

Population Distribution and Poverty

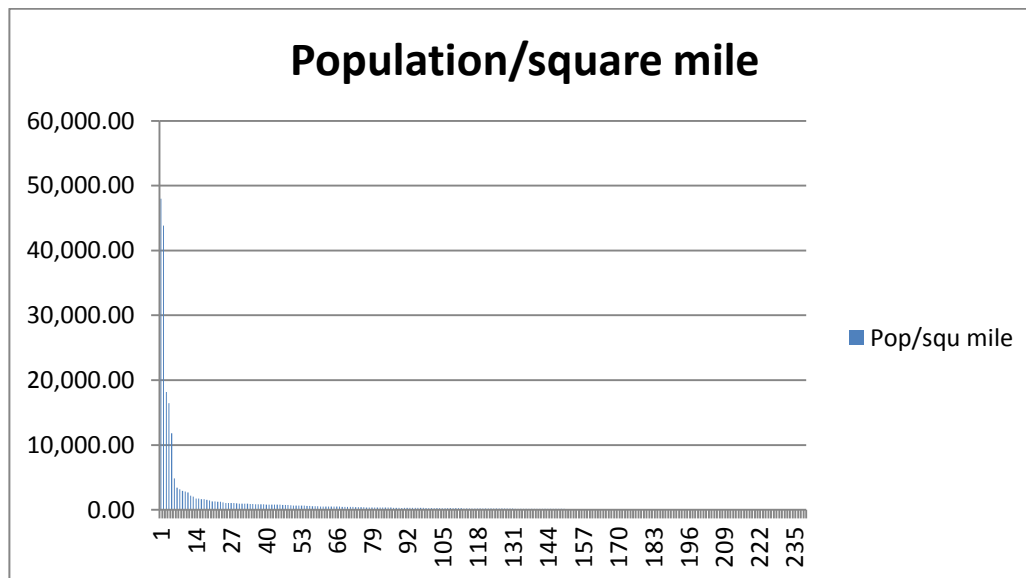
To better understand the relationship between poverty, inequality and the environment, let's take a look at the geography of population density.

A. What is Population Density?

Density is a ratio of people to land area.¹ However, choose a different land area and you'll get a different ratio. For example, the New York SMSA which includes neighboring areas in New Jersey, has only some 5000 per square mile, but in 2009 Manhattan itself had 71,506 per square mile. Nevertheless, we find dramatic patterns.

Population density varies by orders of magnitude around the world. According to a [Wiki list](#) of 239 sovereign states and territories around the world, world population density (land area excluding Antarctica) is 51 people per square kilometer, or 132 people per square mile. The densest territory on the list, Macau in China, has 48,000 people per square mile. The city state of Singapore has 18,000 per square mile. The country of Taiwan has 1656 per square mile. The Netherlands have 1036. Japan has 873. Brazil has 59. Even further down, Australia has eight. The United States, with 82 per square mile, is quite low density compared to European let alone Asian nations, but high density compared to most of Africa or Latin America.

Here's a chart of the 239 sovereign states and territories. Note the steeply concave shape.

