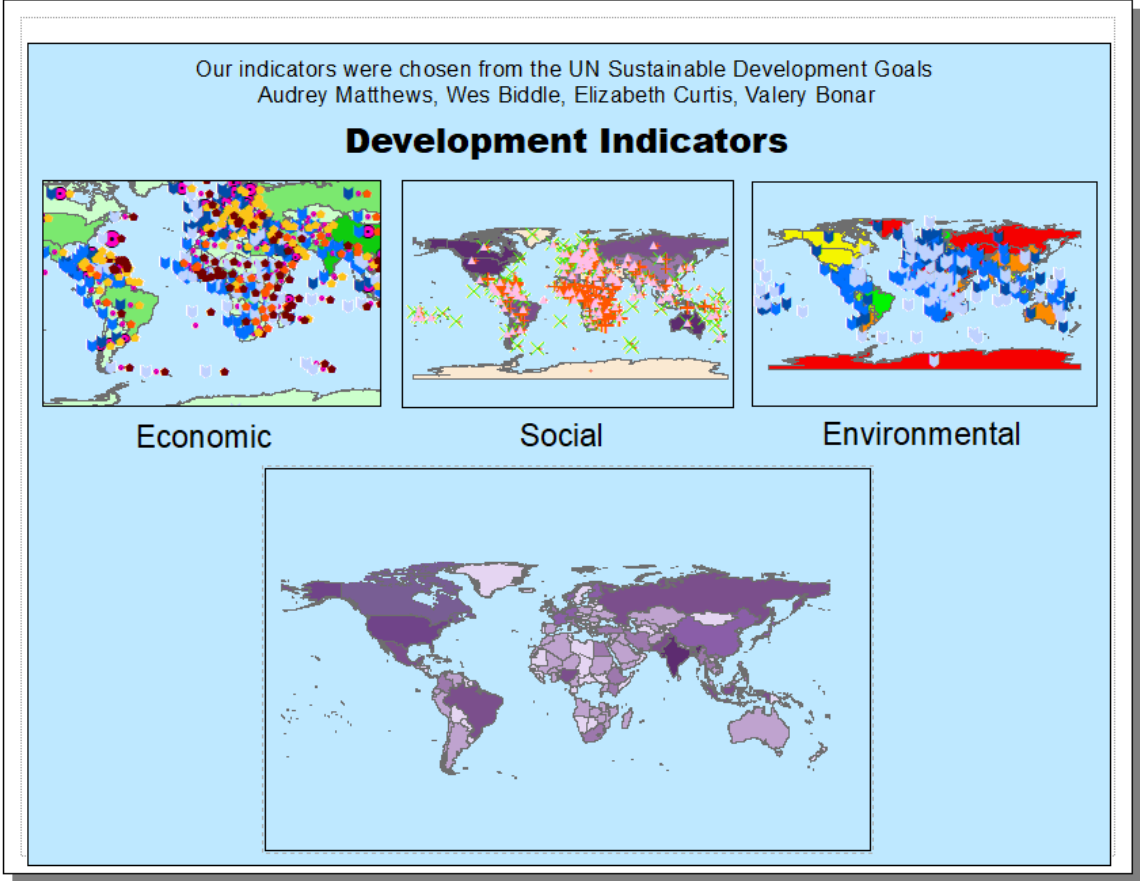


State of the World by United Nations Indicators

Audrey Matthews, Elizabeth Curtis, Wes Biddle, Valery Bonar



Background

The main objective of this project was to develop a system to determine the status or sustainable development progress in each country and use it to determine which countries rank the highest in terms of sustainable development. The three main measures used to classify countries were derived from the three pillars of sustainability, which includes economic, environmental, and social considerations. Each of these measures have three or four selected indicators. The indicators chosen to relate directly to the United Nations 2016 Sustainable Development Goals. These indicators were weighed differently according to how strongly each impacted each measure. After evaluating all of the indicator data for each country, the data was calculated according to weights, and then sorted from highest to lowest based on their final score.

Scope and Characteristics of Study Area

The main priority for this project was to pick indicators that would adequately demonstrate the progress and well-being of each country. For that reason, our group utilized the UN Sustainable Development Goals (UNSDG) as strong indicators for guides of data because the United Nations is well established with a global presence. The goals provide global indicators which show a country's ability to meet their current needs without compromising the needs of future generations. Figure 1. below shows several data variables displayed through a scatterplot matrix of ArcGIS against the social progress index data. This was done to see if the data correlated well with the chosen indicators.

