Natural Resource Distribution vs. GDP per Capita in India

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Abstract

Modern economies greatly impact geological resources around the globe, often to the extent of significant depletion. This project attempts an analysis of the opposite trend: the impact of physical resources on an economy. We collected statewise resource information from various internet portals of the American and India governments. The energy-relevant resources were all converted to megawatts so that we could sum them meaningfully. The energy sum and locations of various important mines were compared to the GDP. The results yielded no clear correlation, which indicates the independence of the Indian economy from the geological resources we have considered. Further research should incorporate other sectors like agriculture and ecotourism. The sole consideration of the primary sector of the economy should also yield a better correlation.

Background

The distribution of resources across India, especially in terms of energy producing fossil fuels and industrial quality minerals, is sporadic in some areas and grouped in others. The distribution of these resources can be traced back to the unique geological history of India, for example the initiation and eruption of the Deccan/Reunion hotspot was a major event leading to the present day Bombay High oil reserve.

These natural resources are the basis for the primary sector of the economy. Typically, in developing countries, the primary sector is more important to the overall economy while in developed countries more importance is placed on other sectors like manufacturing and services.

Objective

By analyzing the distribution of a number of natural resources and the state wise GDP per capita, we are looking for whether or not there is a correlation between availability of natural resources and GDP per capita. In order to make this comparison, we will look at the energy output provided by the natural resources of wind, hydropower, coal, oil and natural gas by state as well as mineral distribution throughout the country. Our hypothesis is that because India is a developing country, there will be more importance found in its primary sector and thus a higher natural resource abundance will correlate to higher GDP per capita.

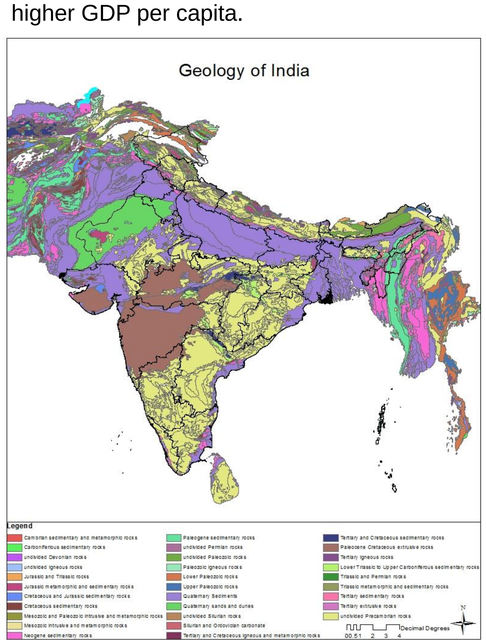


Figure 1 This map is from USGS GIS data. It shows the geological provinces of India and surrounding areas. In the west, India is largely dominated by cretaceous sedimentary rocks. In the east the dominant mineralogy is undivided Precambrian rocks. The north east is dominated by quaternary sediments while quaternary sand dunes are concentrated in a pocket in the north west of Rajasthan. There are several other types of rocks represented throughout India, but to a lesser extent. Age and type of rocks and the tectonic history are closely associated with natural resource occurrence and distribution.

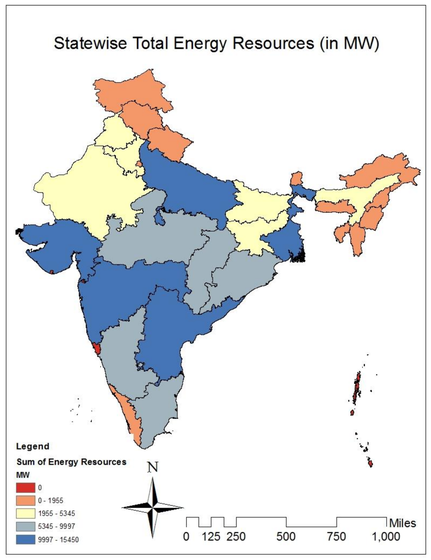


Figure 2 This map analyzes the sum of all the resource energy output in megawatts by state. This is a composite map of wind power, oil, coal, hydroelectric power, and natural gas. The areas of highest resource wealth are Uttar Pradesh, Gujarat, Maharashtra, Andhra Pradesh, West Bengal, Sikkim. Panaji is the only state which has no energy output from natural resource development.