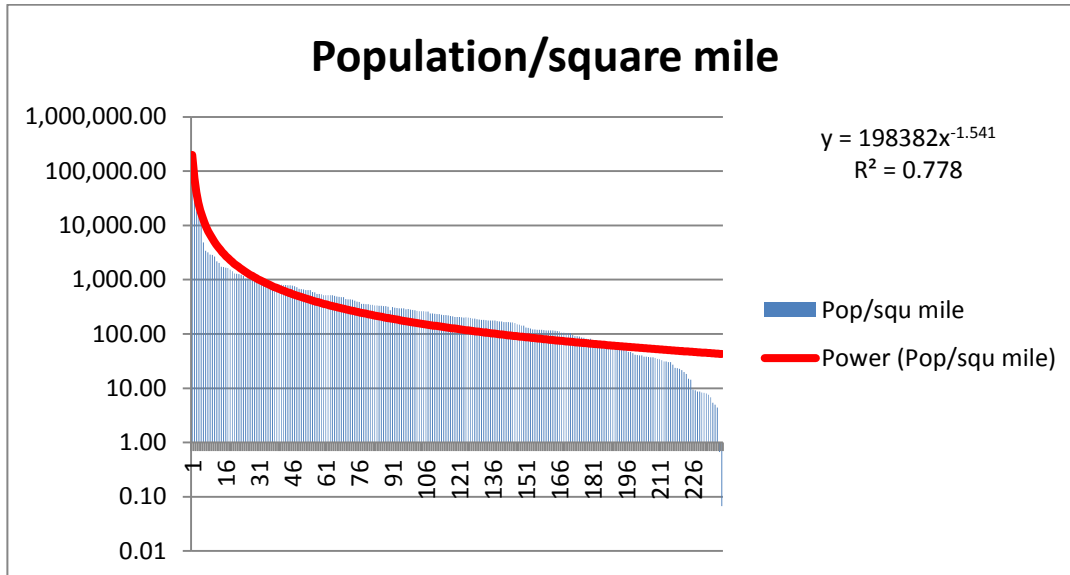


Here's the same chart below with a log scale. Most of the chart shows a fairly flat slope. That suggests that population density follows a power law, or fractal distribution. A power law distribution can be written $y = Ax^\alpha$ where A is a constant, and α is a power. In this case, courtesy of Excel, we find that the actual function is $y = 198382x^{-1.541}$ with $R^2 = 0.778$. That's a pretty good fit considering how arbitrary geographic boundaries are. (The low end countries, like Mongolia or Greenland, are mostly uninhabitable desert or ice.)

(Power law distributions are very common. For example, the law of gravity follows a power law: the force is proportional to the inverse square of the distance between two objects. The

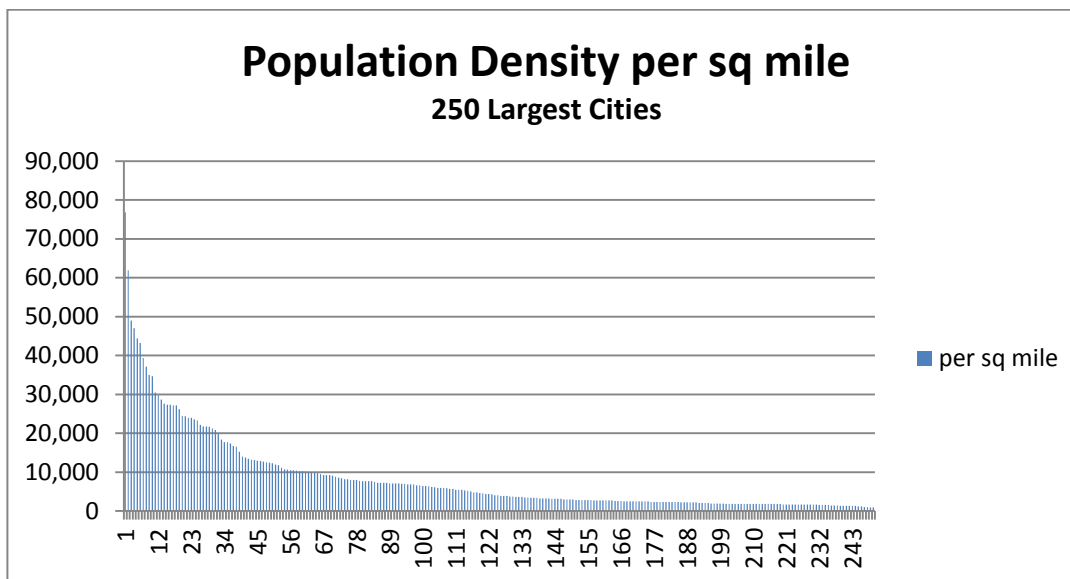
¹ To avoid confusion at the outset, note that density—people per square mile—is not the same as crowding—people per square foot of living space.

distributions of wealth and income follow power laws. Power law distributions simply mean that the same forces operate at different scales.)