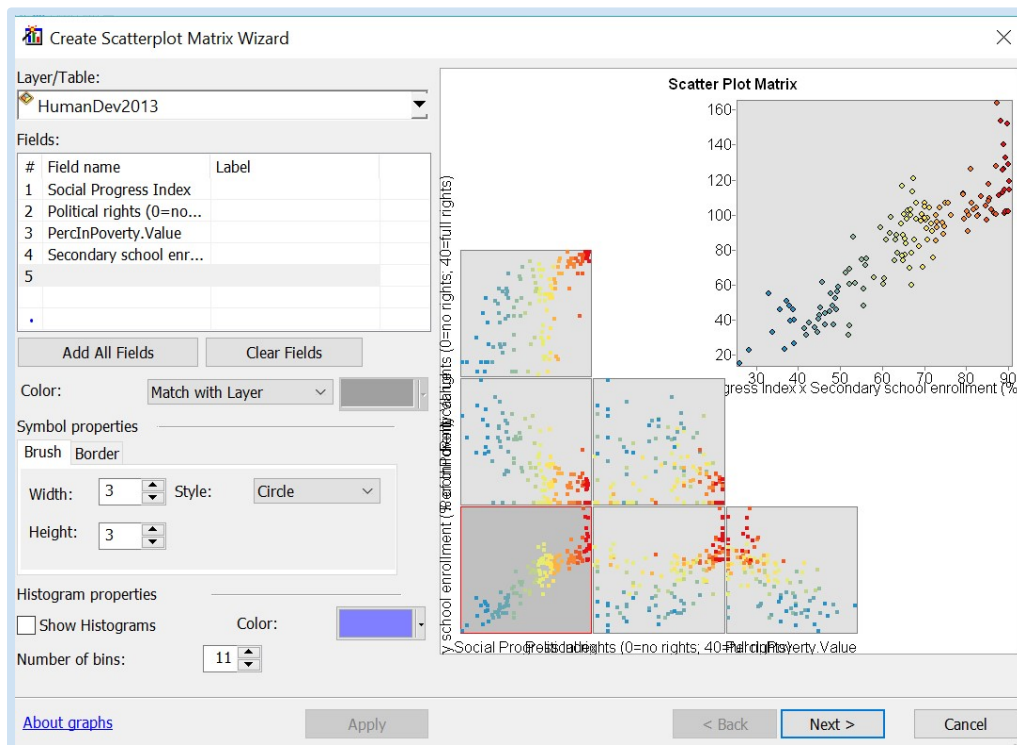


Figure 1. Scatter Plot Matrix

The economic measure is composed of population, GDP per capita, drinking water, and sanitation as respective indicators. Population and GDP per capita express the country's economic stability and influence. Drinking water and sanitation represent the resources accessible for country's inhabitants, as well as the utilities that a country invests their money in. These correlate to the UNSDG eight, six, and nine. These goals include: decent economy and economic growth, clean water and sanitation, and industry, innovation and infrastructure.

The environmental measure has percentage of preservation of biome, carbon dioxide emissions, and renewable energy. Originally the first indicator was percent forest cover but was changed to preservation of biome to more accurately represent a country's impact on their environment and ecosystems. Renewable energy and carbon dioxide emissions are the input and output, respectively, of development. These correlate to the UNSDG of seven, twelve, and fifteen. Which includes: affordable and clean energy, responsible consumption and production, and life on land.

Finally, the social measure has primary education rates, social progress index, gender inequality determined by data on percent wage difference and equality of political power by gender, and political rights for indicators. For the purposes of calculation, poverty rates was removed as it was redundant with the GDP per capita inclusion. These indicators also correlate to the UNSDG four, ten, and sixteen. These goals include: quality education, reduced inequalities, and peace and justice strong institutions.

