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Determining development status of United States counties based on comparative and spatial analyses of multivariate criteria using geographic information systems

Lauren B. Wheeler

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Determining Development Status of United States Counties Based on Comparative and
Spatial Analyses of Multivariate Criteria using Geographic Information Systems

An Honors College Project Presented to
the Faculty of the Undergraduate
College of Integrated Sciences and Engineering
James Madison University

by Lauren Brielle Wheeler
May 2017

Accepted by the faculty of the Department of Integrated Science and Technology, James Madison University, in partial fulfillment of the requirements for the Honors College.

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PUBLIC PRESENTATION

This work is accepted for presentation, in part or in full, at American Association of Geographers Annual Meeting on April 6, 2017 and the Integrated Science and Technology Senior Symposium on April 21, 2017.
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Finally, I would again like to thank Dr. Henry Way and the Department of Integrated Science and Technology for their sponsorship and financial support in allowing me to present my work at the American Association of Geographers Annual Meeting in Boston, Massachusetts. This conference served as learning experience both professionally and academically. The questions asked during my poster session informed the discussion of this thesis and the networks gained will be formative to my future career in Geography.
### COMMON ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>CIA</td>
<td>Central Intelligence Agency</td>
</tr>
<tr>
<td>NCES</td>
<td>National Center for Education Statistics</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
</tr>
<tr>
<td>OECD</td>
<td>Organization for Economic Cooperation and Development</td>
</tr>
<tr>
<td>FIPS</td>
<td>Federal Information Processing Standards</td>
</tr>
<tr>
<td>PPP</td>
<td>Purchasing Power Parity</td>
</tr>
<tr>
<td>GDI</td>
<td>Gender-related Development Index</td>
</tr>
<tr>
<td>SAIPE</td>
<td>Small Area Income and Poverty Estimates</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross domestic product</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
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<tr>
<td>GNP</td>
<td>Gross national product</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
</tr>
<tr>
<td>HDI</td>
<td>Human Development Index</td>
</tr>
<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organization</td>
</tr>
<tr>
<td>HDR</td>
<td><em>Human Development Report</em></td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
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</table>
ABSTRACT

Many world organizations rank countries according to varying development criteria, but rarely are those scales transposed onto smaller geographic regions of a single country in order to more fully understand that country’s development. This global analysis does not take into account regions that are statistical outliers within a country. The United States ranked 8th in 2015 according to the United Nations’ Human Development Index, but empirical evidence shows, through qualitative and quantitative data, that there are regions within the U.S. that would not classify as having “very high human development.” This study used multivariate quantitative data (health statistics, education levels, and income) to replicate development indices like that of United Nations (UN) for counties in the United States. Development thresholds were based on standards of highly reputable and widely recognized organizations such as the UN, World Bank, and CIA World Fact Book. The data were then graphically displayed as maps using ESRI’s ArcGIS software to show the spatial distribution of development across the United States if counties were held to the same standards of international development like those of United Nations or World Bank. The results showed that low development was prevalent in areas with entrenched poverty like the Mississippi River Delta and the Appalachian Region. In total, there are 66 counties that fall into fourth class, or the “low development” category, for all three development criteria. Having applied international development indices to U.S. counties, it is the author’s hope that issues of poverty, development, and human well-being will be approached from a greater global perspective and more domestic aid will be given.
INTRODUCTION

This project transposed the Human Development Index (HDI) onto U.S. counties in order to expose the growing socio-economic disparity within its borders. It is well known that the U.S. is falling behind its co-equals in many aspects, especially social welfare, health, and equality (see Appendix A). For example, the Appalachia Region subculture, marked by poor economic development, healthcare, and literacy rates, sheds light on the increasingly poor standards of living in some areas of the United States (Billings). No part of the U.S., however, has been considered anything less than First World. (“First World” here being the formerly used yet widely recognized term for highly developed countries. More modern terms used are “developed,” being of “high human development,” and “The Global North,” but the rankings of first, second, third, and fourth world are used here for the sake of clarity and consistency.) By applying international classifications to counties in the United States based on statistical analyses and spatial visualization, the severity of development problems might be revealed.

The results, therefore, show the geographical distribution of development issues and provide a visual representation of the U.S. on international scales. The results of this project, then, are similar to the maps that categorize states by the country with the most similar GDP (see Appendix B). Using a more refined scale—counties rather than states—reveals the regional disparities in the United States that go unexamined under broader visualizations. The geographic size of the U.S. explains the extreme variances in education, income, and health across the nation, as well as variations in other aspects of human life such as regional, cultural, histories, and identities, which are not noticeable in smaller, Western European countries. In fact, Colin Woodward identifies eleven sub-cultures within the United States that function as separate nations in “American Nations: A History of the Eleven Rival Regional Cultures in North
America” (2011 (see Appendix C for further information)). Because these regions are so distinct, a national average for any statistical measure can tell a misleading story about the United States. Applying international classifications, then, to counties provides a visual representation of development that is both shocking and revealing.