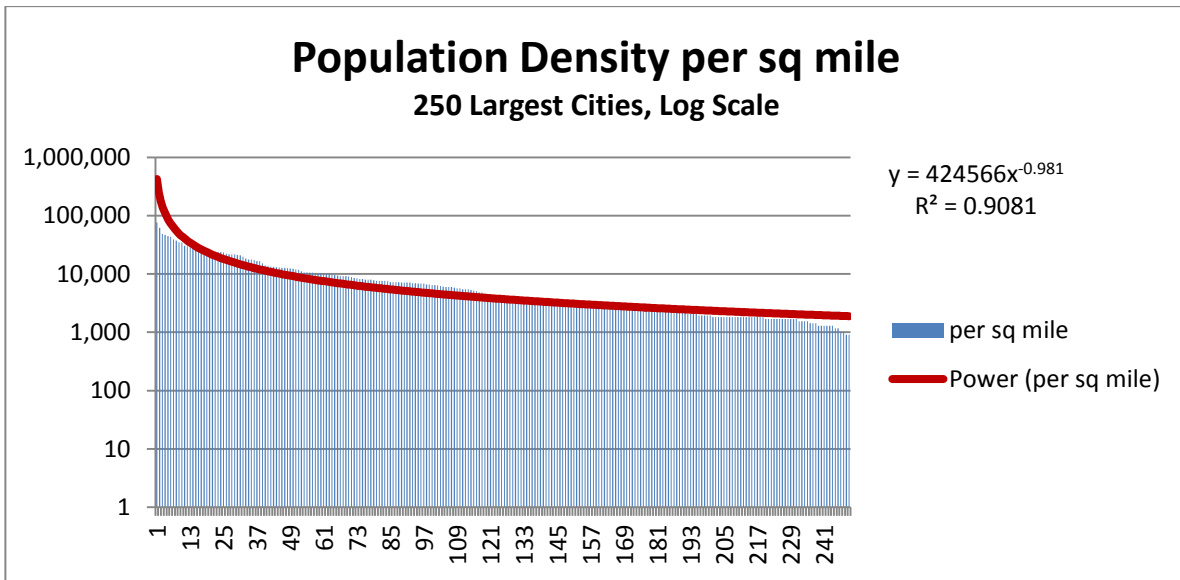


Population varies dramatically within nations. Citymayors.com provides statistics on the [largest cities in the world ranked by population density](#). Heading the list is Mumbai, with 29,650 per square kilometer or 76,790 per square mile. Seoul has 43,000 per square mile. Paris has 9194. The New York standard metropolitan statistical area has 5309. Avignon France has 1295.

Here's a chart of the 250 largest cities. Again, note the concave shape.

