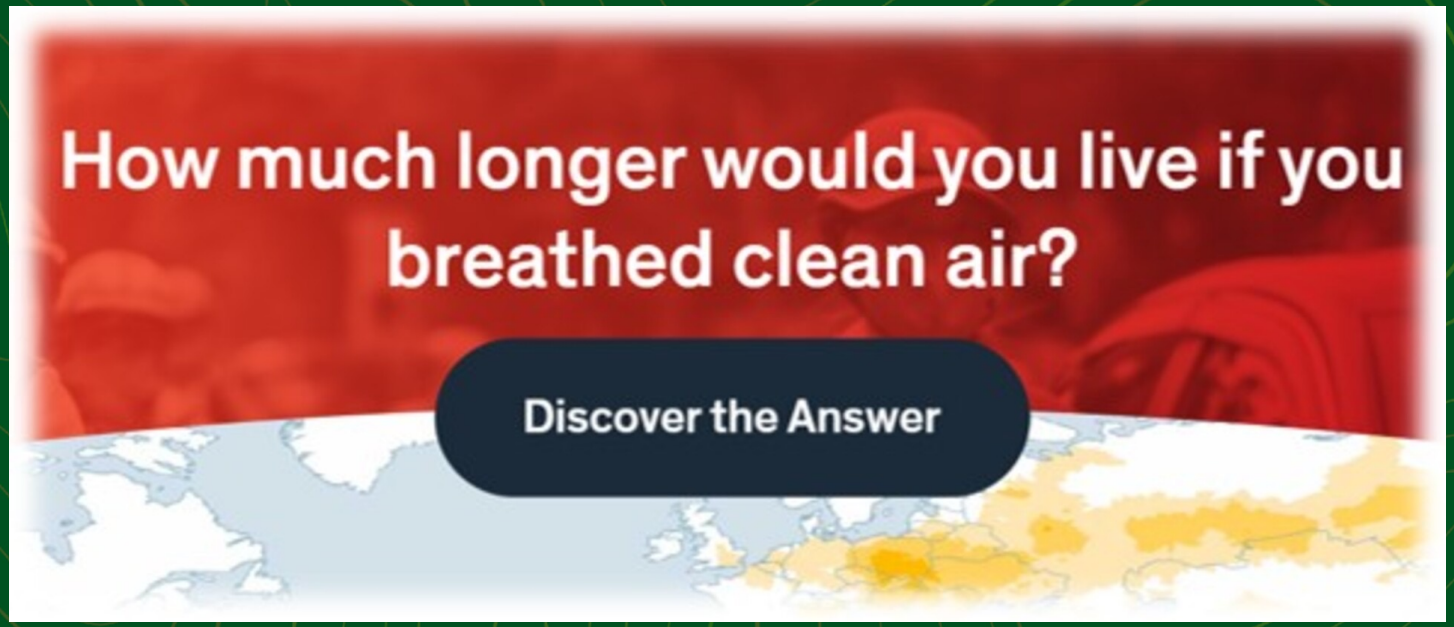
Calidad de Aire | Air Quality

Nishka Sharma - Gerente de Investigación y Políticas en AQLI



Air Quality Life Index (AQLI)

A tool for policymakers to determine the impacts of air pollution on life expectancy

Nishka Sharma
Research & Policy Manager, AQLI and Air Quality Programs at EPIC
Energy Policy Institute at the University of Chicago (EPIC)
Email: nishkasharma@uchicago.edu

Aarsh Batra
Research Associate, Air Quality Life Index (AQLI)
Energy Policy Institute at the University of Chicago (EPIC India)

Christa Hasenkopf
Director, AQLI and Air Quality Programs at EPIC
Energy Policy Institute at the University of Chicago

Visit: https://aqli.epic.uchicago.edu/

PRESENTATION ROADMAP

Air Pollution 101
- What is Air Pollution
- Health Effects of Air pollution

Trends in Central America

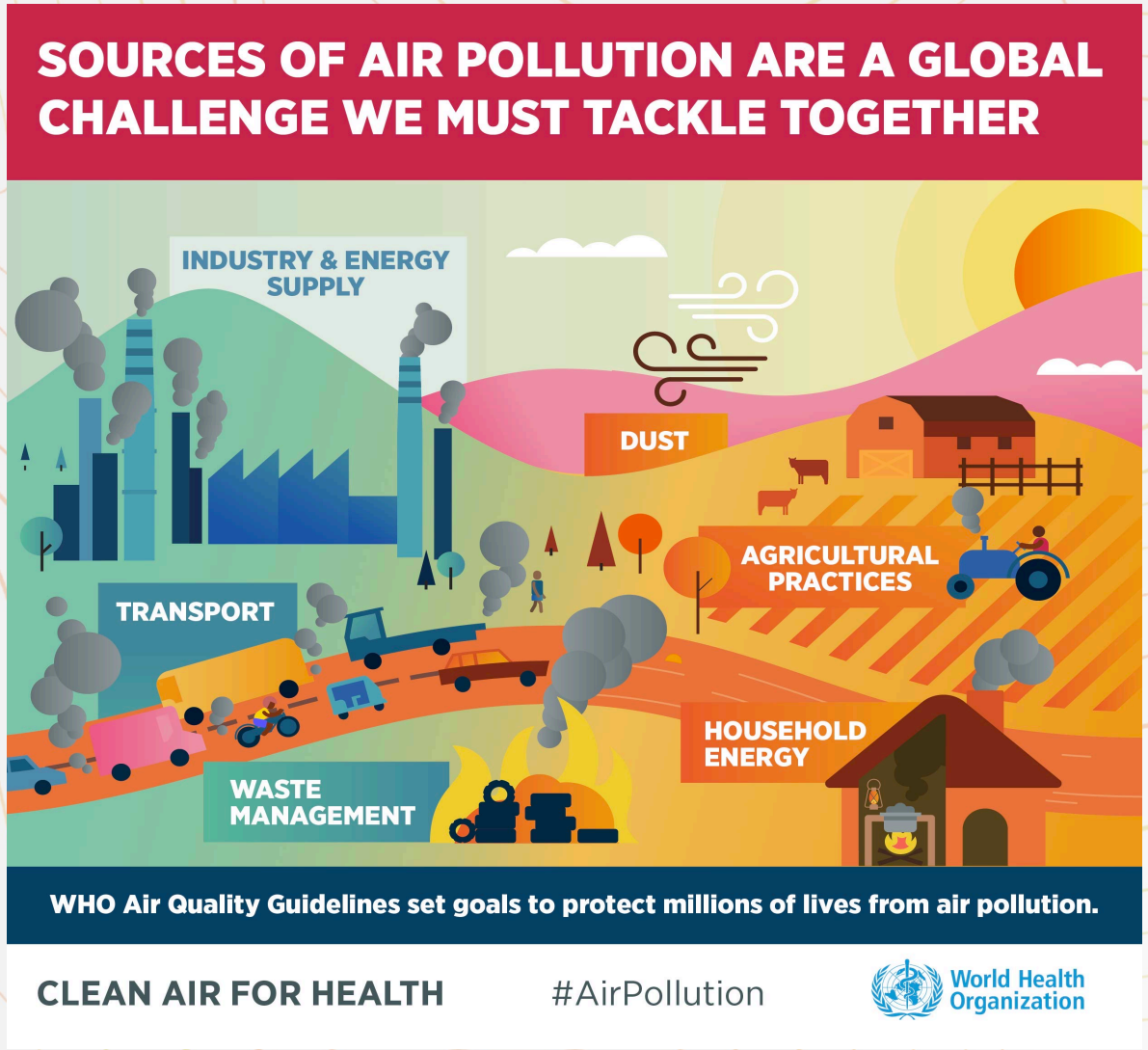
Solutions
- What are some solutions
- Air Quality Management

AQLI
- What is AQLI
- Background on AQLI

Spotlight on Guatemala

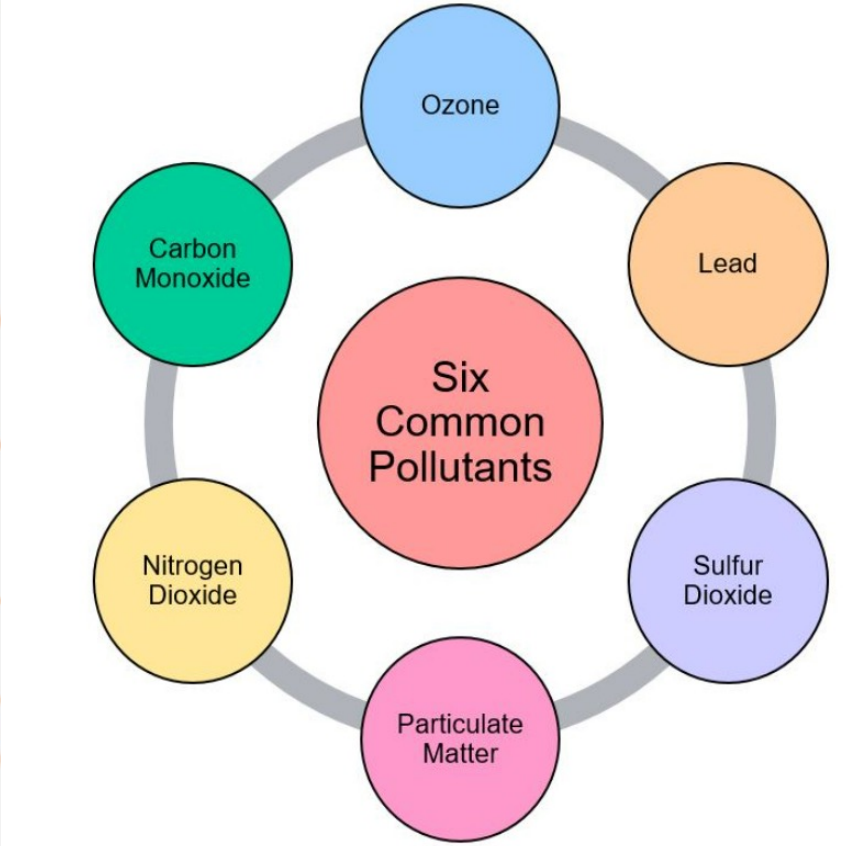
Summary

Air Pollution



What is air pollution? Where does it come from?

Pollutants from various sources interact in the atmosphere and have direct and indirect effect on the environment



What are the main classes of pollutants?

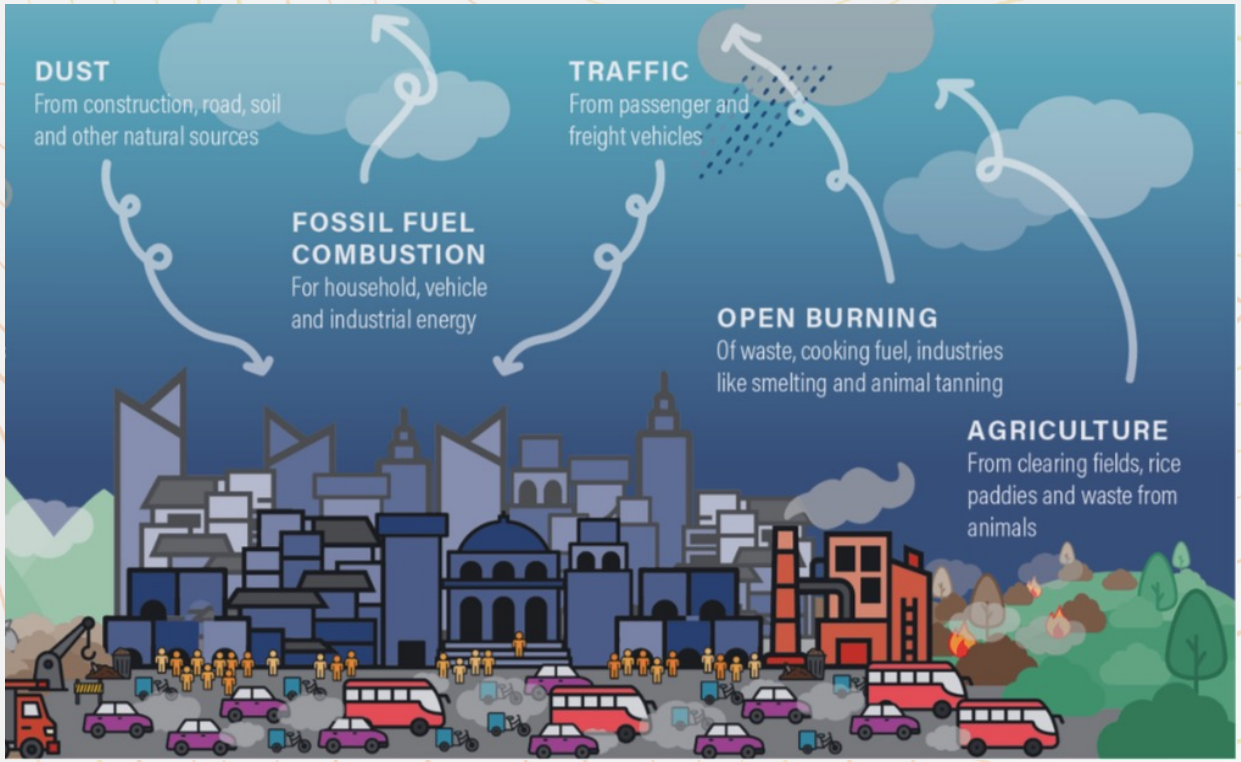
Six Common Pollutants

The Clean Air Act requires EPA to set national ambient air quality standards (NAAQS) for specific pollutants to safeguard human health and the environment. These standards define the levels of air quality that EPA determines are necessary to protect against the adverse impacts of air pollution based on scientific evidence. EPA has established standards for six common air pollutants, which are referred to as “criteria” pollutants.

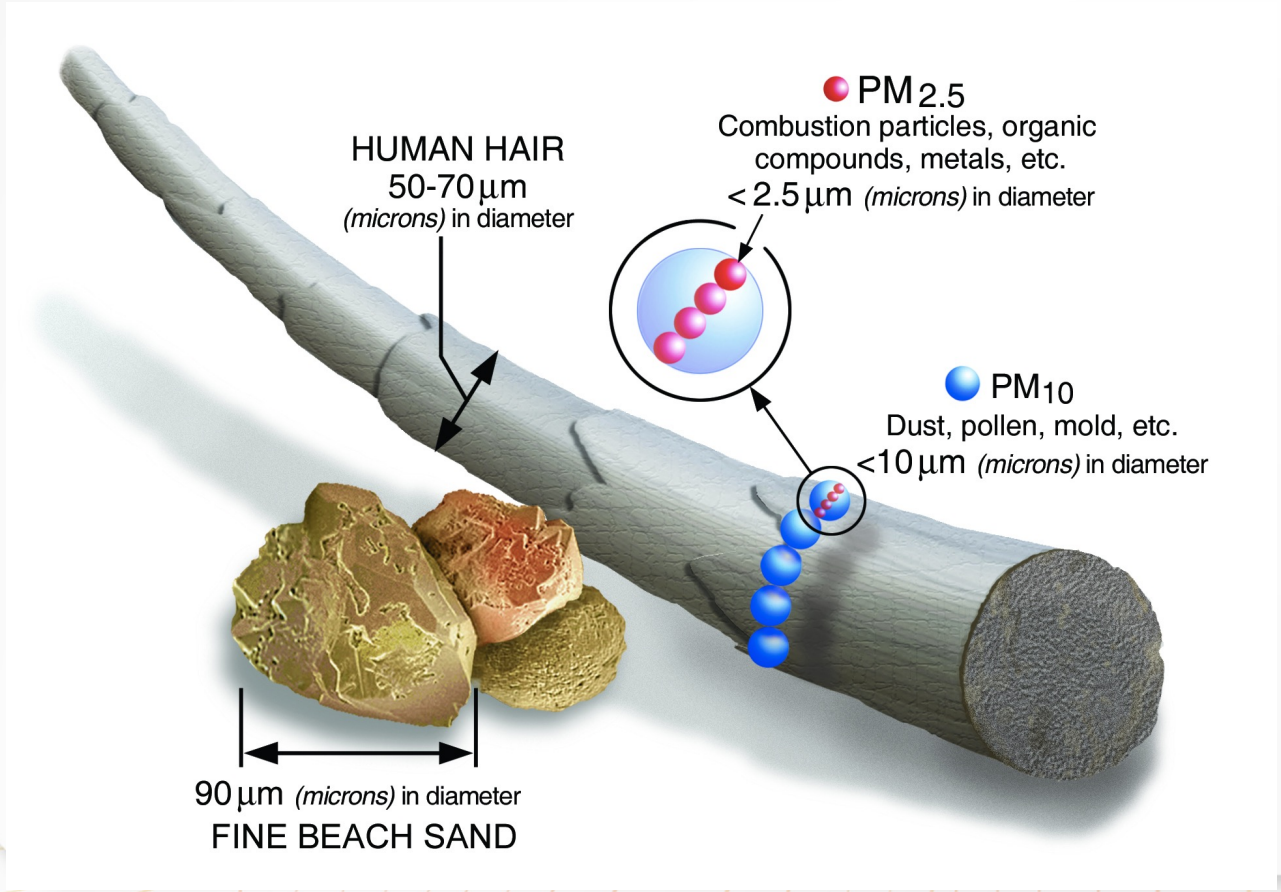
- **Carbon monoxide (CO)**
- **Lead (Pb)**
- **Nitrogen dioxide (NO_2)**
- **Ozone (O_3)**
- **Particulate matter (PM), and**
- **Sulfur dioxide (SO_2)**

Image Credit: My NASA Data

What is PM? Where does it come from?