Because the HDI is the most widely accepted international development index, the same methods for creating it were applied to the data in this project. Counties in the U.S. are compared to countries that fall into one of four HDI classifications: Very High Human Development, High Human Development, Medium Human Development, and Low Human Development. These classifications correspond with the post the World War II terms of first, second, third, and fourth world, as well as the World Bank’s classifications of high, upper-middle, lower-middle, and low economies. Counties are compared not just on income, but on education and health outcomes too, as a way of reflecting the holistic human development approach of the HDI.

While approaching development from a single dimension like income is not enough, it is still an integral factor in a multi-dimensional study. Because income is arguably the most important factor in determining development status internationally, it is equally important to understand the spread of income within the United States. Income plays a large role in a person’s ability to meet the basic needs of him/herself as well as their family. Additionally, income shapes a person’s comfort level and stability. According to the Brookings Institute, “the United States is known for having higher inequality and a less generous social safety net than many affluent countries in Europe” (Smith and Chandy, 2016, para. 4). In fact, according to the Organization of Economic Cooperation and Development (OECD), among the 35 wealthiest countries in the world, the United States as has the highest poverty rate, both generally and for
children, the greatest inequality of incomes, and the lowest government spending as a percentage of GDP on social programs for the disadvantaged. Thus, income in the form of poverty percentages per county will be assessed.

The second dimension for determining development is education. Among the 35 OECD countries, the United States performed below average in 2012 in mathematics, putting it on par with Hungary, Italy, Lithuania, Norway, Portugal, the Russian Federation, the Slovak Republic, Spain, and Sweden (OECD, *Country Note*, 2015, p.2). In reading, the United States performed around the average, comparable with Austria, the Czech Republic, Denmark, France, Hungary, Israel, Italy, Norway, Portugal, the United Kingdom, and Viet Nam. In science, the performance of the United States was also close to the OECD average and comparable with that of Austria, Belgium, and Croatia (OECD, *Country Note*, 2015, p.2). These rankings are an average for the United States and do not reflect areas of high or low achievement. In order to reflect education outcomes at a more refined scale, this project maps the literacy rates of U.S. counties.

The final dimension important to human well-being is, of course, health. Health is not just the absence of disease, but also incorporates physical fitness and mental wellness. These three factors contribute to a person’s ability to lead a long and healthy life. Without meeting basic needs, a person cannot be healthy and therefore cannot fulfill his or her purpose in life. When the development paradigm shifted from the economy to the people, health became an important contributing factor to human development. As such, food security is assessed in this project as measure of health because access to reliable, nutritious food is basic to a person’s health, mentally and physically.
Objectives

With these three dimensions in mind, the objective of this project is to assess U.S. counties based on the Human Development Index and explore domestic development in relation to global standards. The counties will be symbolized on a map according to how they rank globally. This assessment, then, applies well-known development terminology, like first world versus second world or high development versus low development, to U.S. counties to expose the range and severity of development issues within the United States at a level of spatial resolution not usually depicted.

Hypotheses

The author hypothesizes that despite high-levels of presumed development and power, the United States is falling behind other first world or very high developed countries. Overall, the United States has been at the forefront of economic development through much of the twentieth century, but the free market development has also led to significant regional economic inequality. By applying international development classifications to U.S. counties, it is predicted that some counties will be on par with developing countries in critical human development criteria: health, income, and education. In particular, the areas hypothesized to be the least developed are the Appalachian Region, The Black Belt, and Mississippi River Delta, as well as some counties in large metropolitan areas like New York City and Los Angeles.
Global organizations like the United Nations and World Bank have been ranking countries based on economic development for decades. The United States has historically been, and continues to be, at the top of the list with the largest Gross Domestic Product (GDP). Considering GDP as the most prominent measure of wealth and power, the United States sits atop the pedestal of economic success, positioned such that other countries strive to emulate the practices of this great nation. But what GDP fails to measure are the many factors that contribute to the health of a nation—most notably the health and well-being of its people.

Personal wellness refers to optimal health and vitality, not just the absence of disease, in nine, integrated contexts: physical, emotional, intellectual, social, cultural, spiritual, environmental, financial, and occupational (Fahey, Insel, Roth, & Insel, 2017). A healthy and well person, therefore, is able to meet the needs of these contexts and strike a balance that sustains them personally. Income is not the sole factor in determining the wellness of a person and, therefore, not the only factor influencing the wellness of country. If a country’s constituents are not well, the country is not well. The GDP was intended to be used as a marker for national economic progress, but it inadvertently became the marker for well-being, though not equipped to do so. Haq (1995) noted that GDP is just a “convenient abstraction” of a country’s economic progress and neglects many other aspects of human life (p. 4). From this standpoint, development is about the economy, not the people, and neglects to acknowledge markers of human welfare like education, skills, health, goals, values, and equity, to name a few.