Objectives for Main Goal

There are three important objectives to achieve the main goal. The first objective was to decide on which indicators were appropriate for our goal of achieving the three pillars of sustainability using the UNSDG. The next objective was to collect relevant data from several different databases such as the UN database, ArcGIS free data, World Bank Data, and data provided in class. After this, the next objective was to organize and combine the data with respect to their measures on ArcGIS. The last objective was to determine a system to summarize all the data and choose the percentage that the indicators affect a country's ranking and provide that information graphically

Methodology

Given our main idea for this project was using the three pillars sustainability, we chose to weight each category, economic, social, and environmental, equally. From here, we looked through the sixteen United Nations Sustainable Development Goals to decide which indicators were most appropriate for this project. For most of the goals, we were able to find direct data correlations. Only two indicators, renewable energy and gender inequality, required data from two different data sets to express the values we achieved. For each measure, we created a separate map to analyze the data. Figure 2. Below depicts the thought process to create these maps.

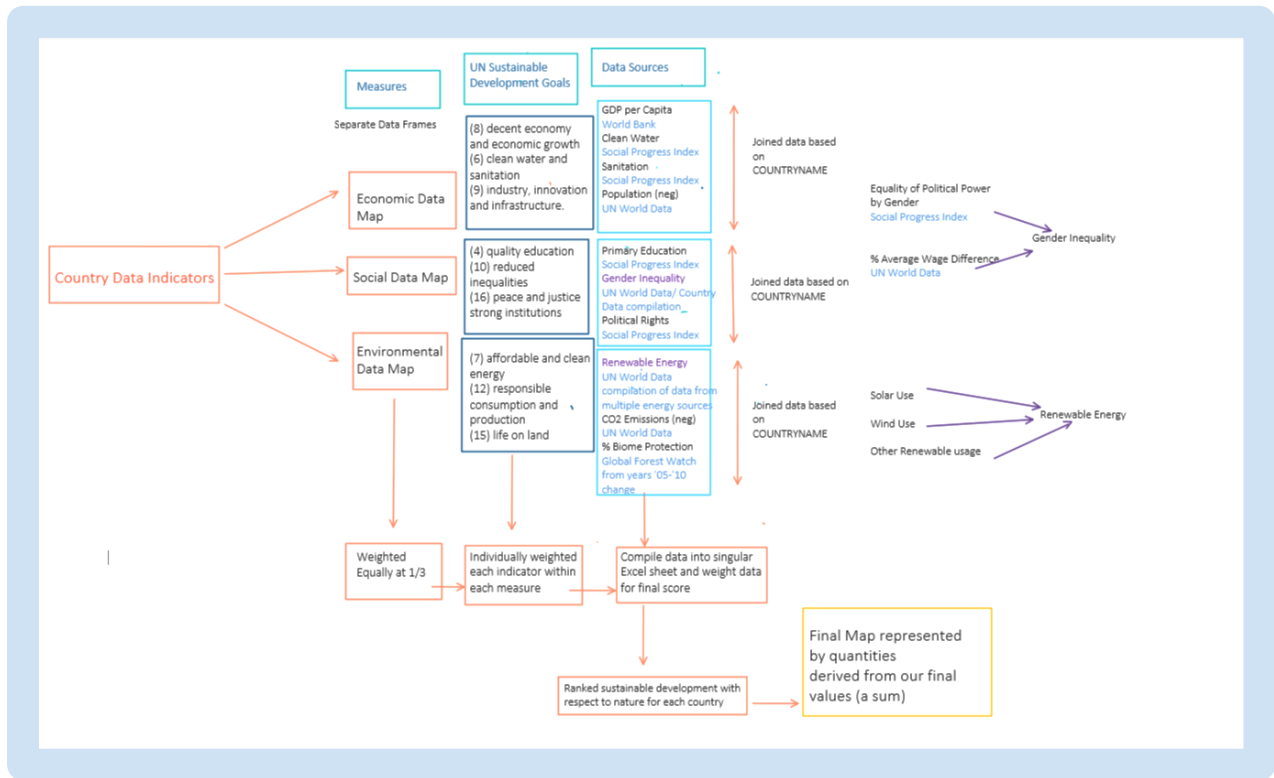


Figure 2. Methodology Flow Chart

Economically, we decided to focus on not just the economic prosperity of a country, but more on the responsibility of the country. In order to capture this, we compared data for the GDP per capita, population, and the improved drinking water and sanitation. We wanted to find the top countries that had not only a reasonably high GDP for the size of the country, but also put their money responsibly towards the essentials of their people. When analyzing the data, there was too much emphasis put on the population, which skewed the data more than expected.