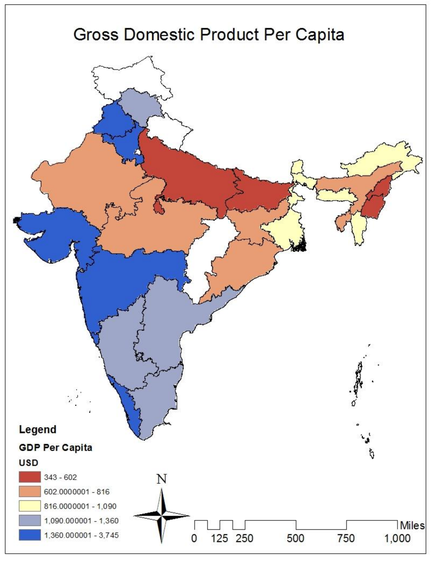


Figure 3 This map takes into account the gross domestic product per capita of each state in India. The darker blue indicates the distance above the mean GDP per capita, which is $1,023 USD, and the darkness of red indicates the derivative below the mean. Lowest GDP per capita is concentrated along the Tibetan and Nepal border in the states of Uttar Pradesh and Bihar and in the eastern states Nagaland and Manipur.

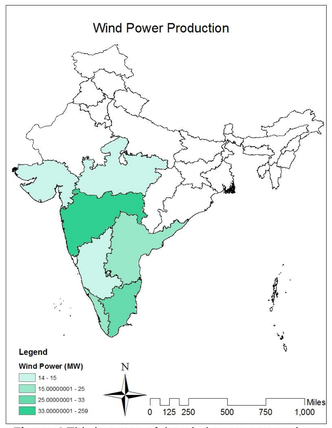


Figure 4 This is a map of the wind-energy output in India. Wind projects are largely concentrated in the south and western regions of India. The darkest teal region is Maharashtra with a wind energy output of 33-259 MW. While wind energy has great room for expansion in India, it currently does not compete with the energy output of other resources, especially fossil fuels.

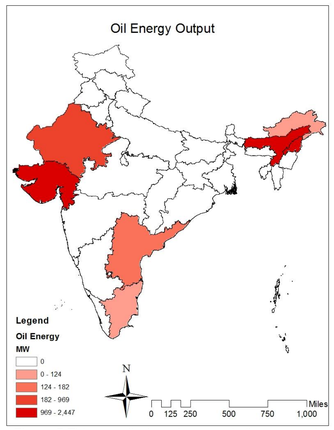


Figure 5 This map displays the natural oil resources in India based on megawatt energy production. The greatest concentration of oil is located in the farthest eastern state, Gujarat, and western states of Gujarat, and Assam and Nagaland. There are a few production sites in the south, but they do not match the energy output of the other regions.

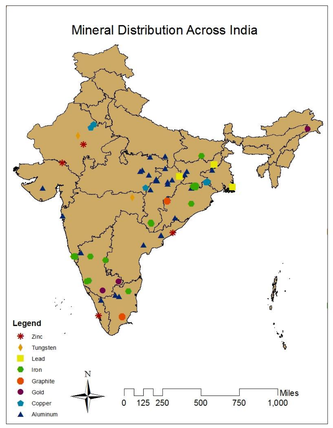


Figure 6 This map shows the distribution of select minerals throughout India. Of the minerals represented, aluminum has the highest presence in India followed by iron. The highest total mineral concentration is found in the north east corner of the country followed by the southern region.

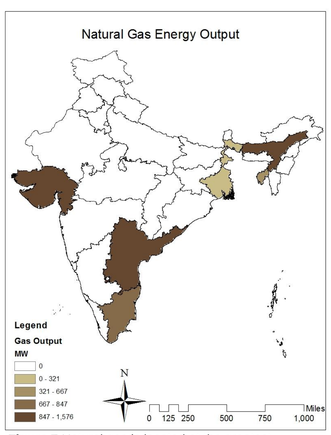


Figure 7 Natural gas is located at the greatest concentrations in the states of Gujarat, Assam, Andhra Pradesh. Besides these areas, there are very few states which have natural gas developed as an energy resource.