Furthermore, this point of view encourages the notion that economic progress is the cause of development, not just one of the many factors that could contribute to it, which is an insidious notion for developing countries. When economic status is the primary basis of a country’s rank
(e.g. developing, an emerging market, the Third World, etc.), it is under the assumption of globalized economic trends and is, therefore, determined by a country’s participation in a capitalist world market (Shenming). Thus, countries designated as “third world” or “emerging” strive for economic development in accordance with Western capitalism—though the economic and social sustainability of capitalism, especially when it becomes extremist, is largely ignored. In fact, Haq notes that “in many societies GDP can increase while human lives shrivel!” (1995, p. 4). For this reason, assessing the sustainability of this development theory is necessary.

In the 1970s and 80s, a development debate began in the social sciences that considered expanding the measures of development beyond GDP. The development conversation began to change from “How much is the nation producing?” to “How are its people faring?” (Haq, 1995, p. 25). By the 1990s, a paradigm shift was underway: economic production was no longer the sole marker of human welfare, and a more holistic approach to human development was rediscovered from ancient and modern philosophers Aristotle (384-322 B.C.) and Immanuel Kant (1724-1804), respectively—both of whom saw wealth as merely a tool for human well-being (Haq, 1995, p. 13). On May 24, 1990, the United Nations released the Human Development Report (HDR), which challenged conventional wisdom about the relationship between economic growth and human development. This report sparked the search for a new composite index under the United Nations Development Program (UNDP) to rank countries based on multi-dimensional socio-economic progress, rather than GDP alone (Haq, 1995, p. 47). This index, the Human Development Index (HDI) ranks countries based on a composite score of three factors: a long and healthy life, knowledge, and a decent standard of living (Human Development Reports, n.d.).
The HDI has become the most widely used and accepted method for comparatively ranking countries. Countries can fall into one of four categories: very high human development, high human development, medium human development, and low human development. As of 2015, the United States ranked 8th globally, in the very high human development category with 49 other countries. Increasingly, however, the United States is falling behind other first world countries in some categories. The Social Progress Index ranks the U.S. 21st in meeting basic human needs, 37th in providing the foundations for well-being, and sixth for offering opportunity (Social Progress Index, 2015, n.p.). The Programme for International Student Assessment found that in 2012, the United States ranked 27th in mathematics, 20th in science, and 17th in reading (OECD, Country Note, 2015, p.2).

An internal study of the United States exposes this. Regions like Appalachia and The Mississippi River Delta are known to have extreme and entrenched poverty, low educational achievement, and poor health but are over shadowed by the economic and social progress of metropolitan areas by development indices like the HDI. This is because the HDI and other indices rank countries based on the national average of varying measures, and therefore hide statistical outliers like the aforementioned regions. In order to fully understand how capitalism has affected the United States, it is important to look at development measures at a more granular scale, like at the state- or county-level, in order to understand the factors contributing to the national average.

With widely accessible geographic data, critical geography and counter-cartography can help visualize the human development within the United States. Counter-cartography is the notion that “unequal power relations might be questioned, transformed, or influenced through the use of mapping” and has also been used to describe less-privileged groups’ use of mapping
technologies in developed countries (Lin, 2013, Chapter 15). Counter cartography, then, is a key tool to describing the development issues in the U.S. that are not addressed in a broad, national view of our country. Cartography used to map the U.S. according to the HDI can approach domestic development from a new light, giving a voice to underserved populations.
METHODOLOGY

In order to apply international development classifications to U.S. counties, this study utilized the same accepted measures of those of the United Nations Human Development Index (See Figure 1). This index was chosen in particular as the guideline for selecting standard study measures because the Human Development Index (HDI) is a “summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable, and having a decent standard of living” (Jahan, 2015, n.p.). These three criteria offer a more holistic approach to determining development than economic progress alone. The HDI uses life expectancy at birth as the chosen measure for a long and healthy life, an average of expected years of schooling and mean years of schooling as the measure for knowledge, and Gross National Product (GNP) per capita as the measure for a decent standard of living.

The indicators in this study—health, education, and income—mirrored indicators from the HDI in order to produce a similar socio-economic approach to development. The measures used to represent these indicators, therefore, were food insecurity, literary rates, and poverty percentages, respectively. For multiple reasons, the same exact measures could not be used in
this study as the HDI, and those explanations will be given in the sub-sections about each measure used (See Figure 2).

![Diagram of the indicators and measures used to create schema used in this project.](image)

**Figure 2.** Diagram of the indicators and measures used to create schema used in this project.

Merely approaching development from the perspective of the economic output of a county ignores the many other factors contributing to human well-being and would prevent the ability to make county comparisons to other countries. Because this study is modeled after the HDI, it is subject to the same limitations. It focuses only on basic dimensions of human development and does not take into account a number of other important dimensions of human development or the effects of human agency.