Credit: World Resources Institute



To learn more, visit: https://aqli.epic.uchicago.edu

What is the international community doing to fight air pollution?

World Health Organisation (WHO) has guidelines for air pollution. After 15 years, WHO proposed updated guidelines in 2021. The updated standard is stricter than the previous standard set in 2005

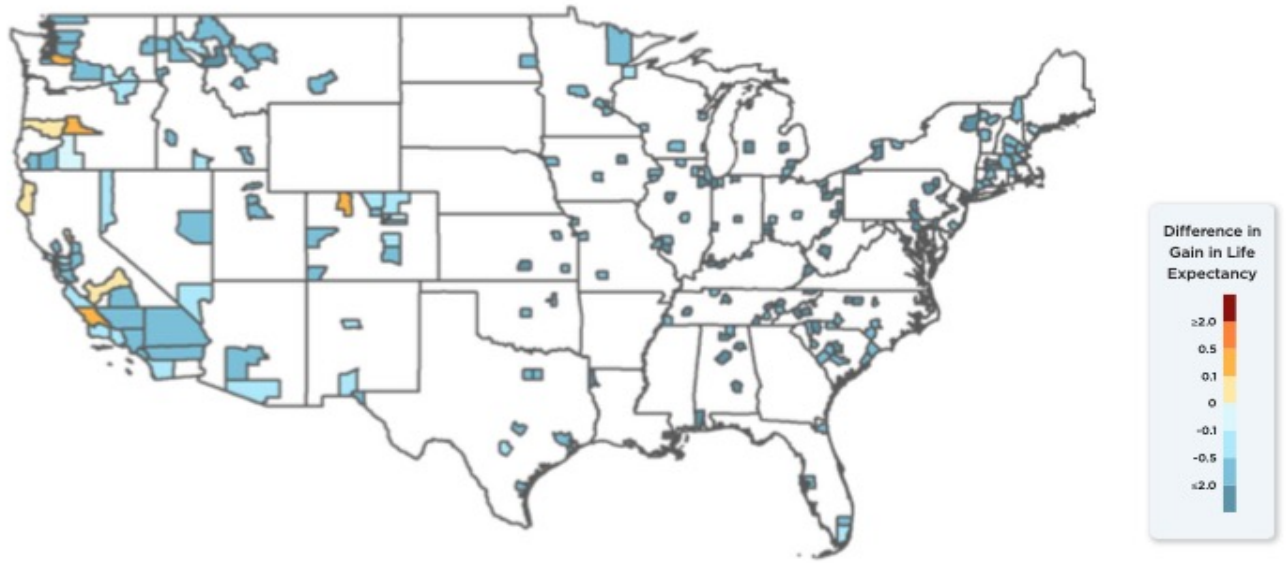
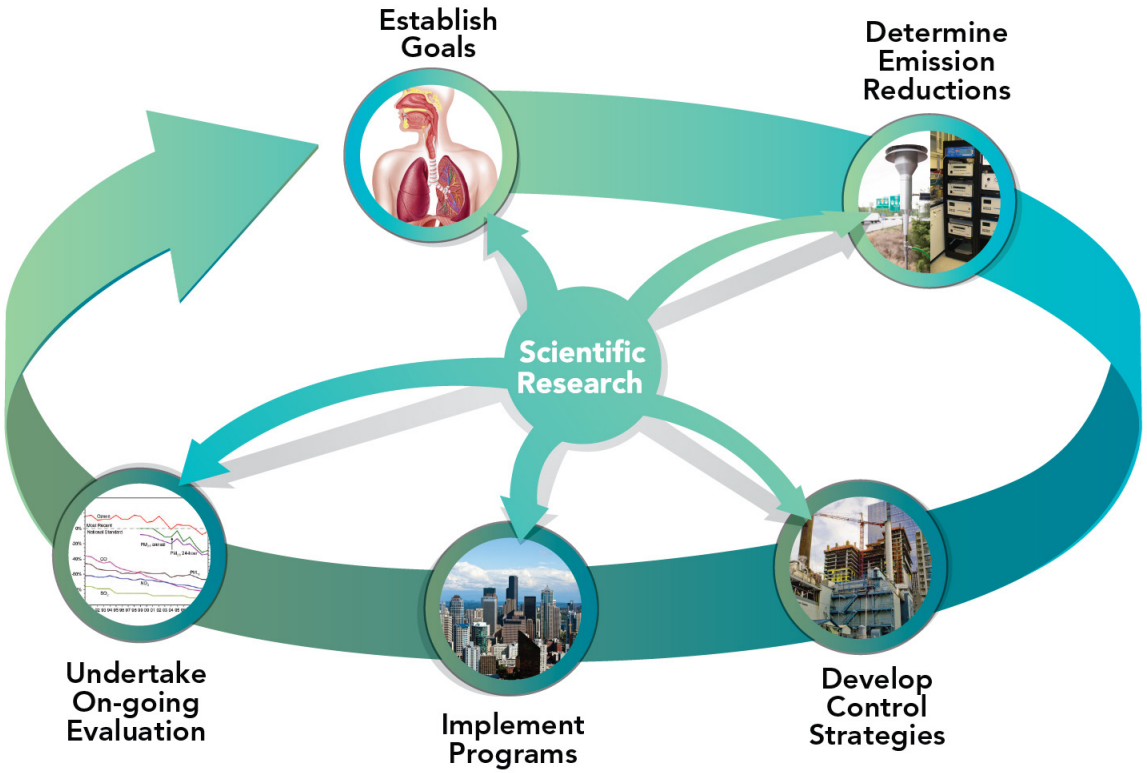


Figure from 2022 AQLI Annual Update

What is the international community doing to fight air pollution?

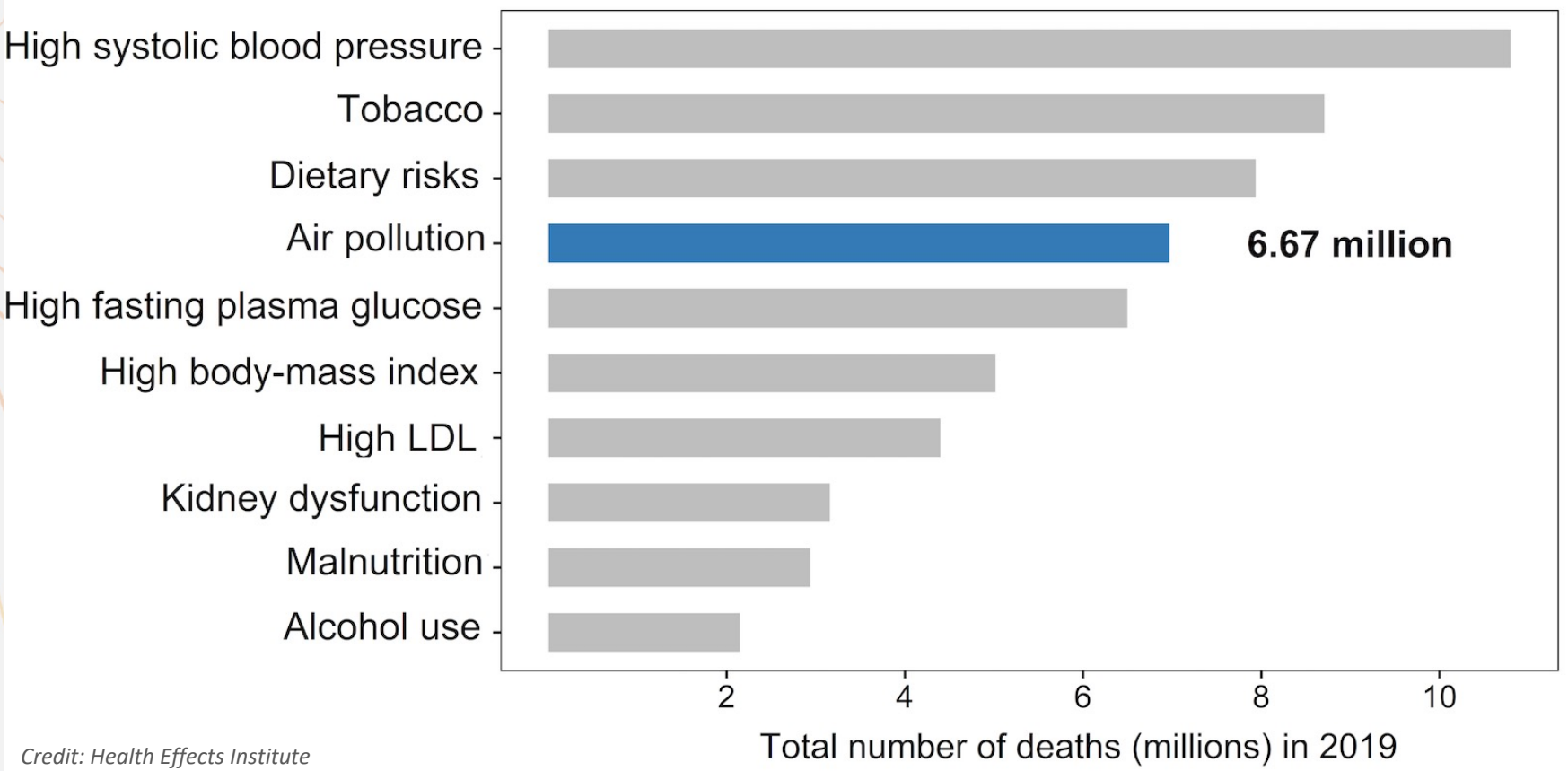
Air Quality Management Programs eg United States Environmental Protection Agency's Clean Air Act of 1970.



Credit: US Environmental Protection Agency

What is the international community doing to fight air pollution?

Some countries have air quality management programs



Credit: Health Effects Institute

Why are these steps being taken?

Air Pollution is the fourth leading risk factor for deaths globally

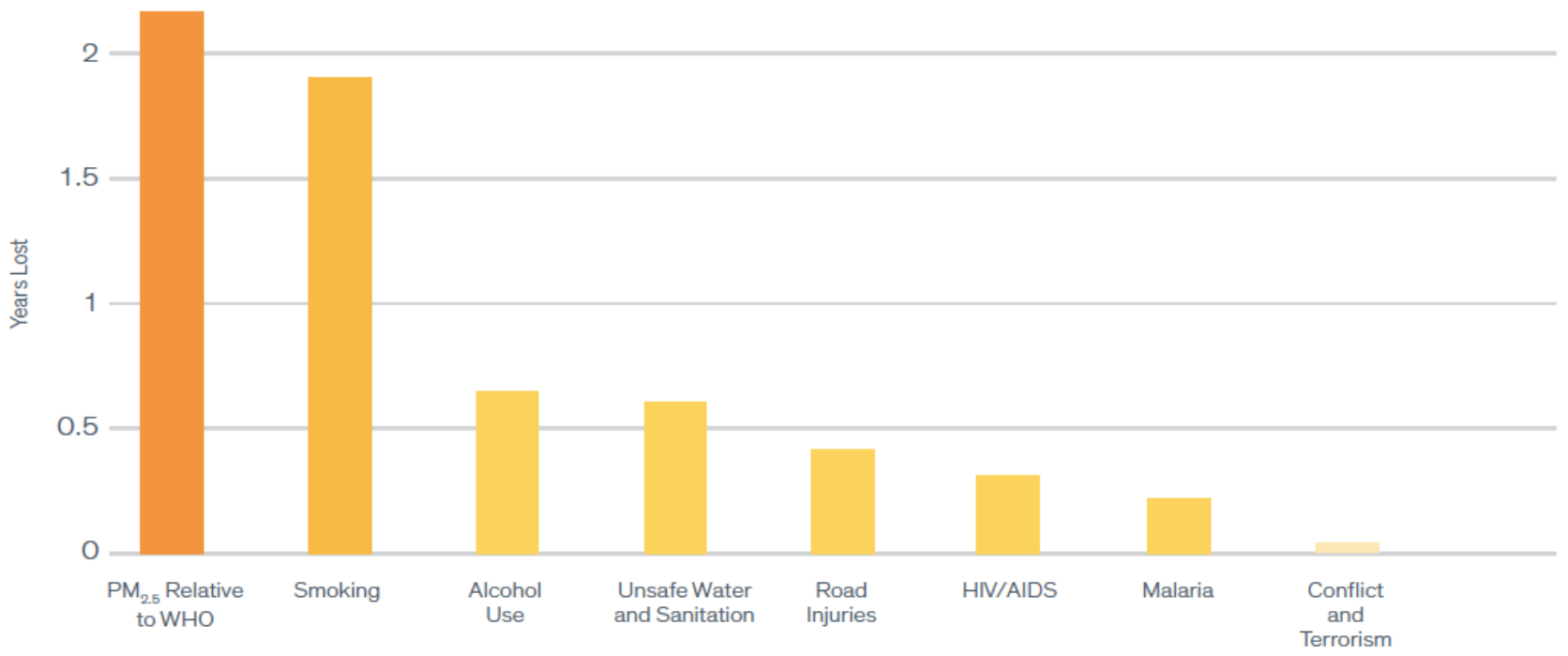
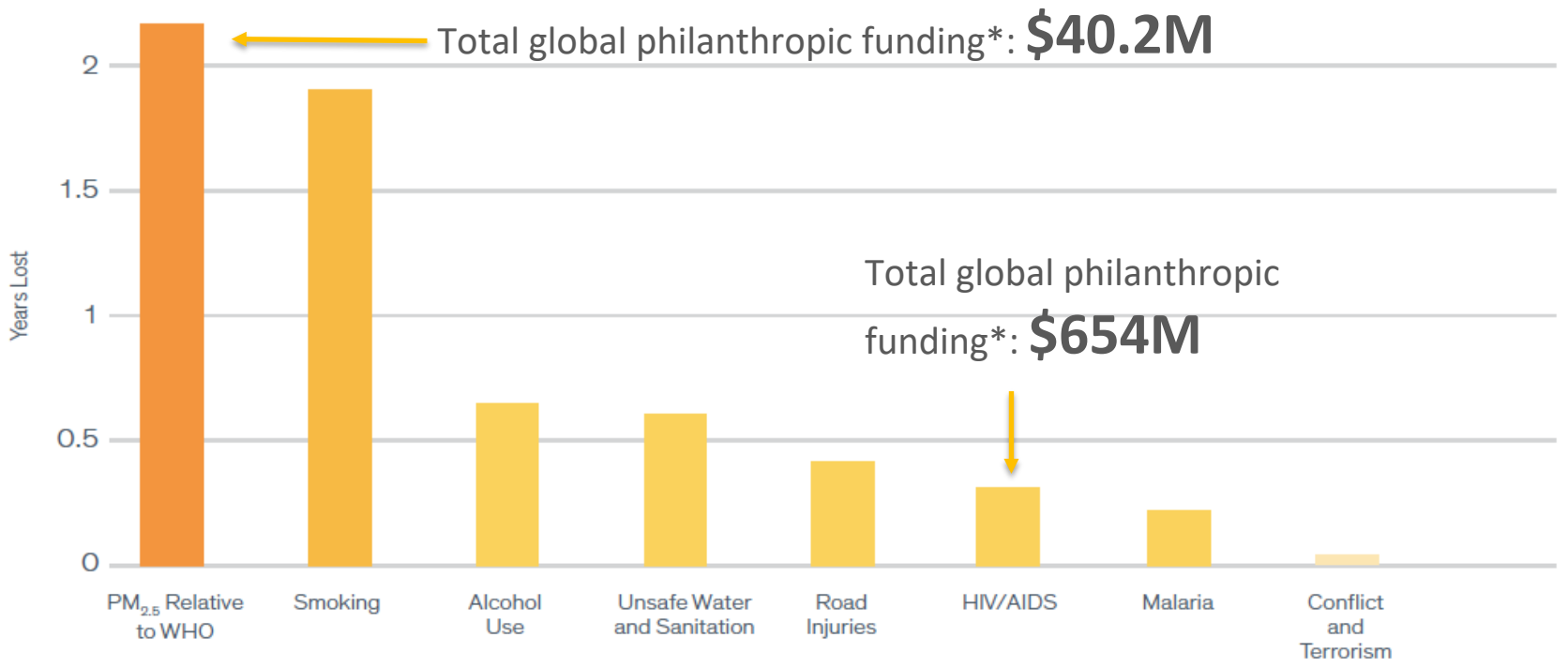