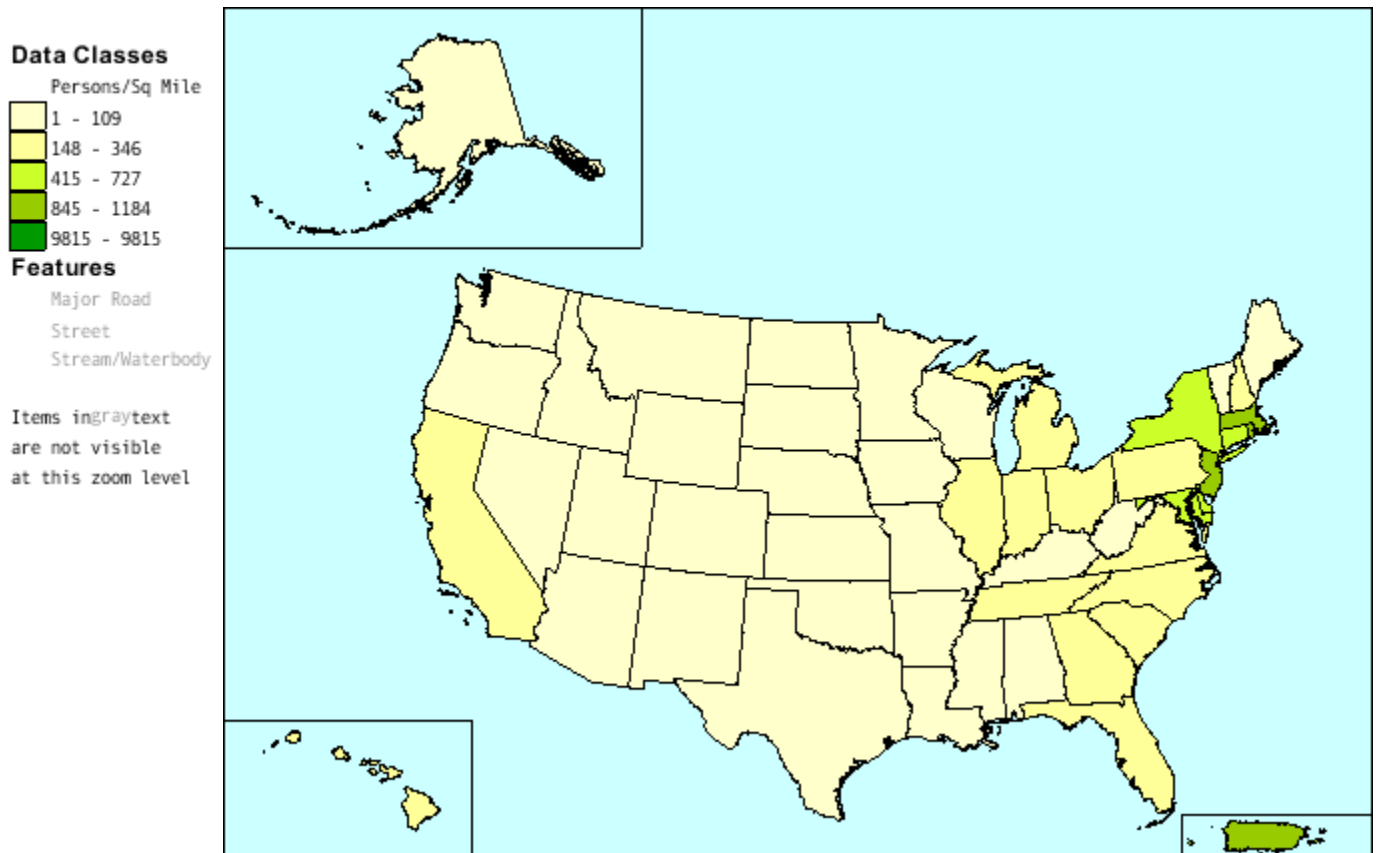


Here's the same data plotted on a log scale. The slope is flatter and smoother than for nations. The actual function is $y = 424566x^{-0.981}$ with $R^2 = 0.9081$.



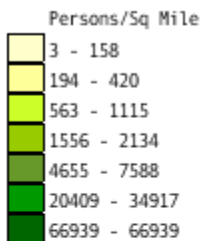
The US Census on line provides some great maps of population density in the US. At every scale, from the level of states to the level of blocks, we find orders of magnitude differences, indicating power law relationships.

Here is density for the entire US, by state, in 2009. Notice how population follows the coasts.

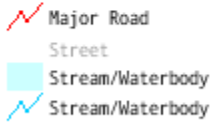


Here is density for New York State, by county in 2000. Most of the population is in or near New York City. Density of Manhattan is 66939 in 2000 (more in 2009).

