

## Urban green infrastructure in Italy: policy integration and effectiveness for air quality improvement

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Urban green spaces play a vital role in regulating air quality, mitigating climate change, and supporting human well-being. However, debates persist regarding their actual effectiveness in reducing pollution. In Europe, especially Italy, recent policies promote urban greening as a key strategy to combat air pollution and ecosystem decline. Nonetheless, a fragmented policy landscape and limited integration with scientific evidence hinder implementation.

This study offers a comprehensive synthesis of Italy's urban green infrastructure initiatives to reduce air pollution, linking national and regional policies with current environmental data and research. We examine critical policy tools, including the National Urban Green Infrastructure Strategy, the Urban and Peri-urban Forestation Plan, and regional guidelines. While these frameworks focus on species selection, ecosystem services, and long-term monitoring, they lack harmonized methodologies and coordinated reporting.

In Italy, current data show decreasing trends in particulate (PM<sub>10</sub>) and nitrogen dioxide (NO<sub>2</sub>) over the past decade, though ozone (O<sub>3</sub>) remains problematic, with frequent exceedances in northern and suburban Italy. Evidence indicates urban vegetation aids pollutant removal, with species-specific traits influencing efficiency. Evergreen species and those with complex leaves excel at capturing particulate matter, while stomatal conductance enhances gaseous pollutant uptake. However, some species emit biogenic volatile organic compounds that can contribute to O<sub>3</sub> formation, offsetting benefits.

The findings underscore the need for integrated planning that combines species selection, air quality modelling, and standardized monitoring. We recommend developing coordinated national platforms, enhancing urban vegetation inventories, and incorporating plant functional traits into atmospheric models. Such advances are crucial for optimizing urban green infrastructure to improve urban air quality in Italy