Data at the county level for the three measures used in this project were sourced, cleaned, and displayed cartographically, based on international development indices. County-level data allows for enough granularity to see regional patterns without obscuring outliers, like national- or state-level data may. Specific data sources and methods of comparison are stated below in the “measures” subsection, followed by the methodology for making the maps and then comparing them to representative countries abroad. By relating counties to countries of similar
development status for each measure, international development terminology (e.g. first world, second world, etc.) was applied and will be explained in the final subsection of the methodology.

**Measures**

**Income**

According to Smith and Chandy, “methods for measuring poverty differs widely both with and across countries, so comparison and their interpretation demand extreme care” (2014, p. 143). This projected heeded that advisory. It is obvious that living on $x$ amount of U.S. dollars (USD) per year in the U.S is very different than living on $x$ amount per year in rural Nigeria, where the costs of living are very different. For this reason, basic income data could not be used to make the comparison. The current HDI uses purchasing power parity (PPP) in USD to compare countries, but a lack of PPP data on U.S. counties prevented this method from being applied to this project. “The HDI is based on a cut-off point defined by a level of income regarded as adequate for a reasonable standard of living and for a reasonable fulfillment of human capacities. Initially, this cut off point was derived from the poverty level income of the industrial countries as reflected by the Luxemburg Income Study, with values updated and translated into purchasing power parity dollars” (Haq, 1995, p. 49). So, instead, this project used poverty data relative to the U.S. poverty line ($24,600 per year, for a four person family) and compared those percentages to representative countries from each of the four development classifications and their percent of the population impoverished relative their poverty line.

Using poverty percentages relative to each country, this avoided the necessary adjustment to purchasing power parity that would be required if average incomes were used. This approach is supported by Smeeding, Rainwater, and Burtles, who suggest that “for international
comparison, poverty is almost always a relative concept” (2001, p. 3). Therefore, the data used in this project come from the United States Census Bureau’s 2015 Small Area Income and Poverty Estimates (SAIPE) at the county level. The data given include the total number of people in poverty in a county as well as the total population of the county for that year. With these data, the total percent of people in poverty per county was determined.

Education

With laws keeping children in the United States in school until a certain age, using data on mean years of schooling in the United States to compare to international standards would have been skewed. It is also cited in the literature that just because American children are attending school, does not mean they are well-educated. For the purposes of comparison to international education standards, then, this project used basic prose literacy as the measure of education.

The data were sourced from the National Center for Education Statistics (NCES) and is supported by the U.S. Department of Education. NCES is the primary federal entity for collecting, analyzing, and reporting data related to education in the United States and other nations (Greenberg and Jin, 2007, Introduction). The National Assessment of Adult Literacy (NAAL) is the survey conducted by NCES to assess the English Literacy of adults (ages 16 and older) in the United States. Literacy is assessed on three scales: prose, document, and quantitative literacy. The data used in this project come for the NAAL on basic prose literacy.

Basic prose literacy is defined as having the knowledge and skills needed to perform prose tasks, like reading brochures and instructional materials (Greenberg and Jin, 2007, p.2).
The data used in this project are from the most recent available survey data in 2003. The data were given as the percent lacking basic literacy in each county.

Because literacy rates are always percentages, making comparisons from counties to countries was simple. International literacy rates were sourced from the CIA World Fact Book and UN Educational, Scientific, and Cultural Organization (UNESCO) and represent the literacy rate of that country in its official language. The rates were given as the percent of the population with basic literacy, and because the data for the U.S. were percent lacking basic literacy, the reverse was found in order to make lateral comparisons.

Health

For obvious reasons, measuring health in the United States and other Western, industrialized countries is very different from measuring health elsewhere. People in the U.S. do not die of the same communicable diseases, like cholera and malaria, at the same rate of those in less developed countries. Instead, Americans die of life lifestyle diseases like heart disease and lower respiratory disease. While the life expectancy is high (about 79 years on average), this does not take into account the quality of life. Americans might be living longer because of modern medicine, but that is not to say the last decade or so is easy. It is likely that many Americans are in significant pain—in fact about 80% of the global opioid supply is consumed by the United States (Gusovky, 2016). Despite this, life expectancy in the U.S. is actually two years lower than the average of the other 34 OECD countries for several reasons, including poor health-related behaviors and a highly fragmented health-care system. These discrepancies in the causes of death and quality of life made using average life expectancy at birth a difficult measure by which to assess health.
Instead, food security was chosen as the measure for health because food is fundamental to life and health. Due to a lack of data, other comparable and important health measures could not be used. One of these was infant mortality. Data on infant mortality at the county level in the United States were surprisingly sparse, with about one-third of counties responding to the survey administered by the University of Wisconsin’s Public Health Institute.

Food insecurity data came from the University of Wisconsin’s Public Health Institute and is defined as the percentage of people in a county who did not have access to a reliable source of food in the past year (County Health Rankings and Road Maps, n.d.). The data were compared to the Food and Agriculture Organization (FAO) State of Food Insecurity in the World 2015 data. The FAO defines undernourishment as not being able to “acquire enough food to meet the daily minimum dietary energy requirements, over a period of one year”—so, in other words, the same way as the County Health Rankings and Roadmaps defines food insecurity. Because both data sources defined food insecurity the same way, the comparisons were made without adjustment.

