**Human Population Growth and Greenhouse Gas Emissions Name:**

*Learning Outcomes:*

* Explore and learn the contributions of both countries and individuals to global carbon emissions.
* Evaluate and report the demographic factors that drive human population growth.
* Become familiar with navigating and utilizing data-centric online tools to explore global change phenomenon.

Humans alter the climate by emitting greenhouse gases, by changing planetary albedo, and by altering atmospheric chemistry. Between 1900 and 2000, humans' emissions of carbon into the atmosphere increased fifteen-fold, while the numbers of people increased less than fourfold. One way to help mitigate global change is to reduce our ‘carbon footprint’. Unsustainable human population growth, however, may overwhelm those efforts. Understanding the relationship between human population growth and global change factors is complex and evolving. To start, understanding human contributions to global change requires an understanding of human population patterns at many scales.

This activity uses two different online tools to explore patterns in global carbon emissions and human population growth. First, the “Global Carbon Atlas” (<https://globalcarbonatlas.org/>) provides data on carbon based emissions across political boundaries. Second, the United Nations publication “World Population Prospects” (<https://population.un.org/wpp/>) uses demographic information to explore human population trends for different countries; including overall population growth, age demographics, life expectancy, and fertility rates.

**Part 1. Exploring carbon based emissions through different lenses.**

1. On the Global Carbon Atlas homepage, navigate to ‘Carbon Emissions’. The default units, metric tons of CO2 per year, represent total emissions by country. Compare the rankings of total emissions by country with what you know about population size of individual countries (*look up population size rankings, if needed*). Describe what patterns you see?
2. Are there highly populated countries that appear to ‘emit’ less? If so, why do you think that is?
3. Now, switch the units to tCo2/person. This represents greenhouse gas emissions per capita or ‘per person’ (tons CO2 per person per year). What new conclusions can you draw about the role of socioeconomics in emissions?
4. Assuming that the current culprits of high emissions have always lead the emissions race ignores the history of the development of human society. Watch the ‘Bar Chart Emissions Race’ which tracks greenhouse gas emissions from countries (and regions) since the industrial revolution. What factors do you believe led to the patterns you see? <https://www.youtube.com/watch?v=WmPfm80qDrA>

**Part 2. Exploring demographic trends in human populations**

1. Assuming that the current culprits of high emissions will continue to lead the emissions race ignores changing demographic trends. Navigate to the ‘World Population Prospects’. Under the ‘Graphs/Profiles’ tab’ Maps’ tab, select Demographic Profiles – Line Charts for the world. Explore current and future population trends on a global scale. Examine patterns in each variables related human demographics. What conclusions can you draw that could be relevant to discussions regarding future greenhouse gas emissions?
2. Today’s largest countries in population – China, India, and the United States – are expected to remain among the most populous, although their growth rates are not among the fastest. Using the ‘Graphs/Profiles’ page, explore the future population projections for one of these countries. Using ‘Demographic Profiles’ and the many options under ‘Probabilistic Projections’ diagnose the mechanisms that explain these lower growth rates.
3. There are many countries in Africa and the Asia-Pacific where populations have surged in recent years. Rapid population growth is expected to continue for countries like Uganda, Angola, Congo and Papua New Guinea. For one of these countries, describe the demographic reasons that can explain future population rise. Use the same tools as with the previous question.
4. Based on everything you have explored today, **where** do you believe we should concentrate future efforts to reduce greenhouse gas emissions? Explain your reasoning.