

F.AIR: Fragile AIR - Unfair Health

An Urban action-research assessing socio-environmental inequalities and access to healthy school environments

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Abstract The F.AIR research (Fragile AIR, Unfair Health) investigates the production and distribution of socio-environmental inequalities associated with air pollution in rapidly evolving urban contexts. Focusing on Milan's municipalities 4, 5, and 6, the project adopts a multidisciplinary action-research framework, bringing together universities, technological partners, and environmental activism associations. Supported by the Cariplo Foundation's Inequalities Research Call, F.AIR is grounded in the recognition that urban air quality is both an environmental and an equity challenge, with children in school settings representing a particularly exposed and under-recognized group.

The research addresses three main questions: (1) How are air pollutants (PM, NO₂) spatially distributed in school environments, and what territorial differences do they reveal? (2) In what ways can participatory methods and distributed sensing, through citizen science, enhance the capacity of school communities to understand, and respond to local environmental risks? (3) How can Urban Living Labs contribute to more inclusive and adaptive forms of urban governance, supporting healthier, and more just environments?

F.AIR develops a four-phase research process:

1. Critical Mapping: High-resolution analysis of air quality across the three municipalities, revealing patterns of environmental inequality
2. Identify Areas of Response-Ability: identification of school contexts requiring transformative interventions through Place-based inquiry
3. Adopt Design Strategies: Activation of Urban Living Labs to enhance access to healthy educational spaces through co-creation and policy dialogue with school communities and institutions
4. Extend Granular Sensing Ability: Development of distributed monitoring capacity using open-source sensor networks

By linking spatial analysis with participatory processes, F.AIR advances methodological innovation at the intersection of environmental science, urban planning, and social justice. The research project aims to generate new evidence on the mechanisms underlying urban environmental injustice, while testing scalable models for

collaborative mitigation and local governance. The anticipated outcomes include actionable guidelines for integrating (urban) health equity into territorial planning and public policy, as well as transferable practices to other urban areas facing similar challenges.

F.AIR offers an empirically grounded approach to advancing urban justice, prioritizing child health and the right to a healthy city environment. More broadly, it demonstrates a replicable model of engagement pathways and collaborative governance, transforming urban research from a purely scientific production into a dynamic platform that connects science with policy, society, and future generations.