AQLI screening test

Datasets for the test: LinkToFolder

- AQLI 1998-2021 GADM2 dataset csv
- AQLI 1998-2021 GADM2 shapefile
- AQLI data dictionary with file definitions

Allowed Languages: R/Python

Max expected time to complete this section
~ 5 hours over two days. If you are unable to complete this task over the course of 5 hours, please send what you are able to complete.

Tasks
For these tasks, unless otherwise directed, please create a word doc to answer the questions below and insert the visuals. You will also be asked to share your code via a GitHub repo, see below for instructions.

1. Basic wrangling tasks and questions

1.1 How many GADM2 regions are present in India?
1.2 Calculate population weighted pollution average of all years at country (GADM0) level

- Save the country level file as a CSV.
- What are the 10 most polluted countries in 2021?

1.3 What was the most polluted GADM2 region in the world in 1998, 2005 and 2021?
1.4 Plot a population weighted pollution average trendline plot for Uttar Pradesh from 1998 to 2021. Save this plot as a high quality PNG file.

2. Geospatial tasks and questions

2.1 Plot a bar graph for the life years lost relative to the WHO guideline in the 10 most polluted countries in the world and also plot them on a global country level map. For the map, the 10 most polluted country boundaries should be filled in with “dark red” and the rest of the map should be grayed out. Save both the bar graph and the map as high quality PNG files.

2.2 Create a potential gain in life expectancy (relative to the WHO guideline) map of eastern v/s western europe at GADM level 2 and save it as a high quality PDF.

- Plot should be in AQLI "Potential gain in life expectancy" color scale. Visit AQLI website Index page > See legend for "Potential gain in life expectancy" and infer "exact" colors from that.
- You can define east and west europe based on any acceptable definition online, but whatever definition you use - mention the source.
- Feel free to add annotations/text boxes etc. to help explain the visualization.

2.3 Look at the AQLI website > switch to Air pollution tab > plot a static version of the global pollution map you see there, in those "exact" same colors. Export it as a high quality (320 dpi) SVG file.

3. Store your outputs on GitHub

- Create a GitHub public repo with a README file and save all your outputs (word doc with responses to questions, and relevant file outputs: CSVs, PDFs, PNGs) at the root in a folder named "Output".
- Small note: If some PDFs are too heavy to store on GitHub due to file size limits, please make sure to share those in a separate zip folder separately. But, all other non-heavy files should be stored in the GitHub output folder.

4. Verbal reasoning and writing

Please read the following excerpt from the AQLI Annual Update 2024 carefully and summarize your key takeaways in three clearly written bullet points. Each bullet should not exceed 30 words.

Whether pollution is increasing or decreasing, it's clear that some regions of the world are much more polluted than other regions. People living in the most polluted places (the top 20th percentile) breathe air that is six times more polluted than the air breathed by those living in the least polluted places (bottom 20th percentile) . That means that pollution in the most polluted places is cutting 2.7 more years off the lives of those living in them compared to those in the cleanest places.

While geographic terrain and meteorological factors can have an influence on pollution, varying policy ambitions in the form of clean air standards or emission reduction goals—and the ability of countries to enforce them—largely impact pollution levels. Policy ambitions vary significantly among countries, with some countries setting strict national air quality standards, others setting weaker ones, and still others setting none at all . A national air quality standard is critical to efforts to reduce pollution because it allows policymakers to have a guidepost to use to set policy goals

and evaluate their success. Out of the 252 countries and territories analyzed in this report, 94 countries that are home to more than 81 percent of the world's population have air quality standards for $PM_{2.5}$.[1]

It's important to note that when countries set air quality standards, they do so in the context of various national policy goals. For example, they may believe that the costs from strict air pollution policies in terms of industrialization and economic prosperity would exceed the benefits in their countries. And even if a country sets a strict standard, that doesn't necessarily mean they have cleaner air. Countries must also enforce their standard.

South Asia is a good example of these nuances. In India, where the annual $PM_{2.5}$ standard is 40 $\mu g/m^3$, more than 40 percent of the population breathes air that exceeds the standard. In Bangladesh and Pakistan, where pollution levels are similar to those in India, virtually the entire population breathes air that doesn't meet the standard.

Thirty-three percent of the world's population lives in regions that did not meet their country's standard in 2022. If these regions met their country's standard, the world's population would gain more than 3 billion life-years. Iraq, Bangladesh and Pakistan would see the highest benefits, with life expectancies increasing by almost 2 years in each of these countries.

However, the ability to meet standards is a problem even in regions of the world that some might consider cleaner and that have stronger limits. While the European Union has recently set a much stricter 2030 target of 10 ug/m^3 for $PM_{2.5}$, the pollution levels in the countries of Bulgaria, Croatia, Cyprus, Czechia, Greece, Hungary, Italy, Poland, Romania, Slovakia, and Slovenia, exceed this tighter standard. More than 75 percent of the population in these countries breathes air that doesn't meet the standard.

A standard—even one not quite achieved, yet—is still better than no standard at all. While 101 countries and territories have a standard, even more—151 —do not have a standard. Countries like the Republic of Congo, Cameroon, and Equatorial Guinea—where pollution is among the highest in the world— do not have a pollution standard. In fact, many of these countries do not even have the monitors and open pollution data needed to help them set an appropriate standard.

5. Submitting your test answers

Once you are done, send the link to your GitHub Repo that you've generated for this activity, as well as your word doc (and zip folder if applicable) answering the questions above to **tganguly@uchicago.edu**.

[1] Country and territory- wise annual average $PM_{2.5}$ standards (where available) as compiled by AQLI for this report can be found here: https://docs.google.com/spreadsheets/d/1jKBEqm-BI2Pm1o5S7tltwUSeddU4txnMUqsNncWiT8I/edit#gid=1888203290