Making the Maps

The spatial and statistical analysis for this project was performed using Geographic Information Systems (GIS). All the data (income, health, and education) came in excel files labelled by county. Attributes included the county name, state name, and the Federal Information Processing Standards (FIPS) code, whether in total, or by state and then by county. For example, the income data spreadsheet included FIPS codes, but with the state FIPS and county FIPS in separate cells. By using the concatenate function, the two cells were combined to form a full FIPS code that could be joined to a shapefile of U.S. counties in ArcMap.
The software used to create the maps and the accompanying geodatabase was ESRI’s suite of ArcGIS products. The applications primarily used were ArcMap and ArcCatalog. Once the Excel spreadsheets were cleaned—had full FIPS codes—the tables were imported into ArcMap and joined to an existing shapefile of the United States retrieved from ESRI. The tables were joined to the county layer by FIPS code. Counties include all United States incorporated cities, boroughs, parishes, and the District of Columbia for a total of 3,144 counties and county-equivalents. Each measure was exported to a geodatabase as its own layer. Three maps were created, each displaying a development measure: health, income and education.

Making the Comparisons

Creating the classification scheme in Table 1 was the first priority. Because most development indices use four classifications for development, this project followed suit. The classes were simply labeled by number, one through four. Class one corresponds with very highly developed classifications—very high human development according to the UN, a high-income economy according to the World Bank, and “first world” according to formerly used terminology. The rest of the classes were defined in the same way.

<table>
<thead>
<tr>
<th>International Classification Legend</th>
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<tbody>
<tr>
<td>Class 1 (&quot;First World&quot;: &quot;Very High Human Development&quot;)</td>
</tr>
<tr>
<td>Class 2 (&quot;Second World&quot;: &quot;High Human Development&quot;)</td>
</tr>
<tr>
<td>Class 3 (&quot;Third World&quot;: &quot;Medium Human Development&quot;)</td>
</tr>
<tr>
<td>Class 4 (&quot;Fourth World&quot;: &quot;Low Human Development&quot;)</td>
</tr>
</tbody>
</table>

Table 1. Classifications levels and their corresponding definition according to formerly used terminology and the HDI, respectively.

Labeling counties with international development designations is the most politically compelling part of this project. To do this, careful comparisons were made based on cross-
referenced statistics for each measure. In order to make comparisons, representative countries were necessary for each class. These countries were chosen because they consistently fall into the same classification, no matter the index used. For example, Kazakhstan falls into the second class of HDI—high human development—and the second class according to the World Bank County and Lending Groups—upper-middle income (Human Development Reports, 2015 and World Bank, 2016).

Similarly, Ghana falls into the third classes of the HDI and World Bank’s rank: medium human development and lower-middle income, respectively. This same cross-referencing process was applied to all of the selected representative countries.

Representative countries were also chosen for their geographic spread across the world for each class. This was difficult for the first and fourth classes, though, because first world countries are typically clustered in the Global North, especially North America and Western Europe, while fourth world countries are clustered in the Global South.

The average percent for each measure was then found for every representative country. These averages for percent food insecure, percent in poverty, and percent illiterate relative to each country were cross-referenced using data compilation sources such as the CIA World Fact Book, UNESCO, FAO, and the World Health Organization (WHO) as well as country-specific studies. Ranges were determined for each classification based on the national average of each measure for the representative countries. For the most part, the classification ranges did not overlap with the exception of food security and literacy rates for the first two classes. This did not have an effect on the literacy rates map because there are no counties in the U.S. that correlate with literacy rates of the other first world countries and will be further explained in the
literacy rates sub-section. The overlap of ranges did have an effect on the map of food insecurity and will be addressed in the results section.

The established data ranges for each class were applied to United States counties in its respective measure. To display this cartographically, the data layer of each measure was given a Natural (Jenks) break with four classes. The classes for each measure lined up almost exactly with the international data ranges, so no further data manipulation was necessary. Each international classification was assigned a color (see Table 2), and counties were displayed accordingly. Therefore, a county falling into the first class would be displayed as royal blue, representing that it has a similar average in that particular measure to first world countries.