Figure from 2022 AQLI Annual Update

Life Expectancy Impact of PM2.5 vs Other Causes/Risks of Death, Global

Particulate pollution is one of the largest public health threats of our time

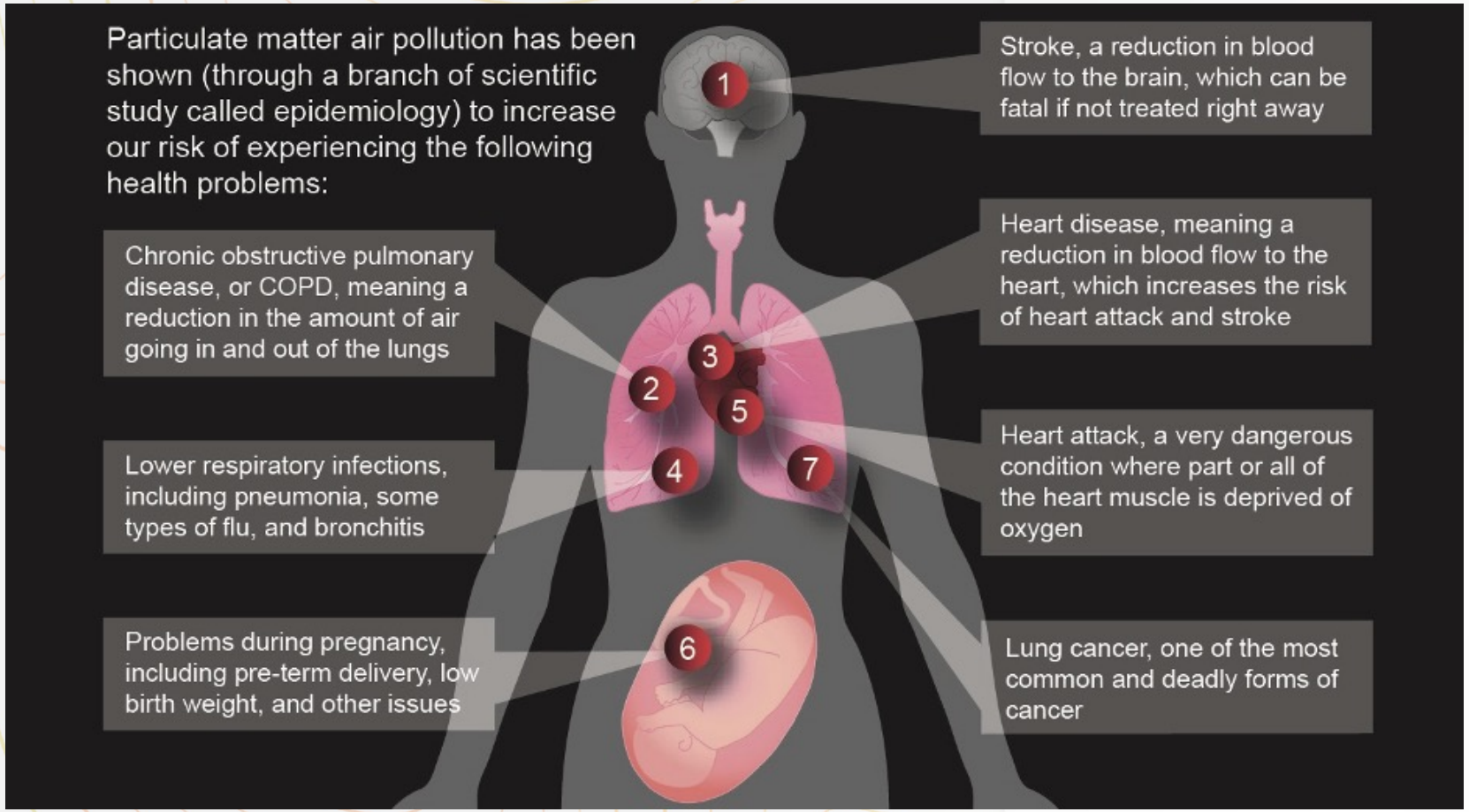


Life Expectancy Impact of PM2.5 vs Other Causes/Risks of Death, Global

Particulate pollution is one of the largest public health threats of our time

Figure from 2022 AQLI Annual Update

**Source: 2021 Clean Air Fund Report on the State of Global Air Quality Funding*

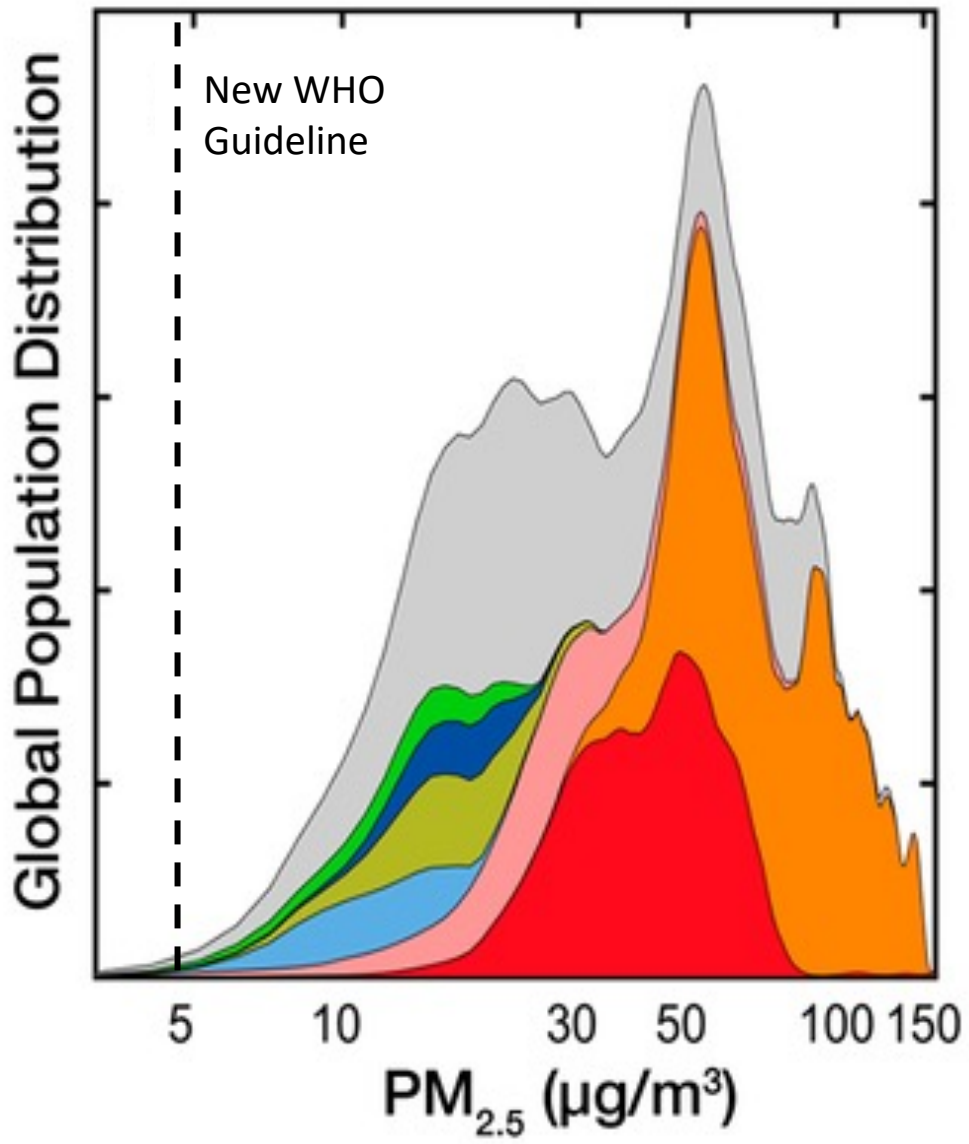


Credit: NASA

How can PM affect our health?

Nearly everyone on earth breathes air more polluted than the new WHO $PM_{2.5}$ air quality guideline

Data: Hammer et al ES&T 2020



Credit: Tweet by Josh Apte

The global toll of air pollution on life expectancy remains high in 2020

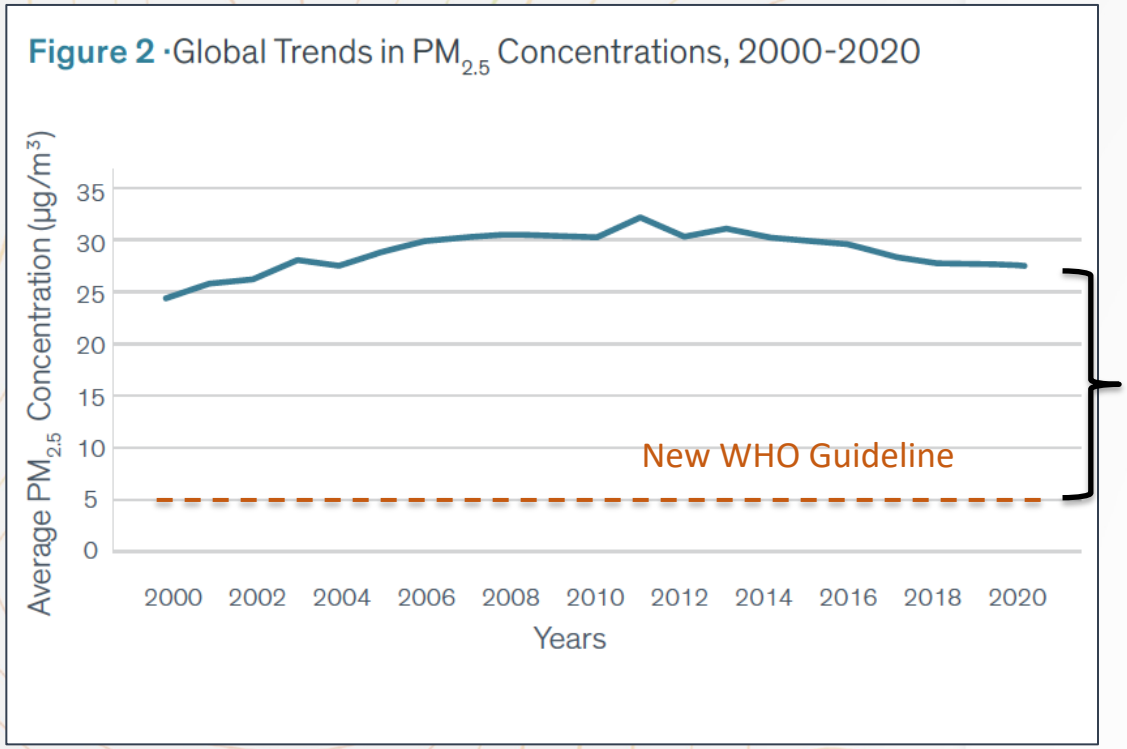
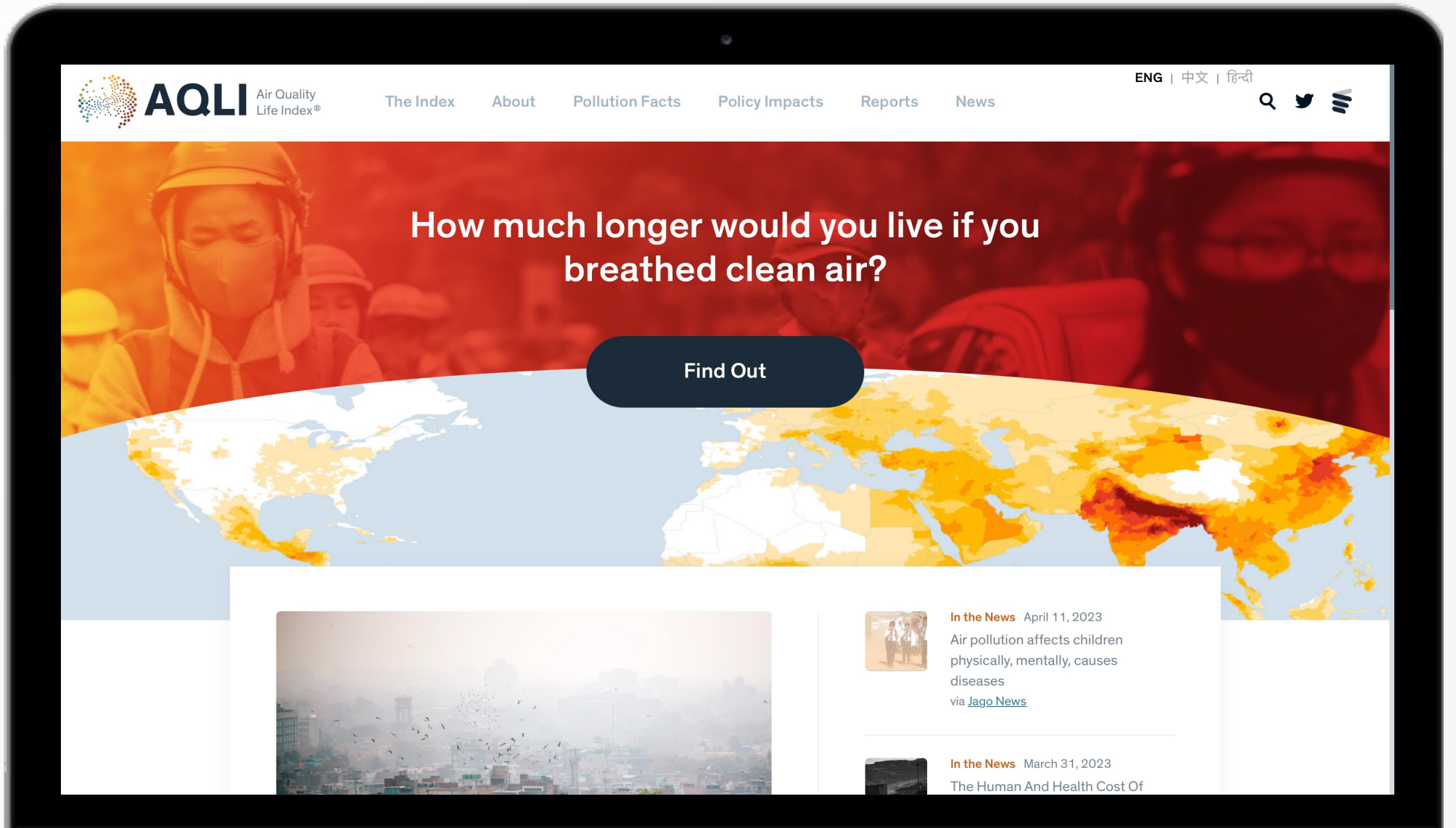


Figure from 2022 AQLI Annual Update

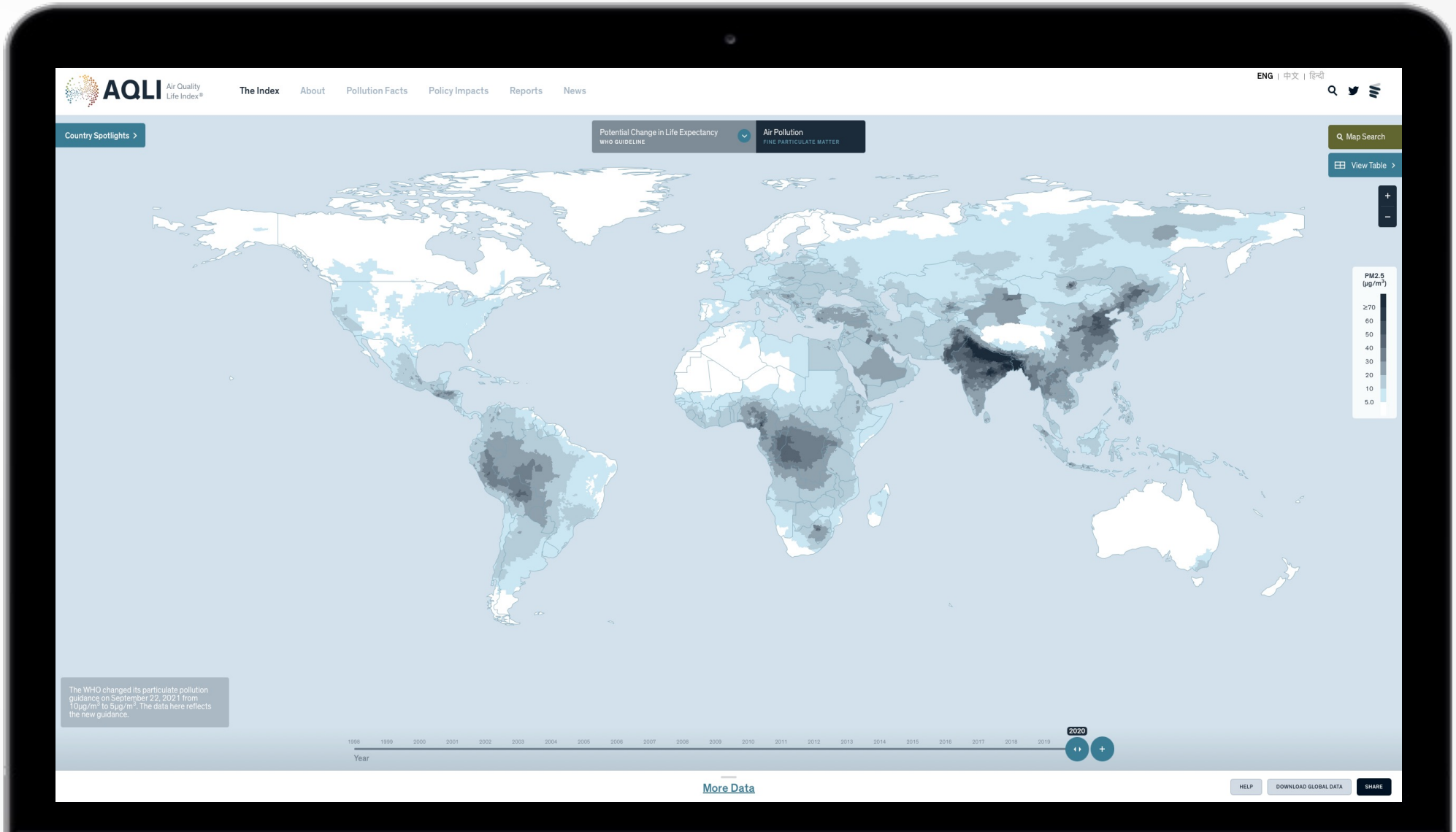
This year's analysis reveals that permanently reducing global air pollution to meet the World Health Organization's (WHO) guideline would add **2.2 years onto global average life expectancy**

