AQLI Air Quality Life Index® | Ecuador Fact Sheet

The average Ecuadorian citizen could live 1.2 years longer if particulate matter ($PM_{2.5}$) concentrations were permanently reduced to meet the World Health Organization (WHO) guideline of 5 µg/m³, adding a total of 21.7 million life years to the total life expectancy in the country.[1, 2] In Ecuador's most polluted cantons—San Miguel de los Bancos, Santo Domingo, and Pedro Vicente Maldonado—residents could gain more than 1.8 years in life expectancy (Figure 1).

KEY TAKE-AWAYS

- Particulate pollution is the second greatest external health threat to life expectancy in the country after dietary risks. While particulate pollution takes 1.2 years off the life of an average Ecuador resident, threats like dietary risks and transport injuries take off 1.8 years and 8 months off, respectively (Figure 2).
- The entire population of Ecuador is exposed to $PM_{2.5}$ levels that exceed the WHO guideline. Additionally, 72.6 percent of the population lives in areas where $PM_{2.5}$ levels exceed the national standard of 15 µg/m³. If these regions met the national standard, 4.6 million total life years could be gained across the country.
- In Santo Domingo de los Tsáchilas, Ecuador's most polluted province, residents could gain 1.9 years of life expectancy if $PM_{2.5}$ levels met the WHO guideline. In Los Ríos, the second most polluted province, the potential gain in life expectancy is 1.5 years (Figure 3). In Quito, the nation's capital and most populous canton, residents could gain 1.2 years in life expectancy.
- In mainland regions of Sierra and Costa, where nearly 94 percent of the country's population lives, residents could gain an average 1.2 years of life expectancy if the WHO guideline were met. [3]
- Between 1998 and 2023, $PM_{2.5}$ concentrations in Ecuador increased by 57.3 percent, contributing to a further reduction of 7 months in life expectancy. In the same period, Costa region saw the largest increase of 63.7 percent, cutting the average life expectancy further in the region by 8.5 months (Figure 4).

Figure 1 · Potential gain in life expectancy from permanently reducing $PM_{2.5}$ from 2023 concentration to the WHO guideline

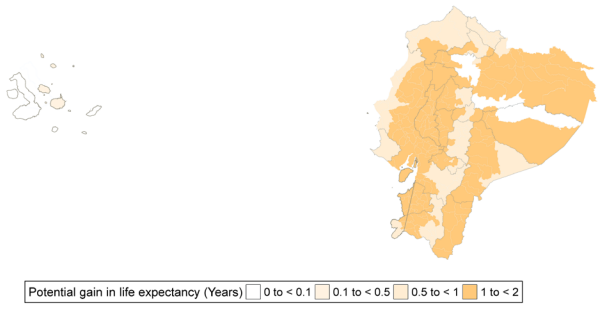
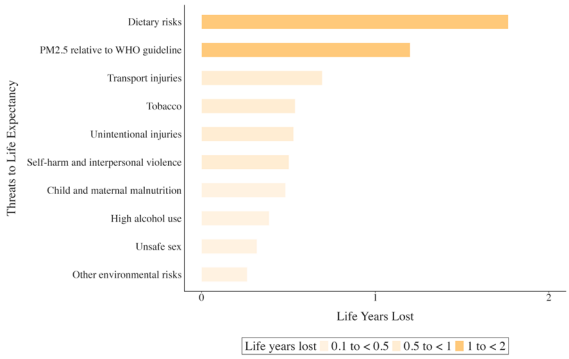


Figure 2 · Top 10 external threats to life expectancy in Ecuador



Sources: Global Burden of Disease (https://vizhub.healthdata.org/gbd-results/) level-2 causes and risks data and WHO Life Tables (https://apps.who.int/gho/data/node.main.LIFECOUNTRY?lang=en) were combined with the Life table method to arrive at these results. "$PM_{2.5}$ relative to WHO Guideline" bar displays the reduction in life expectancy relative to the WHO guideline as calculated by the latest AQLI (2023 $PM_{2.5}$ concentrations) data.

1 This data is based on the data used in AQLI Annual Update 2025 and considers $PM_{2.5}$ concentrations for 2023. dataset. All annual average $PM_{2.5}$ values (measured in micrograms per cubic meter: µg/m³) are population weighted.

2 World Health Organization. WHO Global Air Quality Guidelines: Particulate Matter ($PM_{2.5}$ and PM_{10}), Ozone, Nitrogen Dioxide, Sulfur Dioxide and Carbon Monoxide. Geneva: World Health Organization, 2021. https://iris.who.int/bitstream/handle/10665/345329/9789240034228-eng.pdf?sequence=1.

3 Ecuador is divided into four regions based on geography, climate, and ecosystems. Source: Instituto Geográfico Militar (IGM), Regiones Naturales del Ecuador. The four geographic regions are defined as Sierra: (Azuay, Bolivar, Cañar, Carchi, Chimborazo, Cotopaxi, Imbabura, Loja, Pichincha, Tungurahua); Costa : (El Oro, Esmeraldas, Guayas, Los Rios, Manabi, Santa Elena, Santo Domingo de los Tsachilas); Amazonia : (Morona Santiago, Napo, Orellana, Pastaza, Sucumbios, Zamora Chinchipe); Insular : (Galápagos).