<table>
<thead>
<tr>
<th>Class 1</th>
<th>% Food Insecure</th>
<th>% in Poverty</th>
<th>% Illiterate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>24.1</td>
<td>16.1</td>
<td>1</td>
</tr>
<tr>
<td>Germany</td>
<td>17.1</td>
<td>15.5</td>
<td>1</td>
</tr>
<tr>
<td>Canada</td>
<td>13.1</td>
<td>9.4</td>
<td>5.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class 2</th>
<th>% Food Insecure</th>
<th>% in Poverty</th>
<th>% Illiterate</th>
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<td>2.8</td>
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<td>11.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Kazakhstan</td>
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<td>5.3</td>
<td>0.2</td>
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<th>% Illiterate</th>
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<td>29.8</td>
<td>27.9</td>
</tr>
<tr>
<td>Ghana</td>
<td>5</td>
<td>24.2</td>
<td>23.4</td>
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<tr>
<td>Nicaragua</td>
<td>16.6</td>
<td>29.5</td>
<td>17.2</td>
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<tr>
<td>Kenya</td>
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<td>43.3</td>
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<table>
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<th>% Illiterate</th>
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<td>61.8</td>
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<td>31.6</td>
<td>39.1</td>
<td>29.5</td>
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<td>Haiti</td>
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<td>58.5</td>
<td>39.3</td>
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<tr>
<td>Niger</td>
<td>29</td>
<td>63</td>
<td>80.9</td>
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*Table 2:* Chart displaying the representative countries used for comparison and their relative measures in each other the three chosen development indicators.
Beyond the statistical analyses, the spatial analyses and cartography were also completed using GIS, specifically ArcMap. The USGS Contiguous Albers Equal Area Conic was the chosen projection for all three maps for the continuous 48 states. The inset maps (Alaska and Hawaii) were projected using their respective State Plane Coordinate System. The contiguous U.S. maps were set at a scale of 1:18,500,000, while the inset maps were set to 1:42,000,000 and 1:18,000,000, for Alaska and Hawaii respectively. Projections were chosen for ease of visualization at a national scale, as no geometrical calculations were performed that would require a specific projection.
RESULTS

The results show the geographic distribution of development classifications in the United States according to each of the three indicators: income, health, and education. Three individual maps display the results by county: 1) percent poverty for income, 2) percent food insecure for health and 3) percent lacking basic literacy for knowledge (see Maps subsection). The color of each county symbolizes the development (first, second, third, or fourth world) level of that county in that specific measure.

Overall, there is a similar geographic distribution in all three maps, where the Black Belt throughout North Carolina, South Carolina, Georgia, Alabama, Mississippi, and Louisiana is categorized in the fourth class for all three measures. The same is true of the Mississippi River Delta region. The Appalachian Region, particularly in West Virginia and Kentucky, falls into the fourth class for poverty rates, and varies between third and fourth classes for literacy rates and food security, despite the original predication that this region would fall into the lowest development class.

Single counties in metropolitan areas, despite being predicted to be of the lowest development, are not doing as poorly as counties in the Black Belt and Mississippi River Delta region. In fact, only one borough in New York City, The Bronx, falls into the fourth class for literacy. Otherwise, it falls into the third class for poverty and food insecurity. The same results are true for the Los Angeles metropolitan area, with Kern County to the north, falling in the third class for income and health, and the fourth class for literacy rates. Los Angeles county itself is well-developed in comparison, falling into the first class for income and health, but third for literacy, which will be further assessed in the discussion section.
There was, however, one predominant result that was not predicted: the low development classification of Native American Reservations throughout the country. States with a high concentration of Native American populations and large reservation lands include Oklahoma, Arizona, New Mexico, South Dakota, North Dakota, Wyoming, and Montana (see Appendix D for a map of Native American populations in the United States). Oklahoma, while home to a large population of Native Americans, lacks reservation lands like the other states. An interesting result noticed is that the counties in eastern Oklahoma where Native Americans populations are heavy, tends to be in the second or third class of development for all three measures. This is a stark contrast between Arizona, New Mexico, and South Dakota, where Native American populations with reservation land fall into the fourth class for income, a mixture of third and fourth classes for food insecurity, and a mixture of second and third classes for literacy.

Other notable geographic results include the distinction between the North and South. On all three maps, there is a smooth curve that delineates higher development from lower development between the 35th and 40th parallels, despite a few exceptions like Appalachia and Native American Reservations.

Making comparisons of food insecurity here versus elsewhere in the world was a challenge because there was some overlap in the data ranges for the first and second classes. All of the representative first class countries had a greater food insecurity than those of the second class, so while the map symbols are consistent with the representative counties, it is important to note that maybe highly industrialized economies are not the model countries for food security and that countries traditionally classified as second world are better off.
Finally, it is important to note the apparent short coming of literacy in the United States. The map of education shows that not a single county falls into the first class for literacy, making this measure the worst for domestic development overall, with a total of 479 counties with literacy rates comparable to the Fourth World. Not a single U.S. county is on par with other first world countries, whose literacy rates are 99% and above. The U.S. on average has a literacy rate of 86%, equivalent to that of Jamaica. The literacy rates, however, are so poor because the survey data used to create the maps includes the people who couldn’t respond due a language barrier. This explains the extremely low literacy rates in the border lands to the South. These people, however, are not illiterate completely, but rather just illiterate in English. Literacy rates are so high in Western Europe because language is highly valued, and literacy is determined by fluency in any of the common languages, not just one. Therefore, the U.S. needs to adapt to increasing globalization and migration in order to serve the needs of the many diverse people in the country.