Introducing AQLI

The Air Quality Life Index (AQLI)



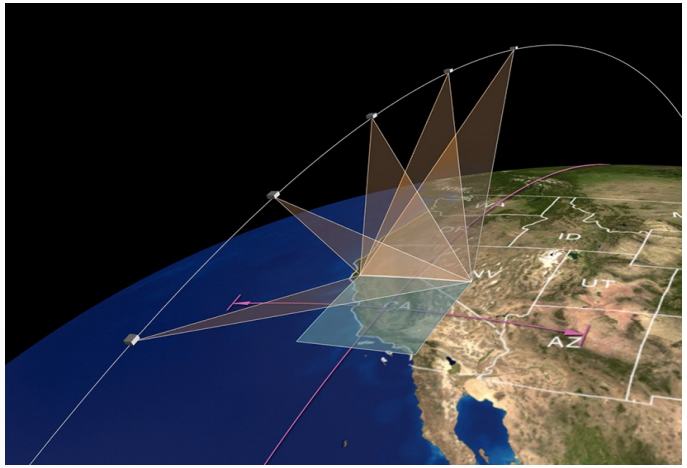
The Air Quality Life Index (AQLI)



How does AQLI get high resolution PM data?

ACAG | Atmospheric Composition Analysis Group

Satellite raw data from NASA MODIS, MISR, and SeaWIFS



Credit: NASA/JPL-Caltech

Credit : OpenAQ

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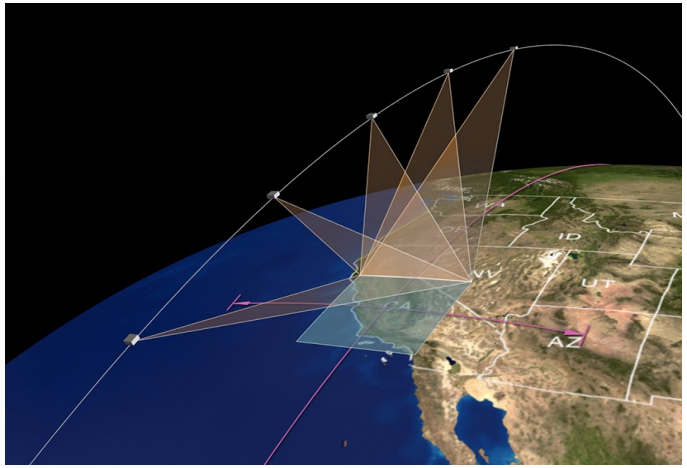

Credit: NASA/JPL-Caltech

+

3D model of global atmospheric chemistry

GEOS-Chem

Credit : OpenAQ

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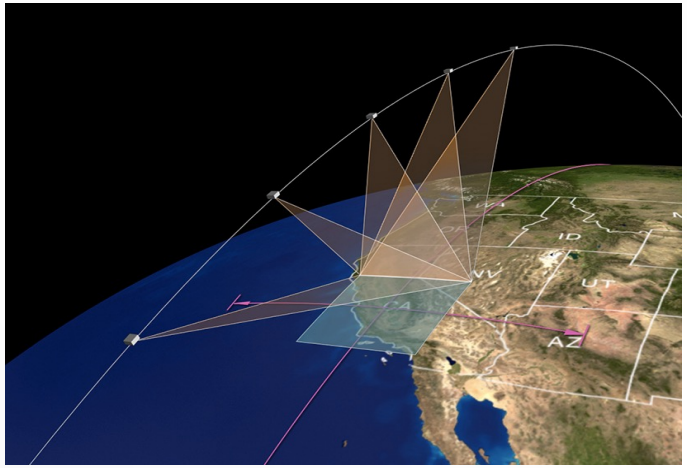

Credit: NASA/JPL-Caltech

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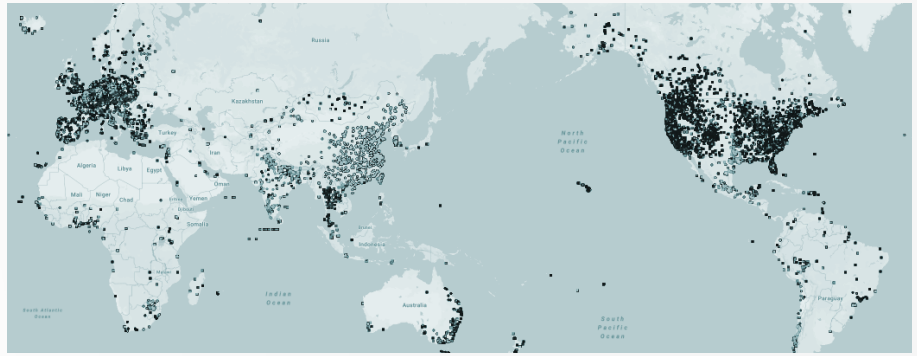
3D model of global atmospheric chemistry

GEOS-Chem

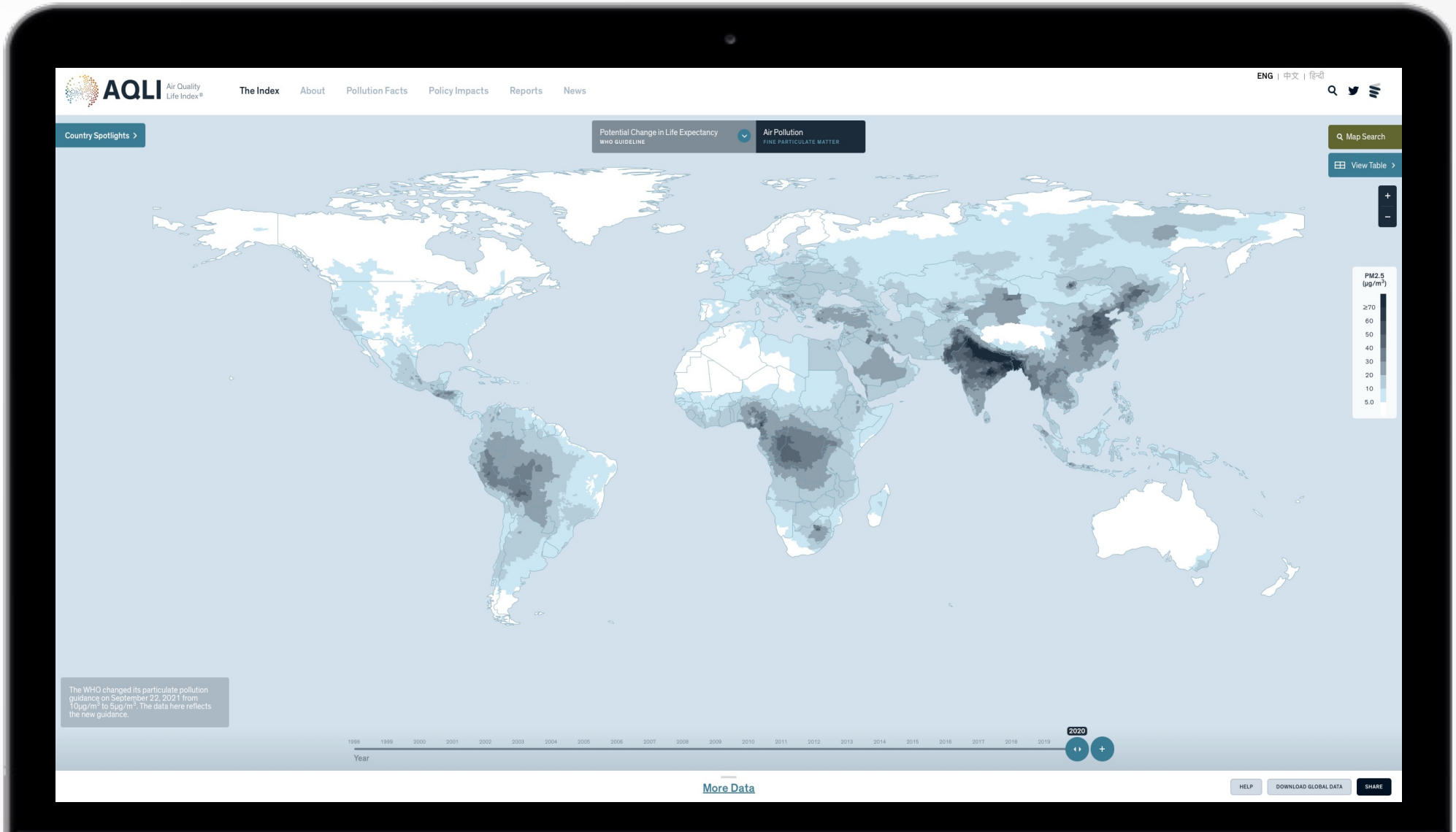
+

Open air quality data from governments' monitoring networks



Credit : OpenAQ

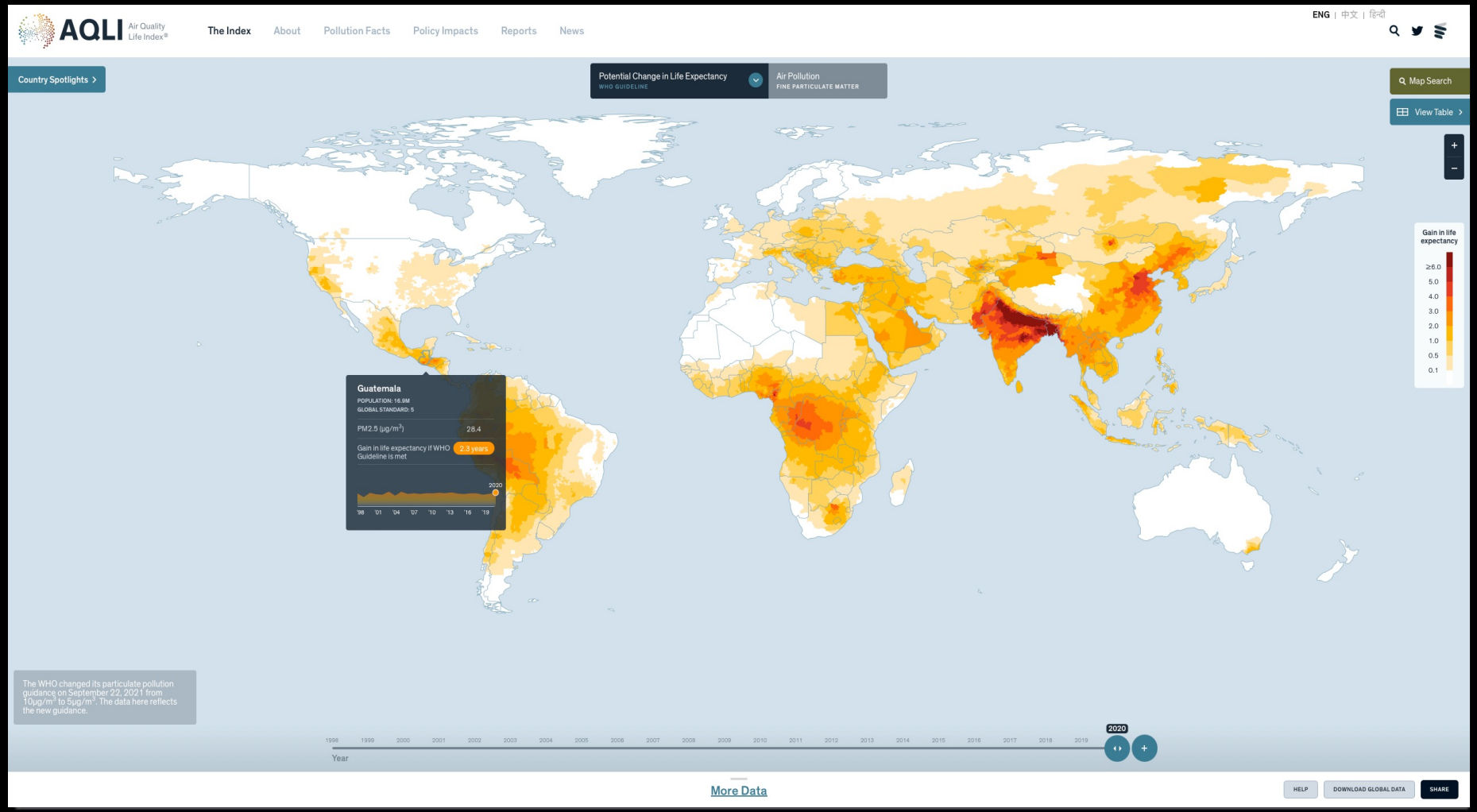
The AQLI provides high resolution data for the entire world

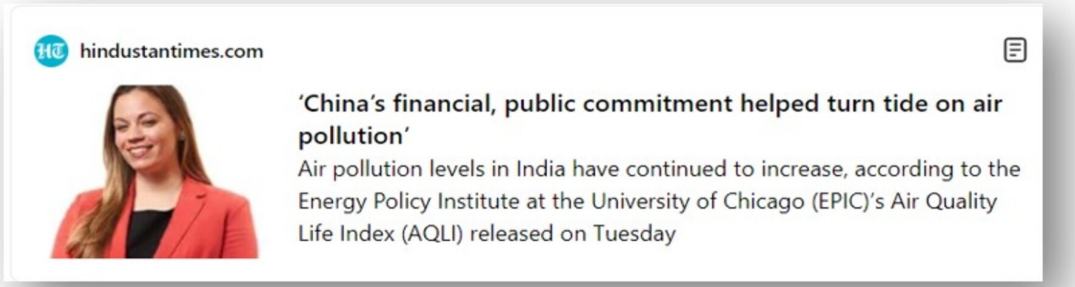


The data can be viewed at multiple levels globally, including national and sub-national

Availability of data from 1998 lets users view trends over time

Combined, the satellite data and AQLI's life expectancy calculation allow for unprecendented view of impact of pollution on life expectancy around the world





AQLI in local, national and international media (2022)

Since its inception, the AQLI tool has been used in ***211 countries*** by ***over 200,000 users***

In the Parliament of India, policymakers are using the AQLI to justify policy action

Indian Member of Parliament, ***Ms. Vandana Chavan used the AQLI*** *findings to* ***demand a change to the India Air Act, 1981*** *during a 2019 Rajya Sabha session*

Background

PNAS
Proceedings of the National Academy of Sciences of the United States of America

RESEARCH ARTICLE | ENVIRONMENTAL SCIENCES | OPEN ACCESS

New evidence on the impact of sustained exposure to air pollution on life expectancy from China's Huai River Policy

Avraham Ebenstein, Maoyong Fan, Michael Greenstone, +1, and Maigeng Zhou Authors Info & Affiliations

September 11, 2017 | 114 (39) 10384-10389 | https://doi.org/10.1073/pnas.1616784114