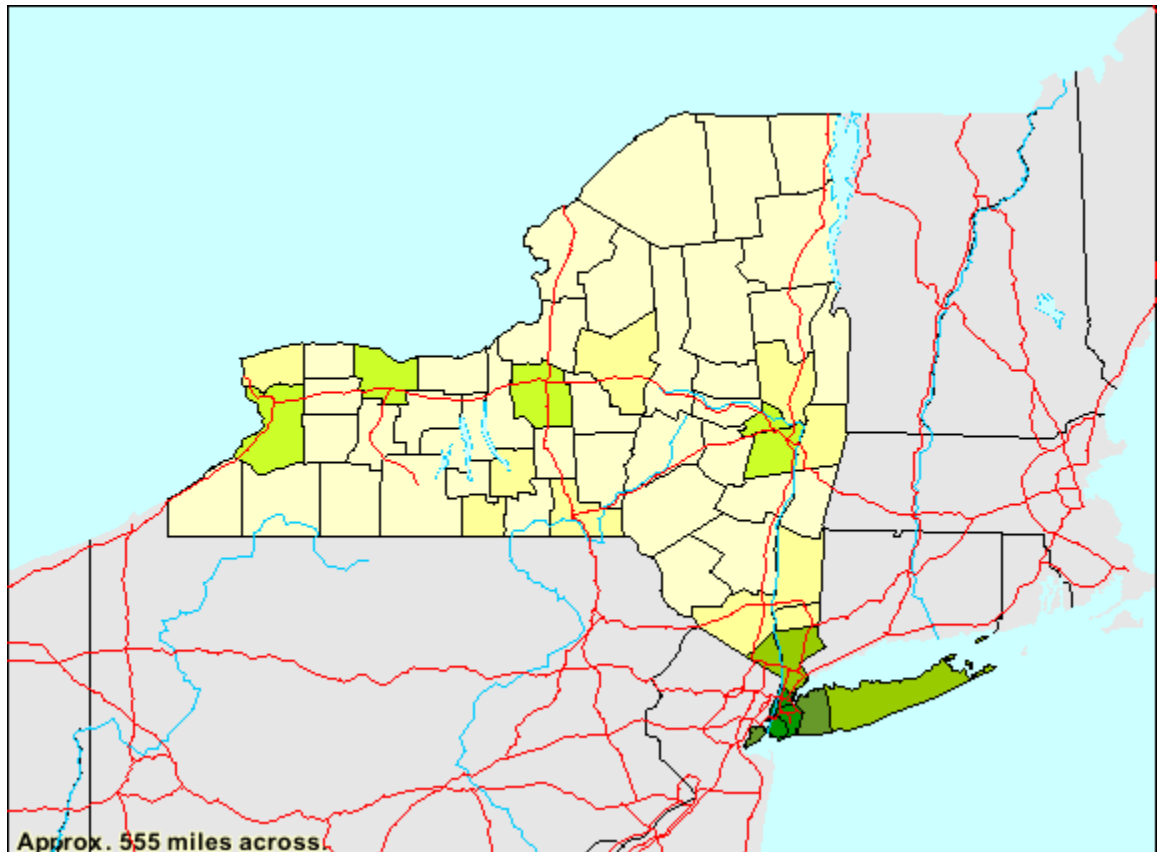
Data Classes



Features



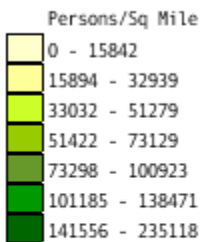
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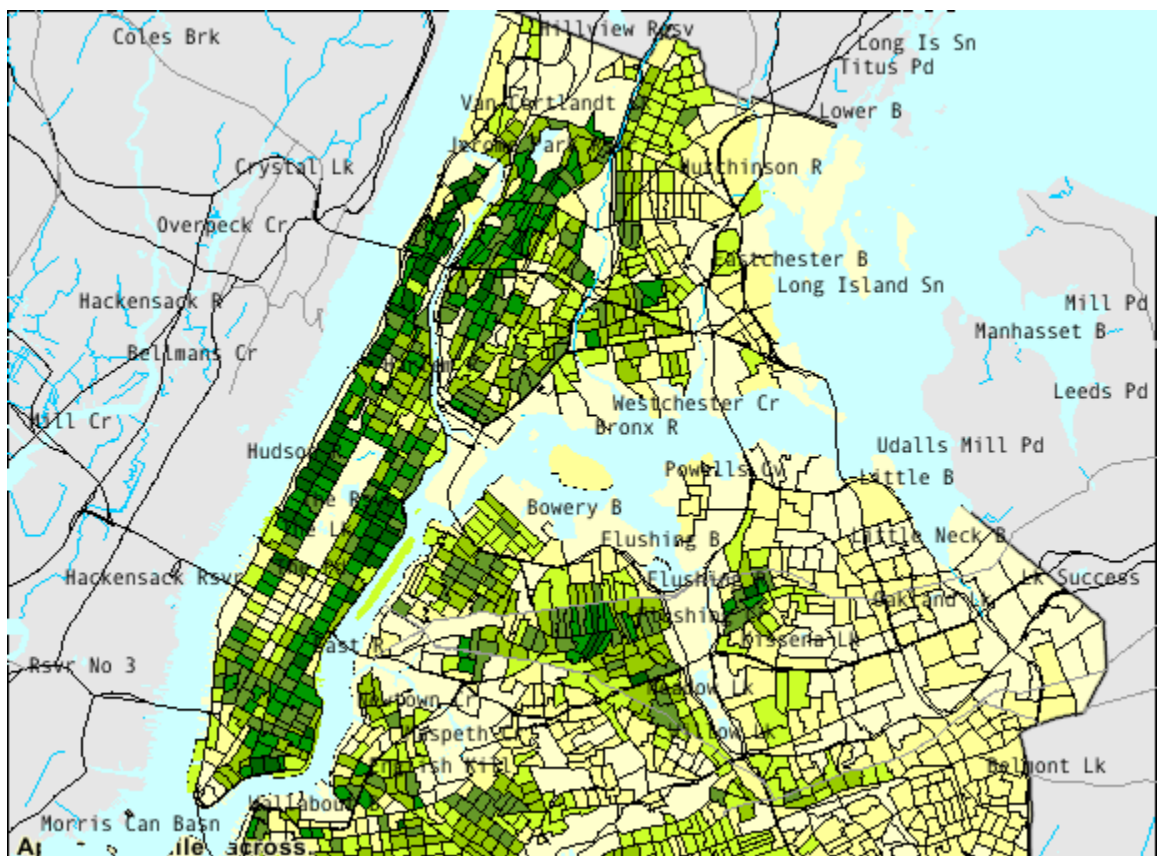
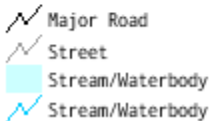
Here is New York City by Census Tract

