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More than 40% Capetonians face high air pollution risk – UCT study

A study at the University of Cape Town (UCT) has produced the first high-resolution map of air pollution risk across the Cape Town metropolitan area, revealing that more than 40% of the city's population is exposed to high or very high levels of air pollution. The findings are published in [GeoHealth](#) journal.

The study, led by [Dr Meryl Jagarnath](#) of UCT's [Division of Environmental Health](#), integrated satellite-derived air quality data with a detailed social vulnerability index, offering a novel framework for advancing environmental justice in urban Africa.

Dr Jagarnath said the study, funded by the National Research Foundation, addresses a critical gap in air pollution science. "Conventional approaches to air quality assessment focus primarily on pollutant concentrations, often overlooking the social and structural conditions that shape exposure and health outcomes," she said.

Using satellite observations from Sentinel-5P, the researchers constructed an air quality index capturing multiple pollutants, including nitrogen dioxide (NO₂), sulphur dioxide (SO₂), ozone (O₃), and particulate matter (PM). These data were combined with a social vulnerability index derived from indicators of demographics, socioeconomic status, housing, infrastructure and land use. By integrating these datasets within a geographic information system, the research identified spatial "hotspots" where high levels of air pollution coincide with high levels of social vulnerability.

The findings showed that approximately 1.9 million people, or 40.3% of Cape Town's population, live in areas classified as high- to very-high-risk. "These areas are concentrated in informal settlements and historically disadvantaged neighbourhoods, where residents face compounded challenges such as poor housing conditions, limited access to healthcare and proximity to pollution sources," said Jagarnath.

According to Jagarnath, Cape Town provides a critical case study for understanding the intersection of environmental and social risk. She said that as one of the most unequal cities in South Africa, Cape Town's spatial patterns of segregation and deprivation continue to shape both exposure to environmental hazards and the capacity of communities to respond to them.

“The study highlights how these structural inequalities are reflected in the geography of air pollution risk, underscoring the need for approaches that explicitly incorporate environmental justice into air quality management,” she said.

The study was conducted in collaboration with Dr Lerato Shikwambana from the Earth Observation Directorate at the South African National Space Agency. This collaboration brought together expertise in environmental health and satellite-based atmospheric science, enabling the integration of Earth observation data into the assessment of air pollution risk in Cape Town.

“The application of Earth observation represents an important advancement in public and environmental health research,” said Jagarnath, adding that satellite platforms provide continuous, large-scale and high-resolution data on atmospheric pollutants, overcoming the limitations of sparse and unevenly distributed ground-based monitoring networks. In this study, she said, satellite-derived data provided comprehensive spatial coverage, including areas typically underrepresented in conventional air quality monitoring systems.

The findings have important implications for policy and practice, noted Jagarnath. “Current air quality management strategies often adopt uniform approaches that do not account for localised differences in exposure and vulnerability. The spatially resolved risk maps produced in this study provide a basis for targeted, location-specific interventions, enabling policymakers, urban planners and public health practitioners to prioritise communities at greatest risk.”

She added: “Such interventions may include reducing emissions in high-risk areas, improving housing and infrastructure, increasing access to healthcare and enhancing urban green spaces. By addressing both environmental exposures and underlying social conditions, these strategies have the potential to reduce health inequalities and improve overall population health.”

The study also highlighted the value of integrating environmental data into health systems. Jagarnath said that spatial information on air pollution and vulnerability can support more informed clinical and public health decision-making, particularly for conditions associated with air pollution exposure, including respiratory and cardiovascular diseases.

She concluded: “More broadly, the study demonstrates the potential of interdisciplinary approaches that combine environmental science, geospatial analysis and public health. As cities across Africa continue to grow, the integration of Earth observation into environmental health research offers a scalable and transferable model for assessing and managing urban environmental risks.

“By making visible the spatial distribution of air pollution risk and its intersection with social vulnerability, this study provides critical evidence base for advancing environmental justice in South Africa.”

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