Key Result: $\frac{0.98\ years}{10\ \mu g/m^3\ \ PM_{2.5}}$

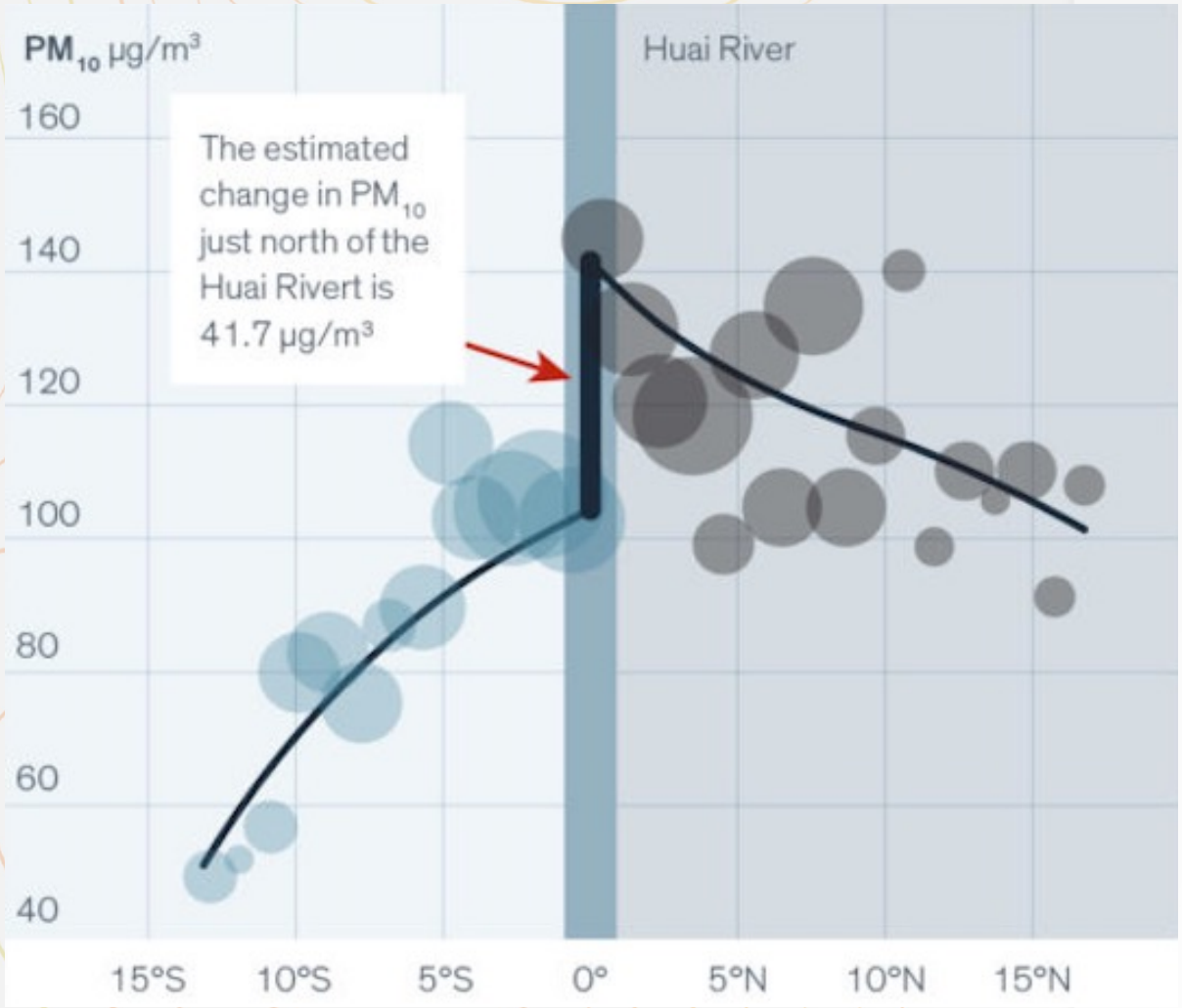
China's Huai River winter heating policy: A tale of two skies

Key Result

$$\frac{0.98\ years}{10\ \mu g/m^3\ PM_{2.5}}$$

Reference Papers: *Ebenstein et al. (2013, 2017)*

Visit: *https://aqli.epic.uchicago.edu/about/methodology/*



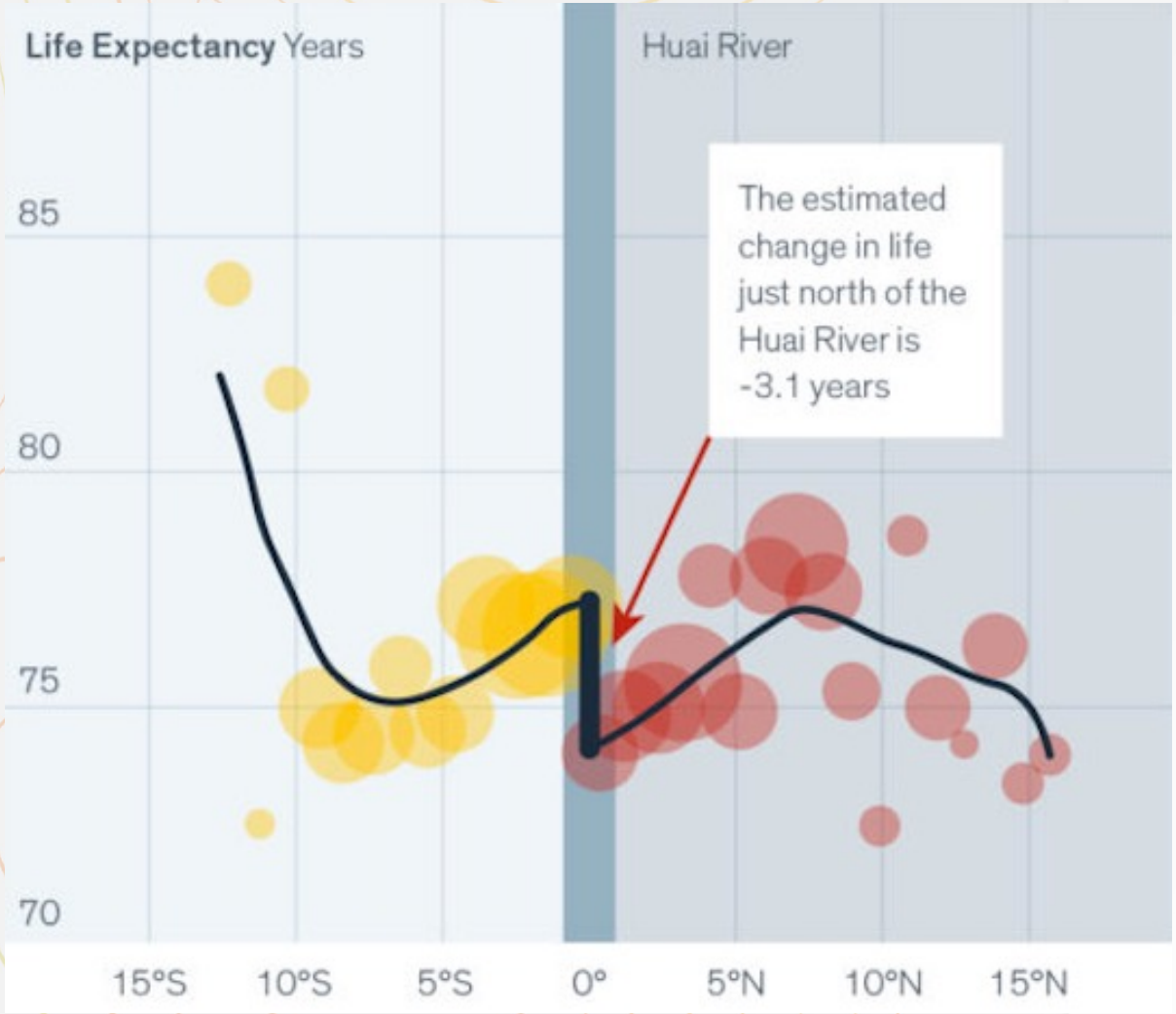
Source: *Ebenstein et al. (2017)*

Pollution is 50% higher north of the river

PM_{10} Emissions North and South of the Huai River

PM_{10} in South

PM_{10} In North



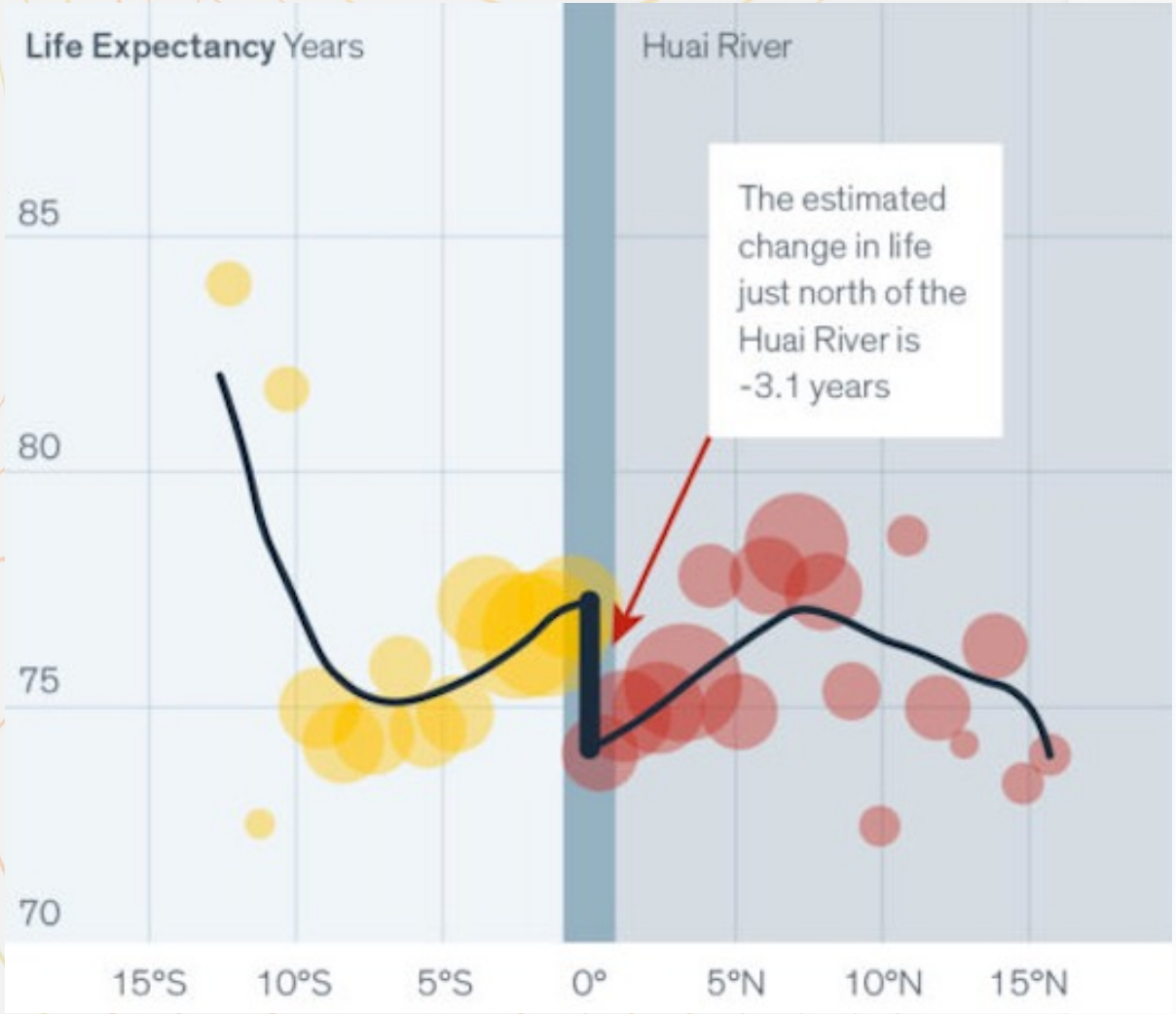
Source: *Ebenstein et al. (2017)*

Life expectancy is about 3 years lower

Life Expectancy in North and South of the Huai River

L.E. in South

L.E. In North



Source: *Ebenstein et al. (2017)*

Life expectancy is about 3 years lower

Key Result : $\frac{0.98\ years}{10\ \mu g/m^3\ PM_{2.5}}$

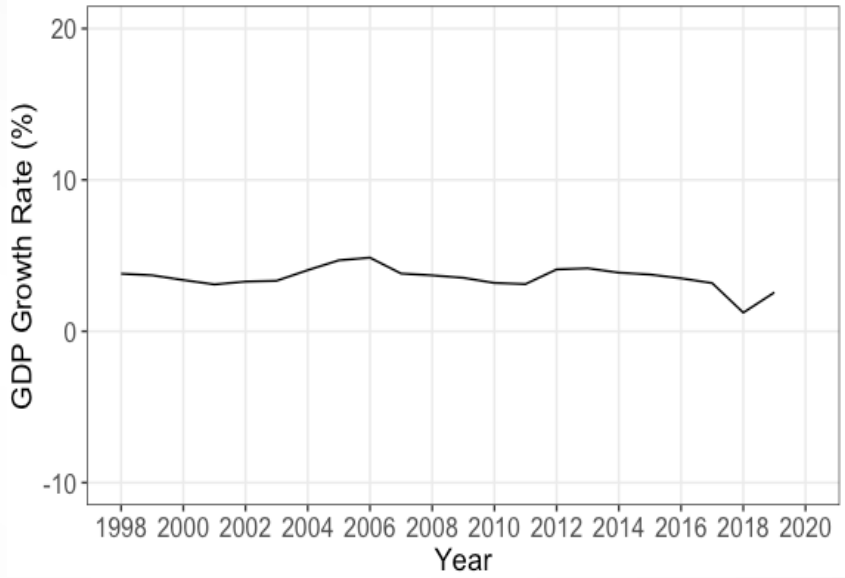
Life Expectancy in North and South of the Huai River