Overall, there are a total of 66 counties that fall into fourth class for all three measures, making them comparable to low development or Fourth World countries.
Figure 3. Map displaying U.S. counties according to the percent of population in poverty, symbolized relative to the international classifications in Table 1. Created by Lauren Wheeler.
Figure 4. Map displaying U.S. counties according to the percent of the population that is food insecure, symbolized relative to the international classifications in Table 1. Created by Lauren Wheeler.
Figure 5. Map displaying U.S. counties according to the percent of the population that lacks basic literacy, symbolized relative to the international classifications in Table 1. Created by Lauren Wheeler.
DISCUSSION

With stark clarity, at the sub-national level, the United States is not the country it is overall perceived to be. The maps illustrate the vastly different worlds in which fellow Americans live, where some regions experience poverty rates near 50%, and close to a third of people wonder when their next meal will be. The recent book, *The Vanishing Middle Class: Prejudice and Power in a Dual Economy*, shares the notion that the United States’ economy is regressing to that of a developing country, where two sides of the economy exist: the affluent minority that is politically in control, and the impoverished, socio-economically immobile majority (Temin, 2017). This project, through the use of cartography, shows the geographical distribution of income, health, and knowledge across the United States and visualizes the severe regression of human development within its borders.

The fact that United States, at least in some regions, is falling behind its previous first world counterparts cannot be ignored any longer. Temin argues that the U.S. has a dual economy similar to that of a developing nation, in which the policy-influencing minority keeps their power through social imbalances, low-wage labor, mass incarceration, and tax cuts for the rich (2017 (see Appendix A for incarceration numbers)). In terms of physical infrastructure, the U.S. is more like Thailand and Venezuela than the Netherlands or Japan (Parramore, 2017). The economic model of product over people is creating a divided nation in which the middle class is shrinking and the top 1% of the population is growing richer on their behalf of the poor.

The maps illustrates that the notion that much of the population is falling behind other parts of the world in terms of human development. The largest continuous area in the lower 48 states with the highest ranks on all three measures is the Great Plains and Mid-West, which is also the area with the lowest population levels because of industrial farming. Large metropolitan
areas are population hubs for wealthy people, while their neighboring counties are burdened with high rates of poverty, food insecurity, and illiteracy. An example of this would be the Bronx juxtaposed against Manhattan on the maps. People are migrating to the hubs in search of work, but are finding that without education—another financial burden—they cannot achieve the touted “American Dream.” The gap between the wealthiest top 1% of the nation and the shrinking middle class has grown so rapidly in the past few decades that crossing this socio-economic divide is nearly impossible. The jobs offered by the top 1% are far fewer due to mechanization and outsourcing in the quest for profit. For many, the American Dream is quite literally a far off dream rather an attainable reality.

Other populations are starkly underserved based on these maps. In all three development indicators, the Black Belt, the Appalachian Region, the Mississippi River Delta, and Native American reservations are doing the worst. Entrenched poverty and systematic racial inequality in these regions are large factors contributing to the regression of these populations. Severe poverty, as high as 47% in some counties, contributes to the low rates of literacy and high rates of food insecurity in these areas. Many students drop out of school in search of unskilled work because the educational system is failing them. If they can find work, low wages prevent access to a reliable source of food. Furthermore, many of these underserved populations live in a food desert and cannot feasibly access nutritionally dense food, causing the food insecurity rates to skyrocket in these regions. This speaks volumes to the lack of domestic social support and funding for chronically underserved populations. Systematic discrimination, like the mass and forced exodus of Native Americans from their lands or school segregation, are not past events for history textbooks, but rather the present reality for people of color and tribal ancestry in the United States.
While the middle class across the U.S. is shrinking and regressing to second world status, the historically underserved populations in these regions are falling into even lower categories of development, classifying them into third, sometimes even fourth, world status. The jobs that have historically served these areas are vanishing. This is particularly noticeable in the Mississippi Delta and the Appalachian regions that are likely regressing due to economic and environmental issues, like the pollution of waterways that historically offered people a livelihood and the elimination of coal mining jobs, respectively. People who migrate to cities in search of labor (as has historically been the case, especially during the Industrial Revolution) find that the blue collar work previously available to their grandparents has moved oversees or been replaced by robotics and machines.

It is obvious then, that a development model based on extreme capitalism encourages countries to focus on the growth of their economy, not the growth of their populations. While it produced jobs and an economic boom in the mid twentieth century, this model is now proving to fail a large majority of the population, causing significant areas of the U.S. to look more like a developing nation than the once great nation we are supposed to be. A change to the economic and development paradigm domestically and abroad is necessary for sustainable development of all people.