Environmentally, we wanted to emphasize the indicators that do the most harm, as well as recognize the positive environmental practices of a country. For this we measured consumption of renewable energy, carbon dioxide emissions, and percent of biome protection for each country. They were each ranked equally at 12%, but to emphasize the indicator that harms the environment, carbon dioxide emissions were calculated as a negative number to deduct points from countries with poor environmental practices.

Socially, we wanted to look at indicators that were the most influential to development in countries: education, gender equality, and political freedoms and rights. First, we wanted to include the social progress index to account for the many social indicators not present: poverty, mental and physical health, etc. Gender inequalities made up 11% with 5% to wage discrepancies and 6% to political power of women in government. Political rights represented 6%, making political social development scores from both political rights and political power of

women in government with a total of 12%. Primary education was not quite 11% due to the inclusion of social progress index, so it stayed at 10% to complete the weighting. Figure 3. illustrates the various weights that were assigned to each indicator.

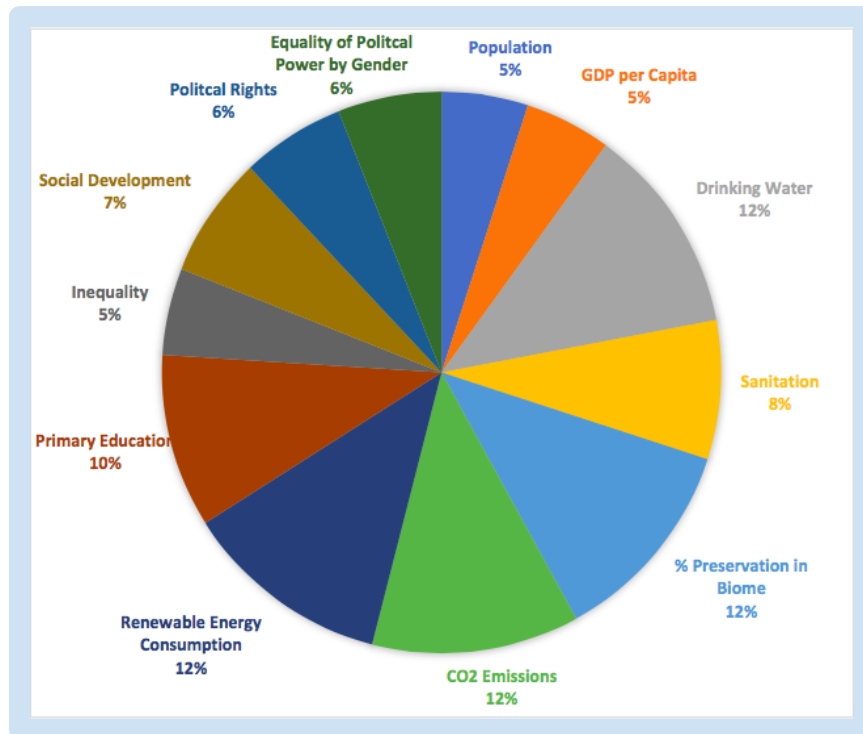


Figure 3. Weighted Indicators

Results and Discussions

Our results ended up with China, India, Niue, United States, Indonesia, Brazil, Pakistan, Nigeria, and Bangladesh as our top developed nations. At first, we thought our math could not be right, because these are not environmentally healthy or sustainable countries. When we looked closer, it was our weighting and selection of indicators that skewed our results. We know that China, India, and the United States all have high impacts to the environment.

The highest scoring countries for social indicators were Finland (with top score of 79.6), Australia, Sweden, Denmark, and the Netherlands. These are all highly developed, affluent, democratic countries, which makes sense why their social indicators were so high. In our top overall countries, the United States, India, and Indonesia did well, which again is most likely due to their democratic governments which account for a sizable portion of their score ($\sim\frac{1}{3}$). China, India, the US, and Brazil all have mandated education programs for their citizens through elementary school. Here, we maybe could have used a higher education data set, as this would show the progress of education beyond the ages of sixteen. As for gender inequality, none of these countries are particularly known for gender equality, but do not have severe of issues as others.