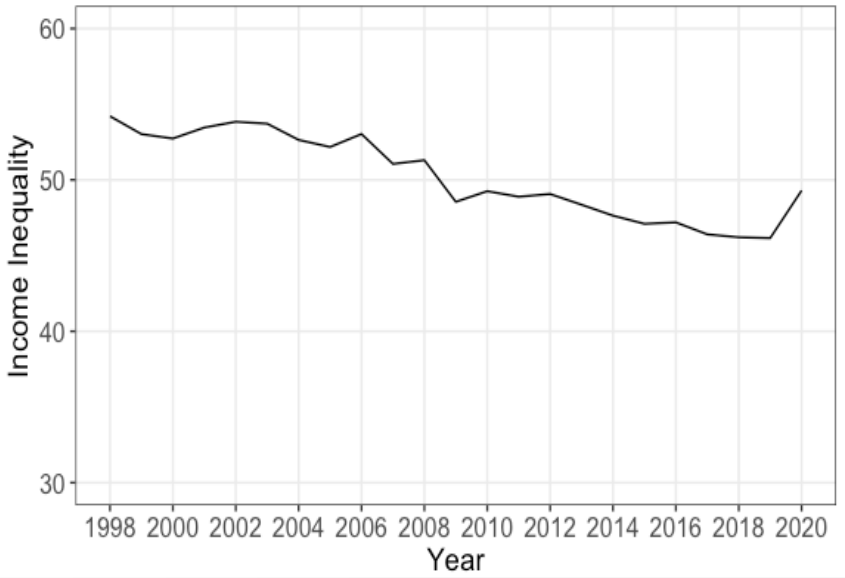
L.E. in South

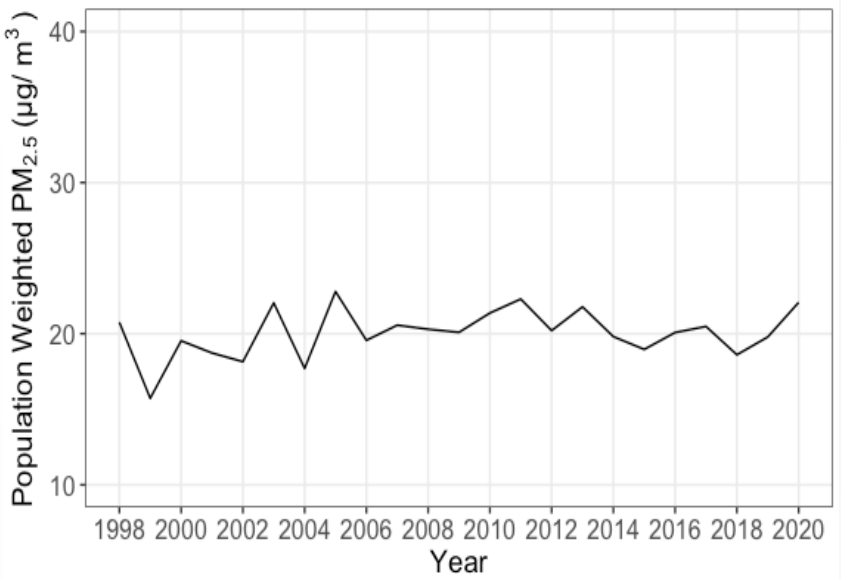
L.E. In North

Trends in Central America

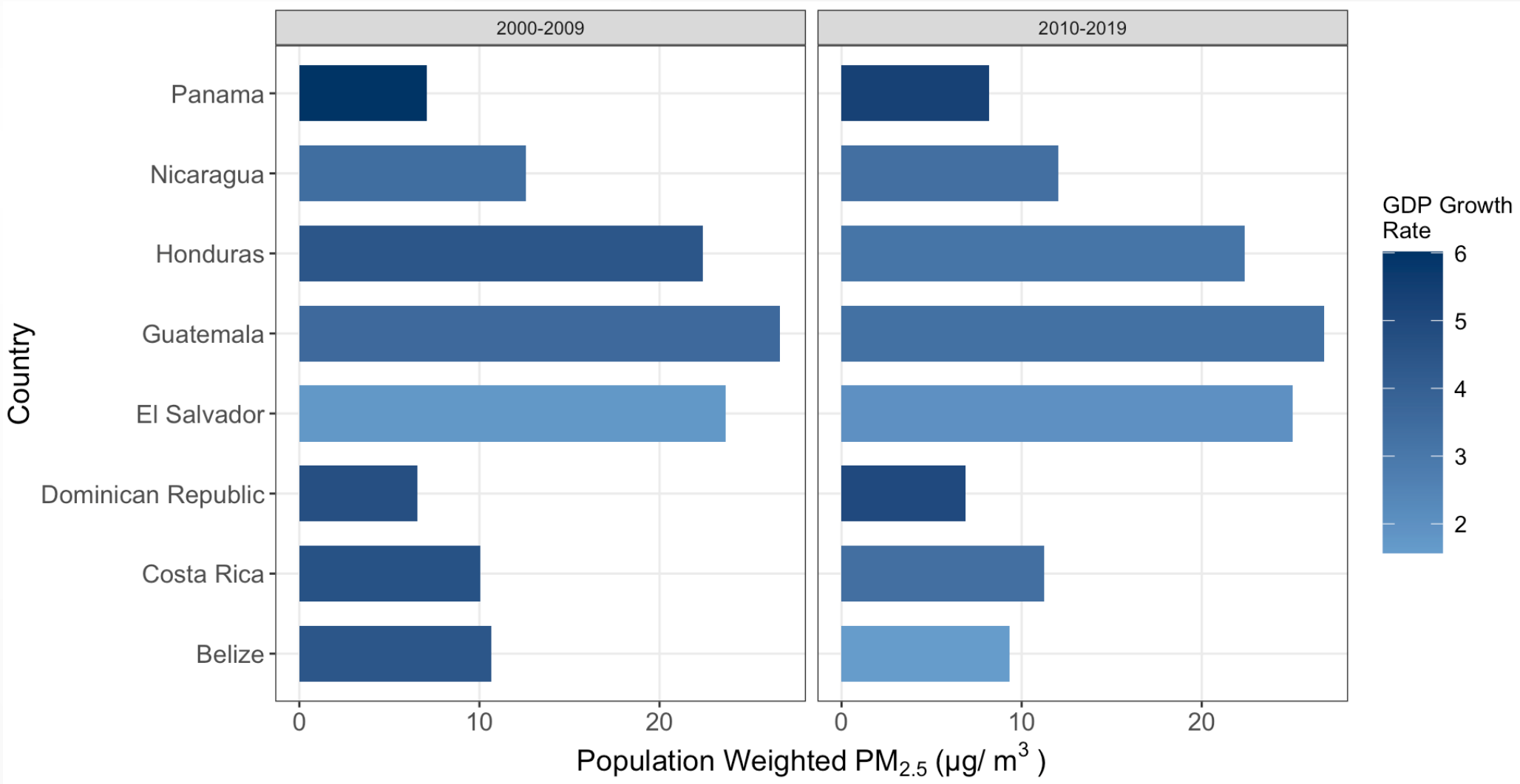
Pollution remains persistent despite favorable trends in GDP growth and income inequality



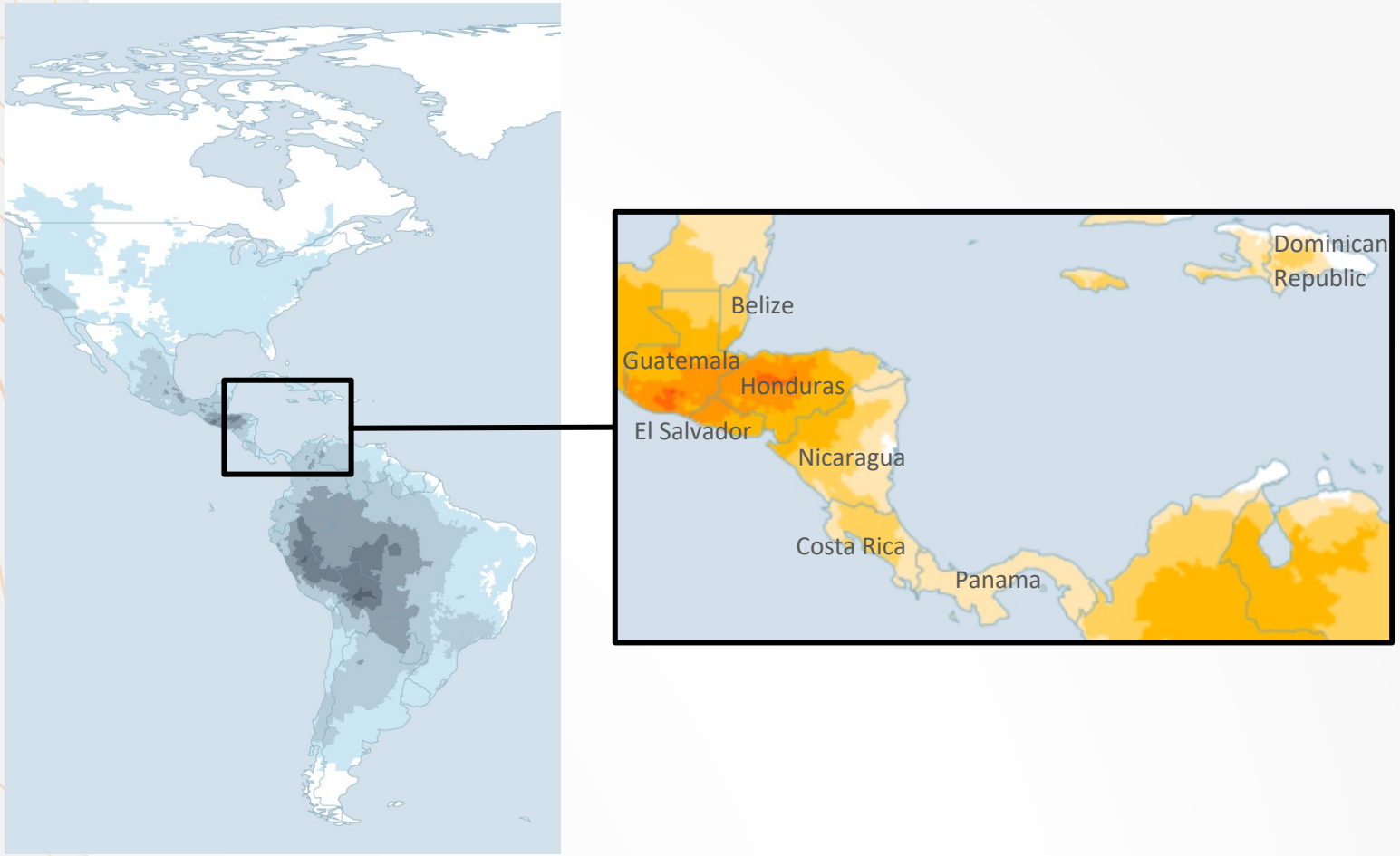


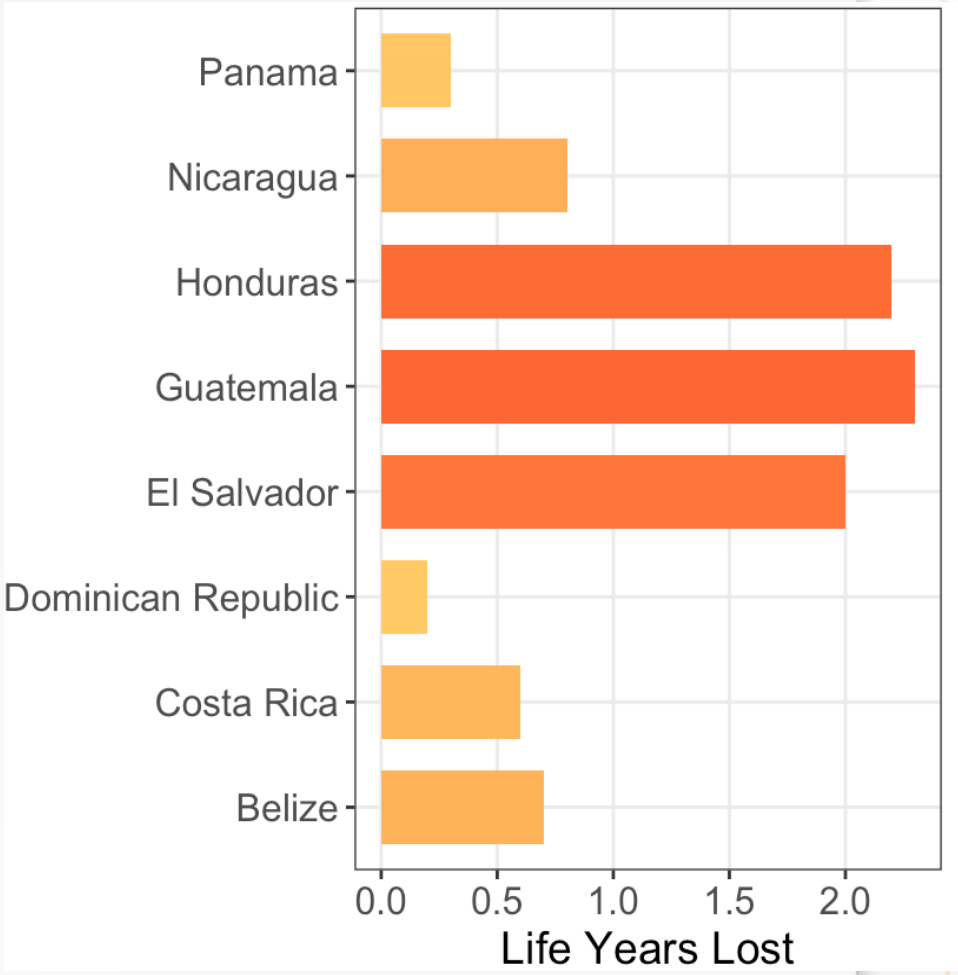


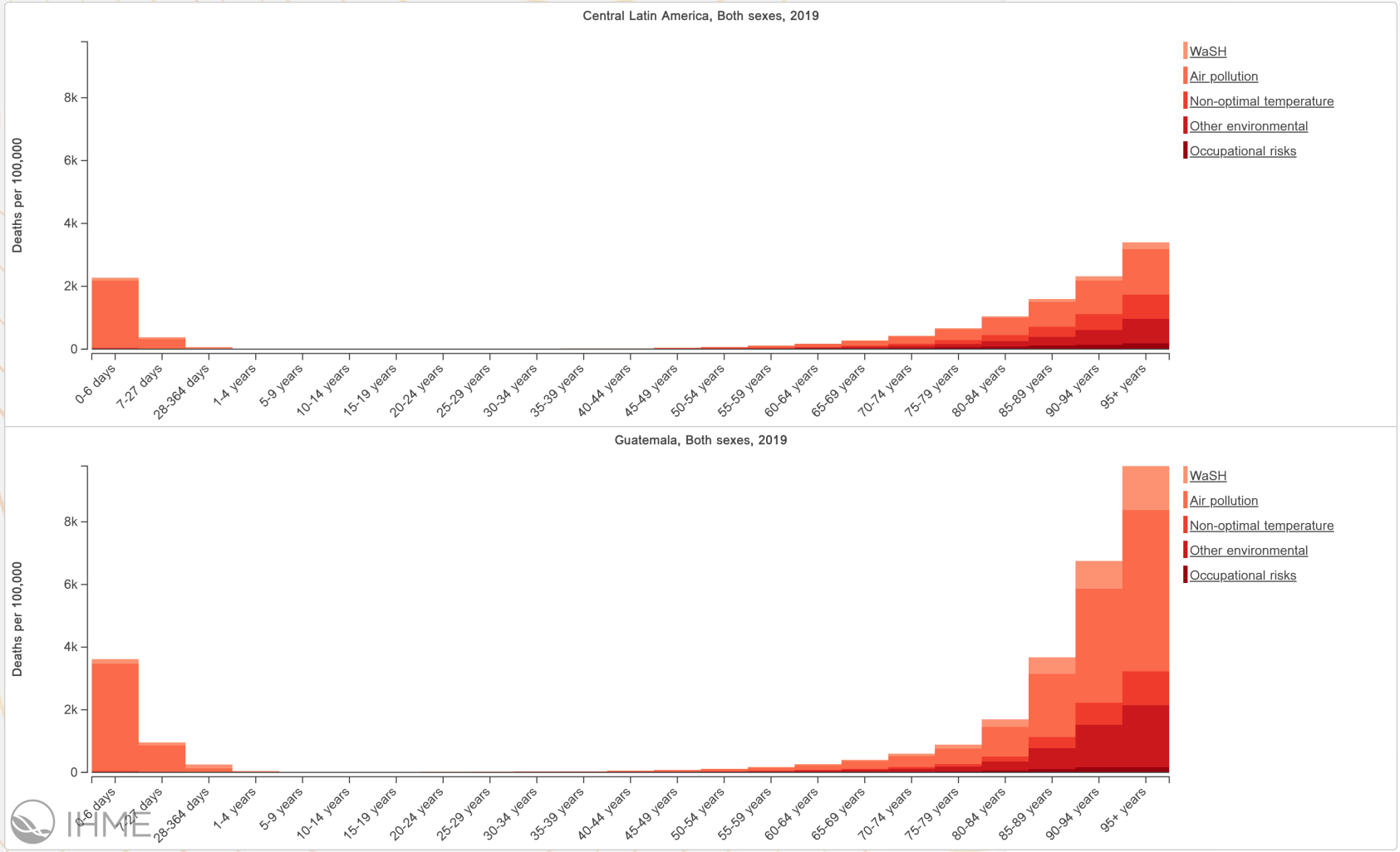
GDP growth rate and PM2.5 by country



Applying AQLI in Central America

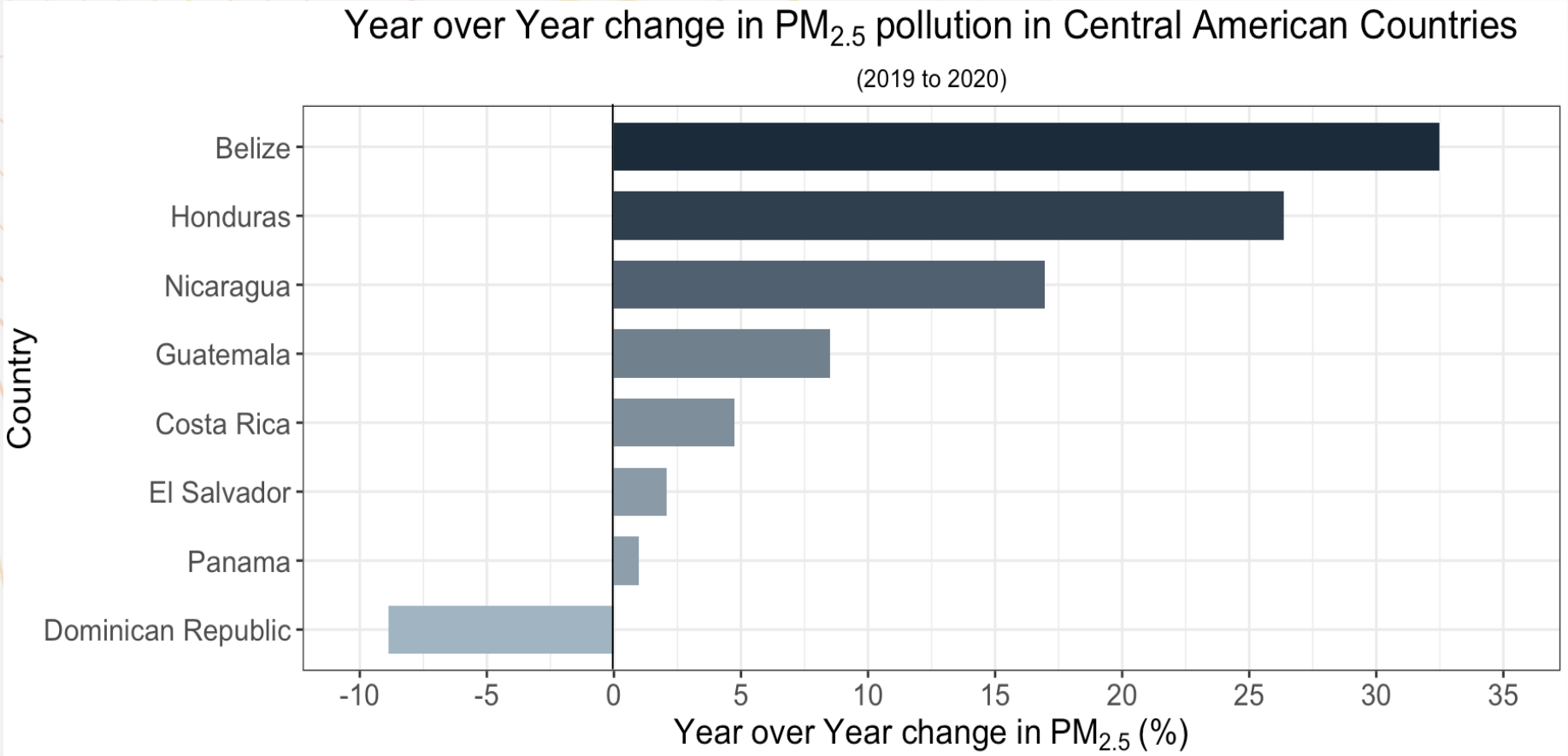






Death rate by risk factor

Compared to the rest of Central America, Guatemala faces a higher health burden due to air pollution