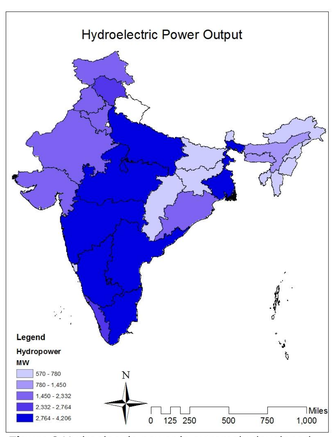


Figure 8 Hydroelectric power is extremely developed across India. The central states running from north to south have the highest level of developed energy in megawatts. All of the states have water resources, which is why this is the most developed resource.

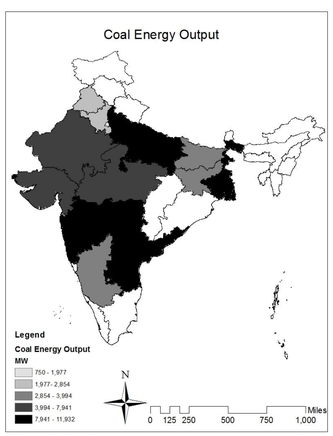
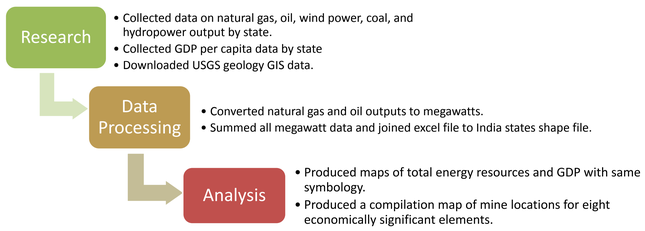


Figure 9 Coal is a highly developed resource in India, and is well represented across the country. The areas of highest energy output are Andhra Pradesh, Maharashtra, Uttar Pradesh, West Bengal. Energy output for coal in these areas is between 7941 MW and 11,932 MW. Areas without coal are located in the far north, south, and east.

Methodology



Results

Energy output dependent on natural resources is highly variable throughout India. Some of this is due to distribution of the resources, and some is dependent on utilization and infrastructure. According to the data collected, coal is the most abundant resource in India in terms of energy output and utilization across the country. Hydroelectric power follows, being the most developed nationwide and the second largest energy producer. Oil and natural gas are concentrated in only a few areas of the country, and wind power is still in its infancy but has potential to grow. High mineral content is located along undivided Precambrian rocks and quaternary sediments, mostly along the eastern half of the Indian continent. Gross domestic product per capita is highest in the southwest and lowest in the northeast and in the agricultural belt in the north. The sum of all the resources based on the energy output (in megawatts) is represented in the Fig. 2, and is used as a "total value" for that region. This is used to draw a comparison between GDP per capita and primary resource wealth.

Discussion

The purpose of this analysis was to discover if there was a link between primary resource and energy production and the general economic wealth (and therefore welfare) of the state. This is working under the assumption that GDP per capita is indicative of welfare. Primary resources (like energy and mineral resources) are usually the most important sector of the economy in developing nations. Our attempts to prove this in India produced inconclusive, and sometimes contradictory, results. In the north, the data indicates that the economic poverty is at odds with the high proportion of coal and hydroelectric resources. In the south, there is a higher GDP per capita as well as coal and wind resources. The only area which is equally represented by its economic map and resource sum map is in the far east by Bangladesh and Myanmar. This data did not take into account agricultural production (which is highest in the "red belt" of the GDP per capita Fig. 3) and could be significantly correlated with GDP per capita. The data indicates that primary resources in India do not determine a state's wealth per capita, and therefore the welfare of the people. Future research should be done to examine the possibility of a correlation between agriculture and the GDP per capita of a state. There should also be research into reasons behind why some states such as Uttar Pradesh have high resource abundance but still low GDP. Perhaps there is a lack of infrastructure or resource investment that could explain this. Finally, if the majority of a state's GDP per capita is not correlated to natural resources and therefore the primary sector of the economy, there should be research into how the secondary and tertiary sectors are contributing to GDP per capita in India.

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