| 1 | Country | Social | Environmental | Economic | SUM |
|----|--------------|------------|---------------|------------|------------|
| 2 | China | 30.345092 | 1.34338952 | -151652495 | 1075368232 |
| 3 | India | 54.513573 | 4.85909878 | -145658699 | 1032855914 |
| 4 | Niue | 10.9639 | 0.22762021 | -39566322 | 280661118 |
| 5 | United State | 47.6899544 | -0.0345454 | -35570008 | 252324034 |
| 6 | Indonesia | 58.5938256 | 5.77718764 | -28722400 | 203674522 |
| 7 | Brazil | 62.4747566 | 6.78801713 | -22841105 | 161979662 |
| 8 | Pakistan | 40.756222 | 5.52925905 | -21252251 | 150700679 |
| 9 | Nigeria | 55.9039706 | 10.6248242 | -20458677 | 145074725 |
| 10 | Bangladesh | 44.1610022 | 4.45471052 | -17924549 | 127104054 |
| 11 | Russia | 47.1915362 | 0.48639331 | -15876954 | 112597423 |
| 12 | Mexico | 59.1154722 | 1.6571368 | -14028753 | 99491652.1 |
| 13 | Japan | 73.8309954 | 1.71241791 | -13966285 | 99100942.3 |
| 14 | Philippines | 61.739371 | 3.87372387 | -11364971 | 80593517.1 |
| 15 | Ethiopia | 36.2759564 | 11.4194841 | -11264290 | 79875532 |
| 16 | Egypt | 35.3579479 | 0.3980119 | -10525510 | 74640723.3 |

Figure 4. Score Breakdown of top Sixteen Countries

| Economic | | Environmental | | Social | |
|---------------------|--------------|---------------------|-------------|----------------|------------|
| Nauru | -180.7552871 | Congo, Dem. Rep. | 13.53436622 | Finland | 79.6120962 |
| Palau | -335.5436845 | Burundi | 13.40415171 | Australia | 79.2337228 |
| Tuvalu | -370.9426769 | Somalia | 13.34821914 | Sweden | 78.058137 |
| Turks and Caicos Is | -410.617748 | Ethiopia | 13.09060407 | Denmark | 78.035728 |
| Greenland | -765.858284 | Chad | 12.57740394 | Netherlands | 77.6439754 |
| St. Martin (French | -1597.45 | Guinea-Bissau | 12.44383172 | Norway | 76.8129142 |
| Gibraltar | -1720.4 | Nigeria | 12.36702123 | Ireland | 76.797854 |
| Liechtenstein | -1883.3 | Nepal | 12.24921959 | Portugal | 76.4762178 |
| St. Kitts and Nevis | -1891.648681 | Malawi | 12.00043205 | New Zealand | 75.995702 |
| Andorra | -1994.690762 | Bhutan | 11.60578621 | United Kingdom | 75.6793666 |
| Sint Maarten (Dutc | -1998.45 | Sierra Leone | 11.34577707 | Costa Rica | 75.458007 |
| Faroe Islands | -2455.85 | Cameroon | 11.18386625 | Iceland | 75.3400318 |
| | | Guinea | 11.16326278 | Spain | 75.171538 |
| | | Pre-demographic c | 11.05391259 | Canada | 75.1092456 |
| | | Haiti | 11.03289829 | Germany | 74.6642368 |
| | | Central African Rep | 10.87020829 | Estonia | 74.6347128 |
| | | Mozambique | 10.81186659 | Switzerland | 74.469939 |
| | | Uganda | 10.79308388 | Slovenia | 74.4561982 |
| | | Zambia | 10.65493381 | Japan | 73.8309954 |

Figure 5. Breakdown for top scoring countries within each measure

Conclusions

Our methodology ended up with us having some of the highest profiting and populated countries in the top ten, the United States among them. Because of having weighted economy, social progress, and environmental measures as equal, it caused the larger producing GDP countries to end up on top. Our results are not wrong, just skewed towards development and growth more than environmental considerations.

Our Presentation: <https://docs.google.com/presentation/d/1-PfECyNCmIkNCXzMfoxl1Ew22fGhm-e4nlgbMOKoxkI/edit?usp=sharing>

Sources:

<https://sustainabledevelopment.un.org/?menu=1300>