an individual could undertake. The majority considered tree planting to be the most beneficial measure, with 78.8%. Proper waste disposal using designated containers received 66.7%, while 62.9% of respondents identified the use of renewable energy as a good starting point for improving air quality. Furthermore, 50.4% of respondents considered a shift towards public transport and

reduction in the use of private vehicles to be measures that could contribute to environmental protection.

When asked whether they considered the data on air pollution in Belgrade to be sufficiently transparent, the largest proportion of respondents (68.9%) stated that the data were not sufficiently transparent. 84.5% of respondents stated that public awareness of air pollution was not sufficiently developed. When air pollution is particularly severe, the largest number of respondents stated that they do not change their daily routines depending on pollution levels. A total of 57.2% of respondents agreed with the statement that they do not change anything, while 26% selected either staying indoors or monitoring pollution trends through applications.

Table 1. Air-quality data for the Novi Beograd monitoring station in 2024

Monitoring station		Pollutants			
Novi Beograd	Selected dates	PM _{2.5} ($\mu\text{g}/\text{m}^3$)	PM ₁₀ ($\mu\text{g}/\text{m}^3$)	NO ₂ ($\mu\text{g}/\text{m}^3$)	CO – max 8h (mg/m^3)
	31.01.2024.	70.3	92.7	60.9	1.1
	19.07.2024.	13	23.4	20	0.1
	Daily limit values	15 $\mu\text{g}/\text{m}^3$	50 $\mu\text{g}/\text{m}^3$	85 $\mu\text{g}/\text{m}^3$	10 mg/m^3

The second part included results of monitoring station Novi Beograd. During the winter period on January 31st 2024, PM_{2.5} concentrations reached 70.3 $\mu\text{g}/\text{m}^3$, while during the summer period, on July 19th 2024, the concentration was 13 $\mu\text{g}/\text{m}^3$. Regarding PM₁₀ particles, the concentration on January 31st 2024 reached 92.7 $\mu\text{g}/\text{m}^3$, whereas on July 19th 2024 it was 23.4 $\mu\text{g}/\text{m}^3$. The NO₂ concentration was 60.9 $\mu\text{g}/\text{m}^3$ during the winter period and 20 $\mu\text{g}/\text{m}^3$ during the summer period, while CO values were 1.1 mg/m^3 and 0.1 mg/m^3 , respectively. Based on the presented data, it can be concluded that harmful concentrations of pollutants in the air are higher during the winter than during the summer period. The causes of increased pollutant concentrations include fossil-fuel combustion, traffic emissions,

industrial activity and the burning of coal and wood for household heating during winter. The measured data therefore show a correspondence with the perceptions of the majority of respondents, who identified winter as the period of more intense air pollution.

Conclusions

The research showed that citizens are largely aware of the problem of air pollution and of its possible consequences for the population and the environment. Most respondents considered the air in Belgrade to be highly polluted, particularly during winter, which coincides with the heating season. The analysis of selected air-quality data also showed substantially higher PM_{2.5} and PM₁₀ concentrations on the winter day than on the summer day, providing measured support for this perception.

Traffic and industry were recognized as the dominant pollution sources, while households, illegal waste disposal and the energy sector were also frequently identified. The findings further indicate that solving the problem of air pollution requires joint action by public institutions, experts and citizens. Education about environmental protection and the development of ecological awareness, particularly among young people, are important for long-term improvement. Although completely eliminating air pollution is difficult, appropriate measures and responsible behavior can contribute to better air quality and living conditions in Belgrade.

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