Potential life expectancy impacts of particulate pollution reductions in the 25 most populous cantons of Ecuador

Province	Canton	Population (100,000)	Annual Average 2023 $PM_{2.5}$ Concentration (μg/m³)	Life Expectancy Gains from reducing $PM_{2.5}$ from 2023 concentration to WHO $PM_{2.5}$ guideline of 5 μg/m³ (in years)	Life Expectancy Gains from reducing $PM_{2.5}$ from 2023 concentration to National $PM_{2.5}$ standard of 15 μg/m³ (in years)
Pichincha	Quito	28.8	16.99	1.17	0.19
Guayas	Guayaquil	28.7	19.51	1.42	0.44
Azuay	Cuenca	6.6	14.34	0.92	0
Santo Domingo de los Tsachilas	Santo Domingo	4.7	24.51	1.91	0.93
Tungurahua	Ambato	4	15.19	1	0.02
Manabi	Portoviejo	3.3	14.9	0.97	0
Guayas	Durán	3.1	19.65	1.44	0.46
El Oro	Machala	3	20.97	1.57	0.59
Loja	Loja	2.7	13.82	0.86	0
Chimborazo	Riobamba	2.7	14.64	0.94	0
Manabi	Manta	2.5	13.27	0.81	0
Esmeraldas	Esmeraldas	2.3	11.48	0.63	0
Imbabura	Ibarra	2.3	14.71	0.95	0
Los Rios	Quevedo	2.3	20.65	1.53	0.55
Cotopaxi	Latacunga	2.2	14.81	0.96	0
Guayas	Milagro	2.1	20.58	1.53	0.55
Santa Elena	Santa Elena	1.9	13.8	0.86	0
Los Rios	Babahoyo	1.9	20.09	1.48	0.5
Guayas	Daule	1.7	18.86	1.36	0.38
Esmeraldas	Quinindé	1.5	16.88	1.16	0.18
Manabi	Chone	1.5	16.41	1.12	0.14
Manabi	El Carmen	1.4	19.47	1.42	0.44
Imbabura	Otavalo	1.3	14.31	0.91	0
Santa Elena	La Libertad	1.3	13.03	0.79	0
Sucumbios	Lago Agrio	1.2	16.87	1.16	0.18

Figure 3 · Potential gain in life expectancy from reducing $PM_{2.5}$ from 2023 levels to the WHO guideline in the 10 most populous provinces of Ecuador

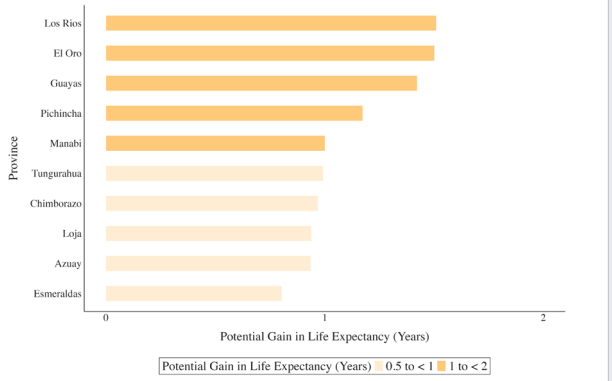
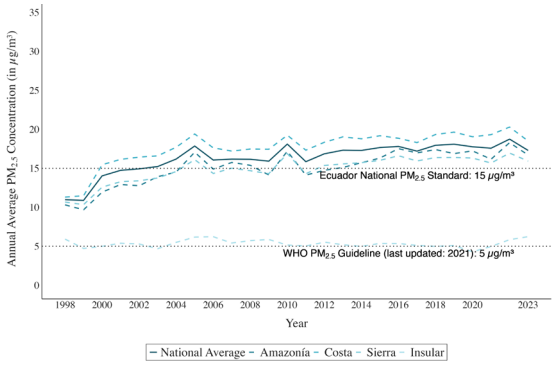


Figure 4 · Annual average $PM_{2.5}$ concentration in Ecuador, 1998-2023[1]



[1] Refer footnote 3 for region definition

ABOUT THE AIR QUALITY LIFE INDEX (AQLI)

The AQLI is a pollution index that translates particulate air pollution into perhaps the most important metric that exists: its impact on life expectancy. Developed by the University of Chicago's Milton Friedman Distinguished Service Professor in Economics Michael Greenstone and his team at the Energy Policy Institute at the University of Chicago (EPIC), the AQLI is rooted in research that quantifies the causal relationship between long-term human exposure to air pollution and life expectancy. The Index then combines this research with hyper-localized, satellite measurements of global particulate matter ($PM_{2.5}$), yielding unprecedented insight into the true cost of pollution in communities around the world. The Index also illustrates how air pollution policies can increase life expectancy when they meet the World Health Organization's guideline for what is considered a safe level of exposure, existing national air quality standards, or user-defined air quality levels. This information can help to inform local communities and policymakers about the importance of air pollution policies in concrete terms.

Methodology: The life expectancy calculations made by the AQLI are based on a pair of peer-reviewed studies, Chen et al. (2013) and Ebenstein et al. (2017), co-authored by Michael Greenstone, that exploit a unique natural experiment in China. By comparing two subgroups of the population that experienced prolonged exposure to different levels of particulate air pollution, the studies were able to plausibly isolate the effect of particulate air pollution from other factors that affect health. Ebenstein et al. (2017) found that sustained exposure to an additional 10 μg/m³ of PM_{10} reduces life expectancy by 0.64 years. In terms of $PM_{2.5}$, this translates to the relationship that an additional 10 μg/m³ of $PM_{2.5}$ reduces life expectancy by 0.98 years. This metric is then combined with sea-salt and mineral dust removed satellite-derived $PM_{2.5}$ data. All 2023 annual average $PM_{2.5}$ values are population-weighted, and AQLI's source of population data is https://landscan.ornl.gov/. We are grateful to the Atmospheric Composition Analysis Group, based at Washington University in St. Louis, for providing us with the satellite data. The original dataset can be found here: https://sites.wustl.edu/acag/datasets/surface-pm2-5/. To learn more deeply about the methodology used by the AQLI, visit: aqli.epic.uchicago.edu/about/methodology.