Future Considerations

There is more to be done on this part as part of a larger effort to analyze inequality in the United States. At the moment, the author plans to continue this project by making a composite map of all three measures in order to capture the true severity of the development crisis in the United States. The author also plans to continue this project with longitudinal data for all three
measures. Because development by definition is a process, temporal data would more accurately represent the development landscape in the United States. Due to time limitations, this was aspect of the project was not considered. In the future, longitudinal data about income, health, and education will be applied to assess development trends in the United States. Development connotes progression, but based on literature, news, and the dropping national averages in these three dimensions, it is likely that the U.S. is actually regressing for the majority of the population. Lucy Parramore explains that the dual economy theory developed by Temin emerged slowly as the result of policy choices beginning in the 1970s (2017). Longitudinal data, therefore, would illustrate the slow regression of regions within in the U.S. to second or third world countries.

Other considerations include performing spatial analyses to see geographical relationships between areas of poor development and possible correlations. Some of these might include overlaying maps of racial distributions, unemployment rates, political affiliation, infrastructure quality, education attainment, food deserts, hypokinetic disease and cancer prevalence, tobacco use, and Superfund sites. While all of these factors will not necessarily have causal relationships with development, it may be corollary. It will also help provide insight and possible explanation for domestic development trends.

The final consideration is to expand the scope of the project beyond the Human Development Index (HDI). The rapidly changing nature of the planet requires a new paradigm for development. Sustainability is an important factor to consider when assessing a country’s or region’s development. Without sustainable practices—environmentally, socially, and economically—countries will inevitably regress, as is proven in the case of the United States. Applying outdated development models (whether in practice or via assessment) to an ever-
changing planet and population is futile. Development theories, models, and indices need to be
developing themselves, and with the increasing rate of change, organizations need to be
funneling resources to this area with fervor. If not, second and third world countries will
continue to develop according to economic principles that are not sustainable and will eventually
fail a majority of their population, as the U.S. is currently experiencing. If the pattern is not
adjusted based on the body of quantitative and qualitative data to which this project contributes,
it is hard to see the world moving toward anything but social turmoil.

With this in mind, indices should not go without assessing justice and equity. As more
countries are moving toward meeting the basic human needs of food and water (though radical
capitalism is trying it’s best to thwart that), development indices should also consider the
secondary needs in order to have a high quality of life, like gender and racial equality,
employment opportunities, and safety. The HDI has started to do this by also producing the
Gender Development Index (GDI) when it releases new Human Development Reports. It does
not factor a country’s GDI score into the HDI, however. Creating composite scores that include
basic and secondary human needs would be the most holistic and effective approach to human
development. Even if this is not feasible on the global scale, using this project’s methodology to
measure these indicators in the United States would be a revealing way to understand the effects
of a one-dimensional development scheme: capitalism.
DATA SOURCES


WORKS CITED


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APPENDIX A

AMERICAN EXCEPTIONALISM?

Amongst the 35 wealthiest countries in the world, America has:

- The highest poverty rate, both generally and for children
- The greatest inequality of incomes
- The lowest government spending as a percentage of GDP on social programs for the disadvantaged
- The lowest number of paid holidays, and annual and maternity leave
- The lowest score on the UN’s index of material well-being of children
- The worst score on the United Nation’s gender inequality index
- The lowest social mobility
- The highest public and private expenditure on health care as a portion of GDP, yet accompanied by the highest:
  - Infant mortality rate
  - Prevalence of mental health problems
  - Obesity rate
  - Low birth weight of children per capita (except for Japan)
  - Consumption of anti-depressants per capita
- The shortest life expectancy at birth (except for Denmark and Portugal)
- The second highest carbon dioxide emissions and highest water consumption per capita
- The lowest spending on international development and humanitarian assistance as a percentage of GDP
- The largest international arms sales
- The most negative balance of payments (except New Zealand, Spain, and Portugal)
- The lowest scores for student performance in math (except for Portugal and Italy) (and far down from the top in science and reading)
- The highest high school drop-out rate (except for Spain)
The American criminal justice system holds more than 2.3 million people in 1,719 state prisons, 102 federal prisons, 942 juvenile correctional facilities, 3,283 local jails, and 79 Indian County Jails as well as in military prisons, immigration detention facilities, civil commitment centers, and prisons in the U.S. territories.

While the United States represents about 4.4% of the world’s population, it houses around 22% of the world’s prisoners.

All data comes from the Organization for Economic Cooperation and Development, which is composed of the 35 wealthiest countries in the world. http://data.oecd.org/

Source:

APPENDIX B

Map of U.S. States according to counties with similar GDPs. Maps making comparisons to countries, like this one, inspired this project.

US States Renamed for Countries with Similar GDPs, 2015

Source:
According to Colin Woodard in his book “American Nations: A History of the Eleven Rival Regional Cultures in North America,” the United States is really broken up into eleven cultural nations. Each nation has its own distinct values, principles, religions, and political views that distinguish it from the others. In comparison the development maps, there seems to be geographic correlation between the level of development and the cultural “nations.”

Map by Brian Stauffer

Source:

APPENDIX D

Map of the Native American Reservation and populations in the United States for comparison with development indices in the resulting maps of this project.

Source: