

air pollution



Understanding the Impact and How We Can Help

Academic Year: 2025-2026

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Master's Degree Programme in Law - Course: "Ecological Transition and Law"

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What is Air Pollution?

Introduction

The problem of air pollution is particularly significant because air does not respect national borders. Air pollution is a pressing global issue that impacts not only human health but also the environment, economies, and ecosystems.



Types of Air Pollution

Air pollution can be categorized based on how pollutants enter the atmosphere:

Primary Pollutants

These are directly released from pollution sources.. Examples include: Carbon Monoxide (CO), Sulfur Dioxide (SO₂), Nitrogen Oxides (NO_x), Particulate Matter (PM).

Secondary Pollutants

These pollutants form when primary pollutants react in the atmosphere: Ozone (O₃), Smog, Acid Rain.



*Sources of
Pollution*

Major Causes of Air Pollution



Natural Sources

Air pollution can occur naturally through events like wildfires, volcanic eruptions, and dust storms.

- Wildfires produce smoke and fine particulate matter, worsening air quality and respiratory conditions.
- Volcanic eruptions release sulfur dioxide and ash, leading to acid rain and climate effects.
- Dust storms lift fine particles into the air, causing visibility issues and respiratory hazards. While these sources are beyond human control, climate change and deforestation can intensify their impact.

Human-Induced Factors

Human activities are the leading cause of air pollution, mainly through industry, transportation, agriculture, and deforestation.

- Factories and power plants burn fossil fuels, releasing toxic gases like sulfur dioxide and carbon monoxide.
- Vehicles emit nitrogen oxides and hydrocarbons, contributing to smog and ozone pollution.
- Agriculture releases methane from livestock and ammonia from fertilizers, worsening air quality.
- Additionally, deforestation reduces carbon absorption, increasing greenhouse gas levels.

Short-Term Effects

Short-term exposure to air pollution can cause eye, nose, and throat irritation, headaches, dizziness, and fatigue. People with asthma or other respiratory conditions may experience worsened symptoms, including coughing and difficulty breathing. High pollution levels can also trigger allergic reactions and increase the risk of lung infections and cardiovascular stress.

Long-Term Effects

Prolonged exposure can lead to chronic respiratory diseases like COPD and lung cancer, as well as heart disease, strokes, and high blood pressure. Polluted air weakens the immune system and may affect lung development in children. Pregnant women face a higher risk of premature births and low birth weight. Over time, exposure to toxic pollutants contributes to reduced life expectancy, particularly in heavily polluted urban areas.

Health Consequences of Air Pollution



Effects on Human Health

The Planet Under Threat



Climate Change

Greenhouse gases such as carbon dioxide and methane contribute to global warming by trapping heat in the atmosphere. This leads to rising temperatures, melting ice caps, rising sea levels, and extreme weather conditions, including heatwaves and hurricanes.

Acid Rain

Sulfur dioxide and nitrogen oxides combine with moisture in the atmosphere to form acid rain, which corrodes buildings, damages soil fertility, and harms aquatic ecosystems by lowering water pH levels.

Environmental Consequences

Ecosystem Disruption

Pollutants like heavy metals and pesticides accumulate in the environment, disrupting food chains and affecting wildlife health. Poor air quality stunts plant growth, reducing biodiversity and agricultural output.

Economic and Social Impacts

The Cost of Air Pollution

Healthcare Costs

Increased rates of respiratory and cardiovascular diseases due to air pollution place a heavy financial burden on healthcare systems worldwide. Medical expenses and loss of productivity cost billions annually.

Workforce Productivity

Poor air quality leads to higher absenteeism in workplaces and schools. People exposed to polluted air suffer from fatigue, reduced concentration, and chronic illnesses that lower productivity and economic growth.

Agricultural Losses:

Air pollution affects crops by damaging leaves, reducing photosynthesis, and contaminating soil with toxic substances. This leads to lower yields and food security challenges, impacting farmers and consumers alike.

Urban Livability

Cities with high pollution levels face decreased quality of life, lower property values, and a reduced ability to attract tourists and investors. Poor air quality discourages outdoor activities, affecting social interactions and public health.



*Fighting Back
Against Pollution*



Global Efforts to Reduce Air Pollution

First Global Conference on Air Pollution and Health (2018)

“Current knowledge is sufficient to act immediately. In ten years, we will not be able to say that we did not know”.

European Green Deal aims for an environment free from harmful pollution by 2050. Meeting this ambition requires updating and strengthening rules to tackle air pollution from buildings, energy, transport, agriculture and industry. Several Green Deal policies in these sectors support better air quality.

Two Ambient Air Quality Directives (AAQDs) :

- Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (the 2008 AAQ directive).
- Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air (the 2004 AAQ directive)

The two directives aimed, among other things, to maintain and improve air quality and to identify monitoring patterns: the directives establish how measurements should be carried out and, on one hand, specify the types of pollutants (13), while on the other hand they set thresholds, which are in turn based on the 2005 WHO guidelines.





Repealing and repealing the previous two directives consolidated the rules into a single coherent framework.

main changes:

- Normative unification — the previous two directives are merged into a coherent and simplified text.
- Stricter standards — more stringent limits for major pollutants (e.g., annual PM2.5 limit reduced by over half).
- Scientific alignment — standards are closer to WHO recommendations, though still not fully matching the 2021 WHO values.
- Periodic review — standards must be reviewed every 5 years based on the latest scientific evidence.
- Information and citizens' rights — greater transparency and the possibility of compensation if the rules are not respected.
- 2030 targets — Member States have until 2030 to meet the new limits and until 2026 to transpose the directive into national law.

The legislative amendment does not align at all with the scientific information provided. Thresholds have been lowered from 2008 to 2024, but they are still too high. Air quality regulations, therefore, do not provide protection.

Directive 2024/2881/EU

Real-World Impact

London's Smog Crisis

The Great Smog of 1952 caused thousands of deaths due to heavy coal smoke trapped by weather conditions. This disaster led to the UK's Clean Air Act, reducing industrial emissions and transitioning towards cleaner fuels.



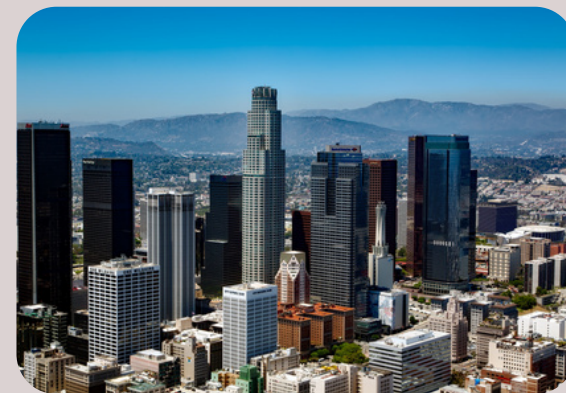
Beijing's Air Pollution Control Measures

In response to severe pollution, China implemented policies such as restricting coal use, regulating vehicle emissions, and promoting renewable energy. These measures have significantly improved air quality in major cities over the past decade.



Palermo Maglia Nera nel 2025

Based on the data from Legambiente's report "Mal'Aria di città 2026" (which analyzes 2025 data), Palermo is confirmed among the Italian cities with the most critical air pollution situations (followed by Naples and Milan). With 89 days exceeding the permitted limits for fine particulate matter (PM10) due to air quality, Palermo has been under scrutiny for European Union infringement procedures.



Case Study