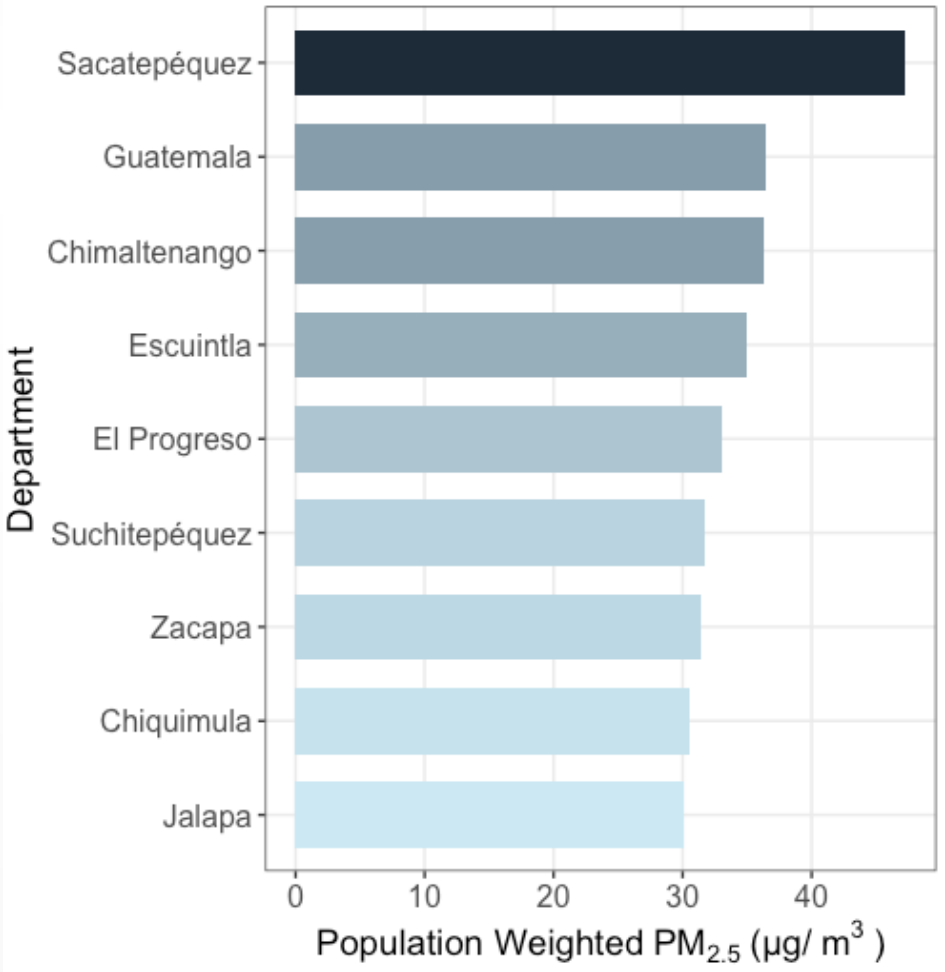


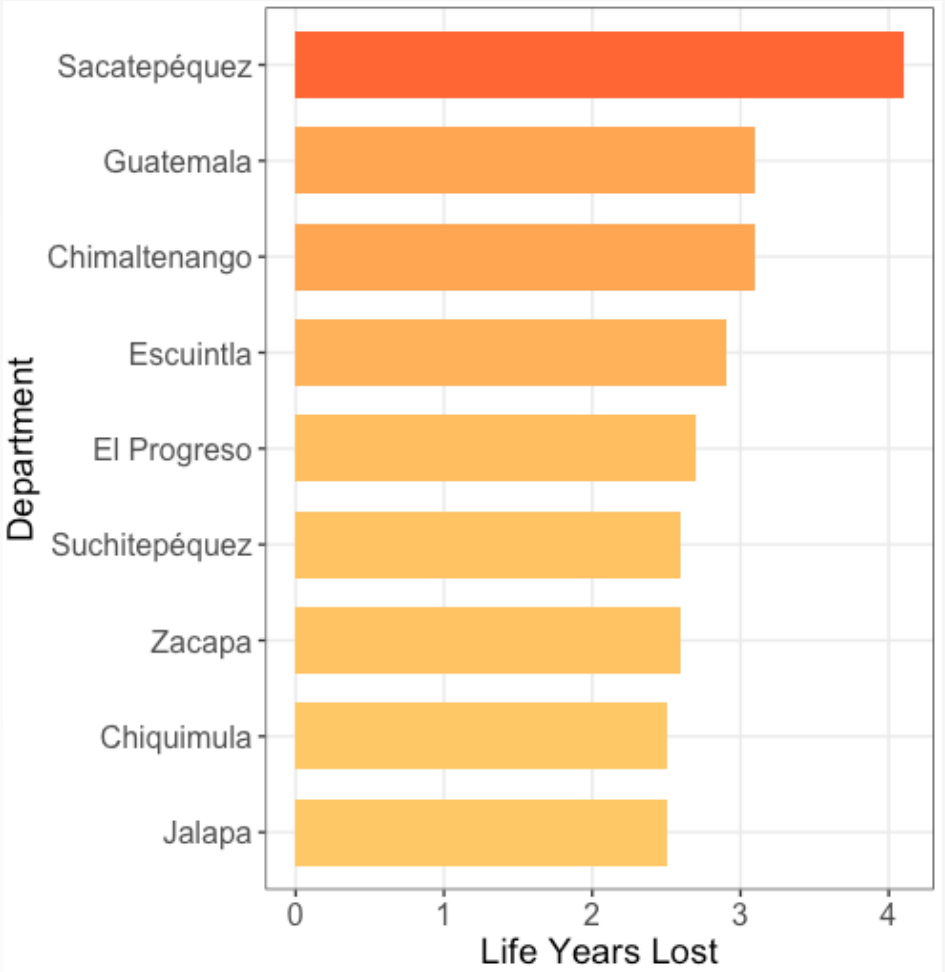
Year over year change in PM2.5 concentration

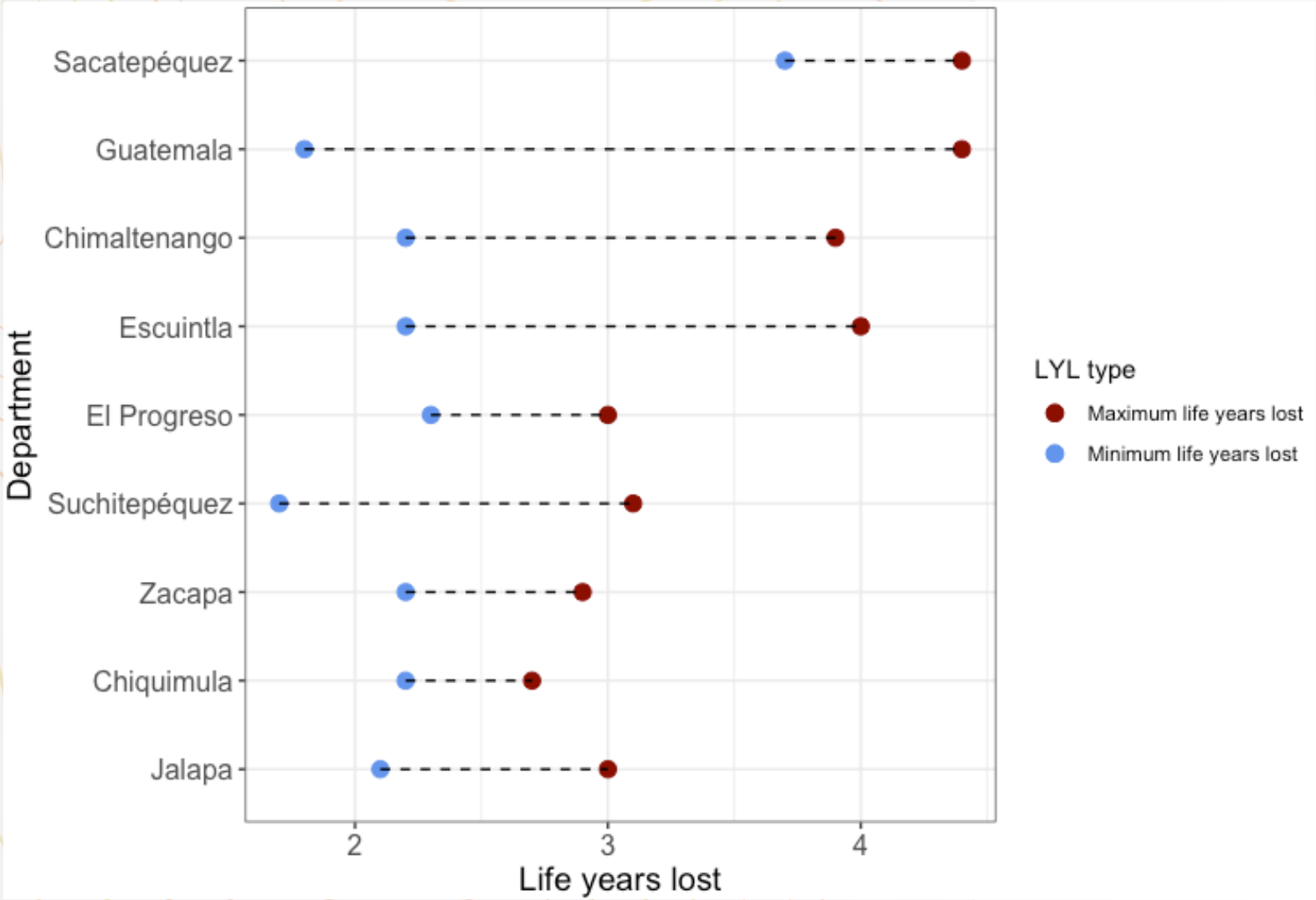
But not all is bad. Guatemala did not see the maximum rise in particulate pollution from 2019 to 2020

Zooming in on Guatemala

PM2.5 concentration and Life Years Lost in Top 10 Most Polluted Departments in Guatemala



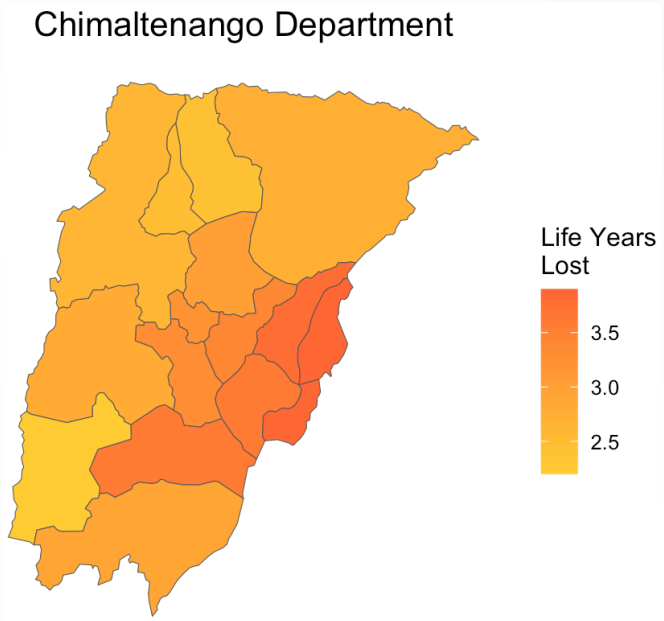


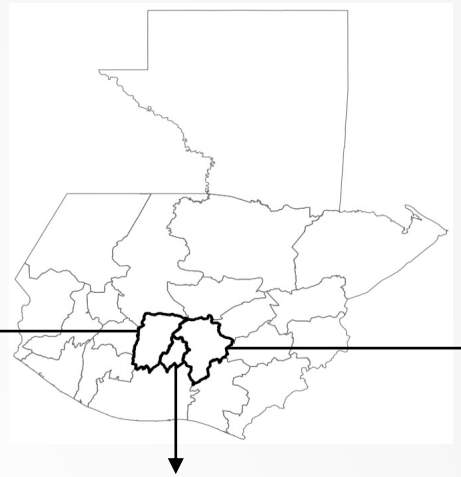


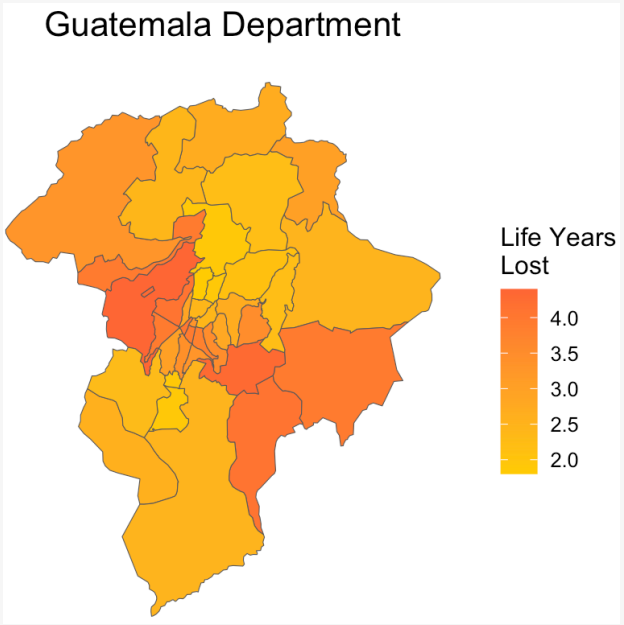
Range of life years lost in the top 10 most polluted departments in Guatemala

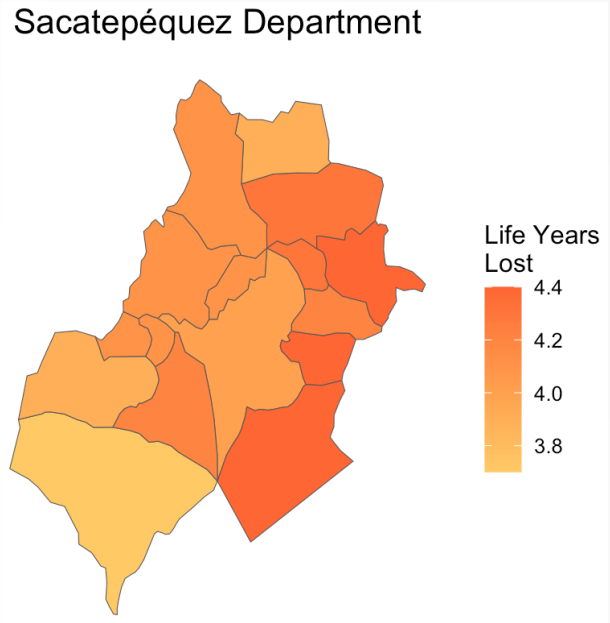
The least polluted municipality in Sacatépequez is more polluted than the most polluted municipalities in most other states in this list

Spatial distribution of life year lost in 2021 in the top 3 most polluted departments in Guatemala









Recommendation	PM2.5 (µg/m3)	Life Years Lost
Interim target 1	35	2.94
Interim target 2	25	1.96
Interim target 3	15	0.98
Interim target 4	10	0.49
AQG level	**5**	**0**

Table: WHO recommended Air Quality Guideline (AQG) with interim targets and their corresponding Life Years Lost

Monetary benefit of achieving WHO target level of particulate pollution

In addition to health benefits, there are monetary benefits to reducing air pollution.

Monetary benefit of achieving WHO target level of particulate pollution

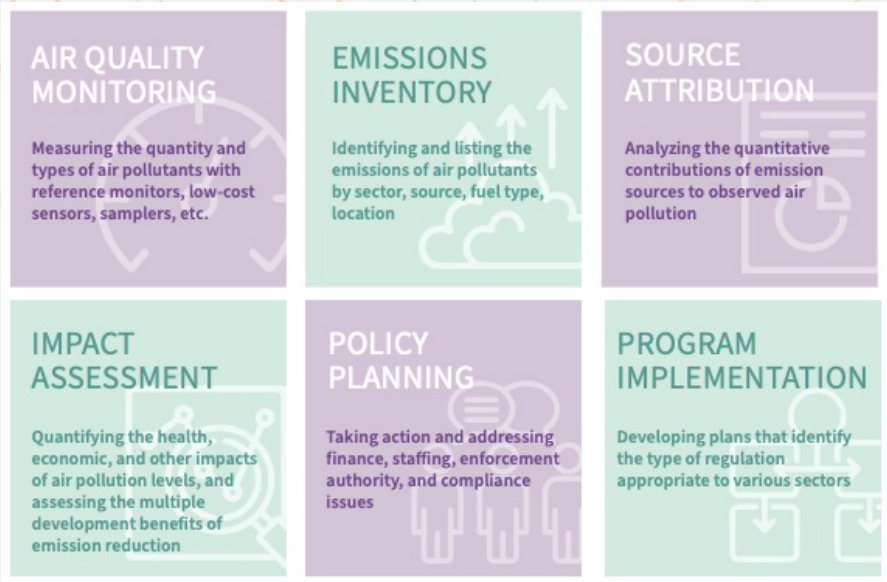
$$Monetary\ Benefit = Affected\ Population \times Average\ Gain\ in\ Life\ Expectancy \times VSLY$$

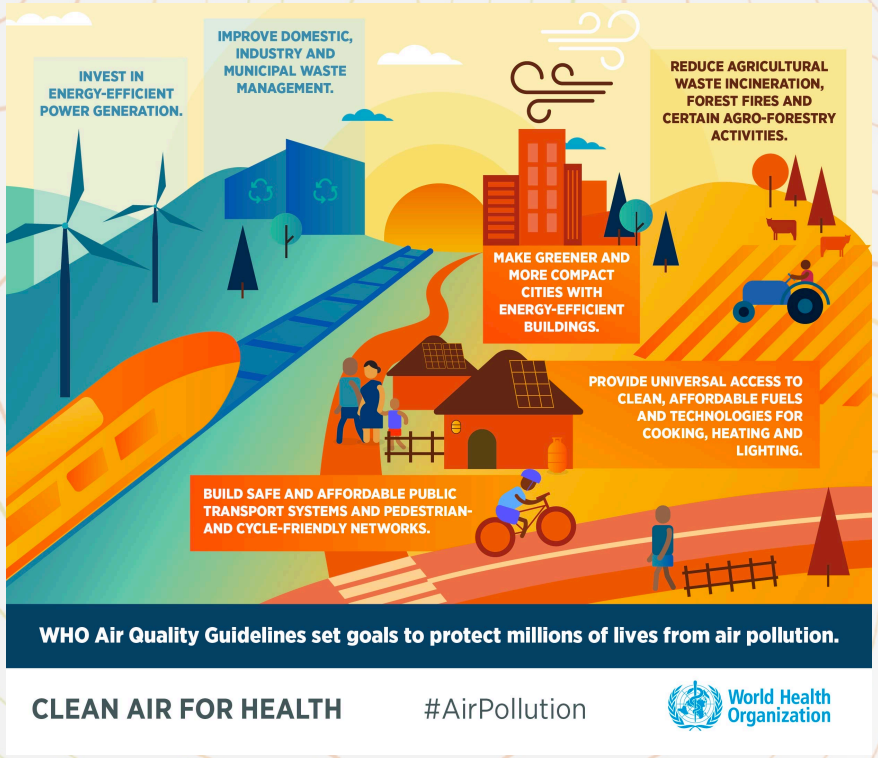
1

$$Guatemala\ VSLY = \frac{US\ VSL \times (\frac{Guatemala\ GNI}{US\ GNI})}{Expected\ Life\ Years\ Remaining\ for\ Median\ Age\ Individual}$$

2

Proposed Solutions



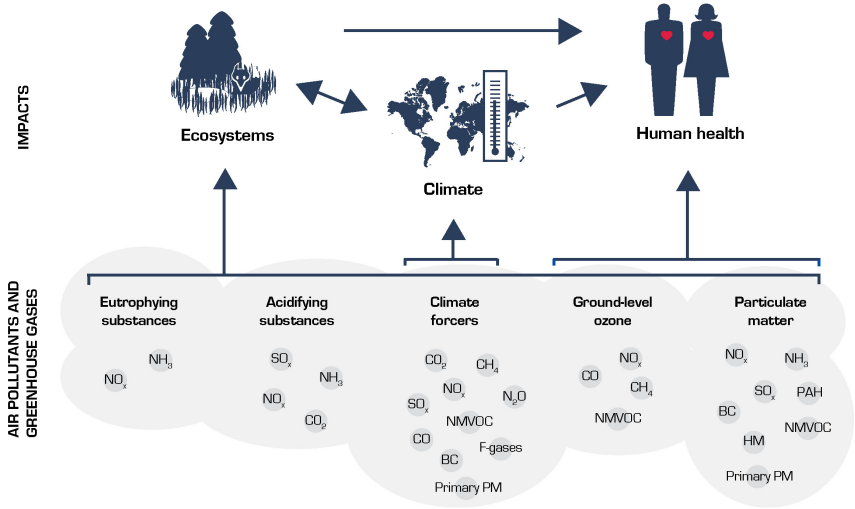


What are some solutions to the air pollution problem

Small scale/local solutions e.g., Mexico City's ProAire program

Some helpful resources that talk about good air quality management practices:

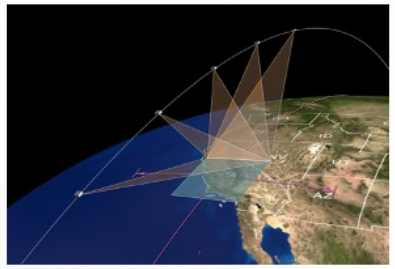
1. Open Air Quality Data: The Global Landscape report by OpenAQ, 2022
2. Strengthening Air Quality Management Guidance report by Clean Air Fund and UNEP, 2022
3. Urban Emissions Air Quality Monitoring 101 https://urbanemissions.info/blog-pieces/air-monitoring-101/



EEA Report No 9/2013: Air quality in Europe - 2013

ACAG Atmospheric Composition Analysis Group

Satellite raw data from NASA MODIS, MISR, and SeaWIFS



Credit: NASA/JPL-Caltech

+

3D model of global atmospheric chemistry

GEOS-Chem

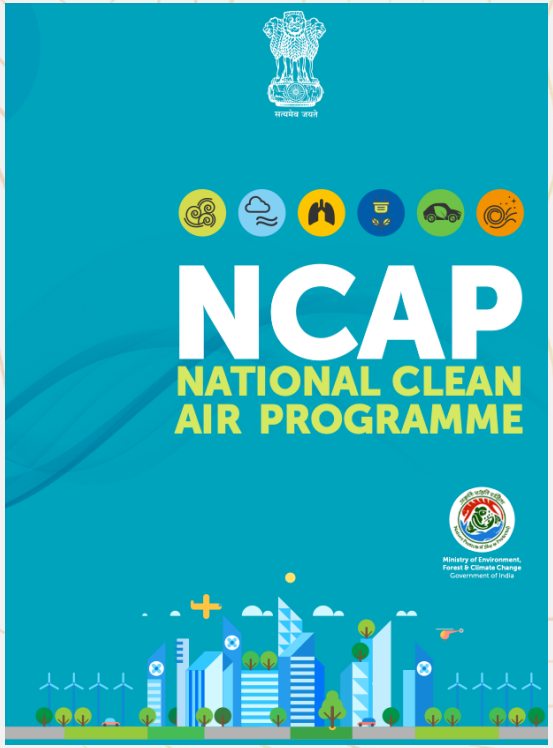
+

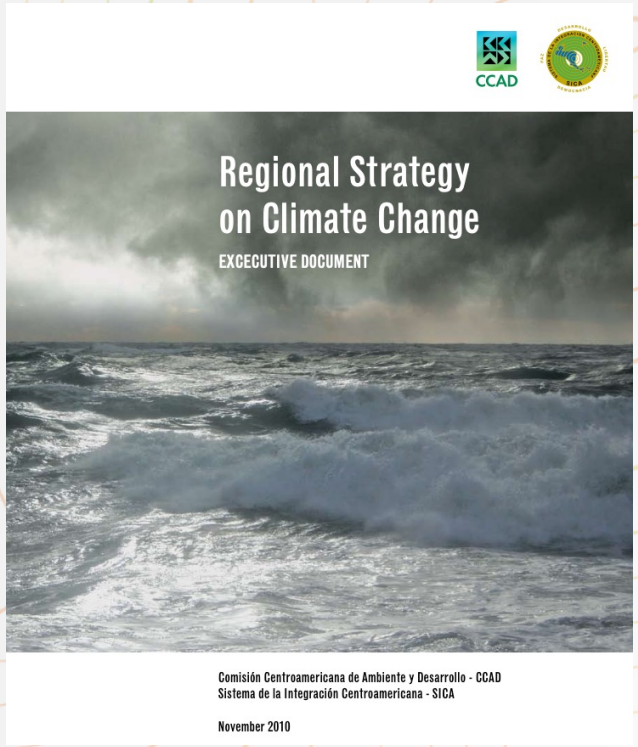
Open air quality data from governments' monitoring networks

Credit : OpenAQ

Why is air quality management important?

- Air Quality affects human health through direct and indirect pathways
- National Ambient Air Quality Standards (NAAQS) and data help in presenting an accurate status of local air



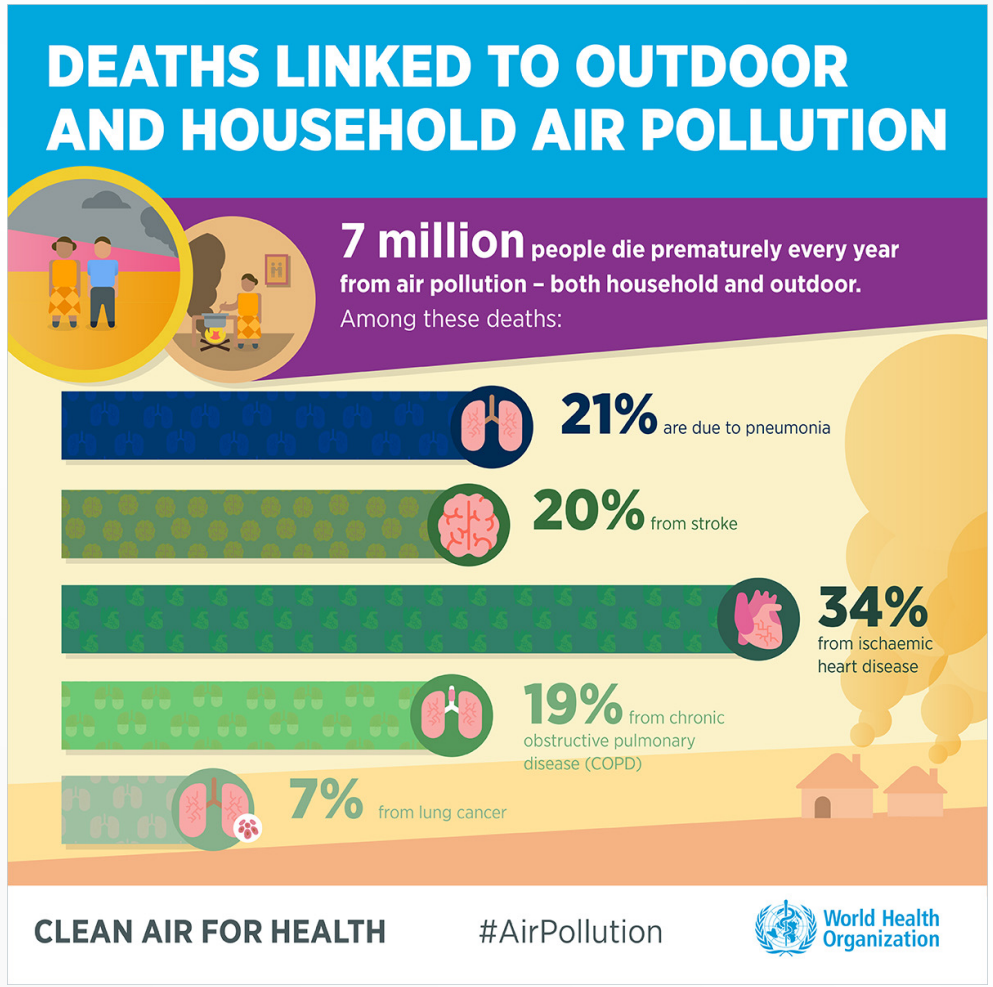


Examples of air quality management programs

- In 1992, Mexico City administration initiated the ProAire Programme
- In 2015, Mexico introduced a nationwide National Air Quality Strategy (ENCA)
- India launched its National Clean Air Programme in 2019 with the goal of reducing PM concentrations
- Central American Integration System's (SICA) Regional Strategy on Climate Change

To Summarize…

Air Pollution is one of the most pressing problems



AQLI is built to help everyone tackle air pollution

Directly connects air pollution information to health

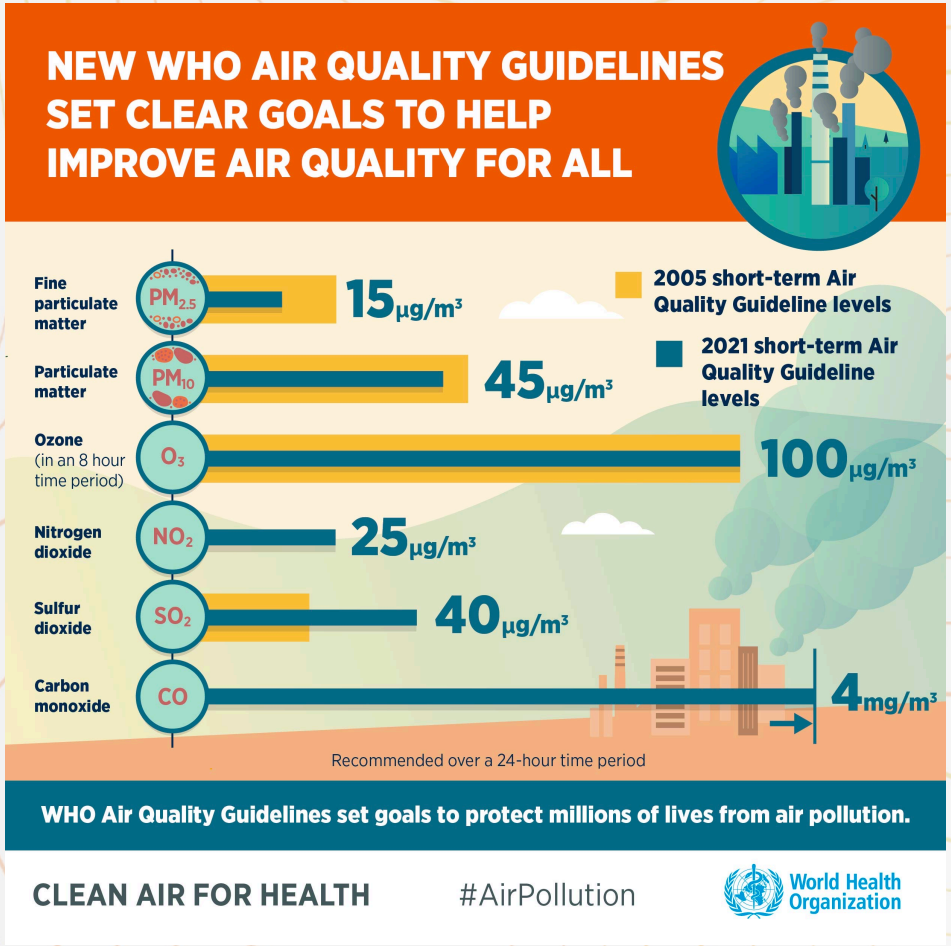
Life expectancy lost, an ***easily understandable*** underlying health ***metric***

Hyperlocal and Global

Comparison ***across regions and time***

Can be used by ***both policymakers and public alike***

Interactive platform with full and ***open access***



Air quality management practives are an important tool in the fight against air pollution

Thank you

Have Questions? Write to me at: nishkasharma@uchicago.edu

To learn more, visit: https://aqli.epic.uchicago.edu/

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