2000: Manhattan and the Bronx

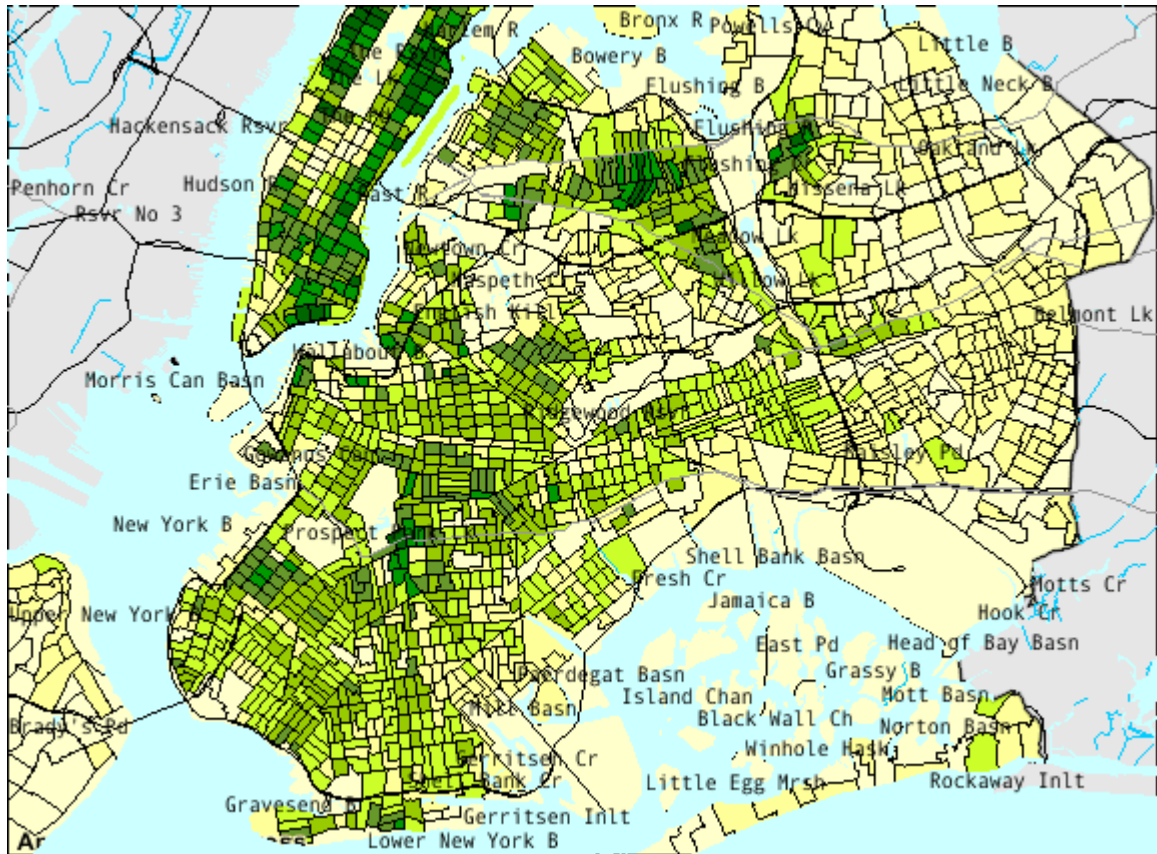
Data Classes



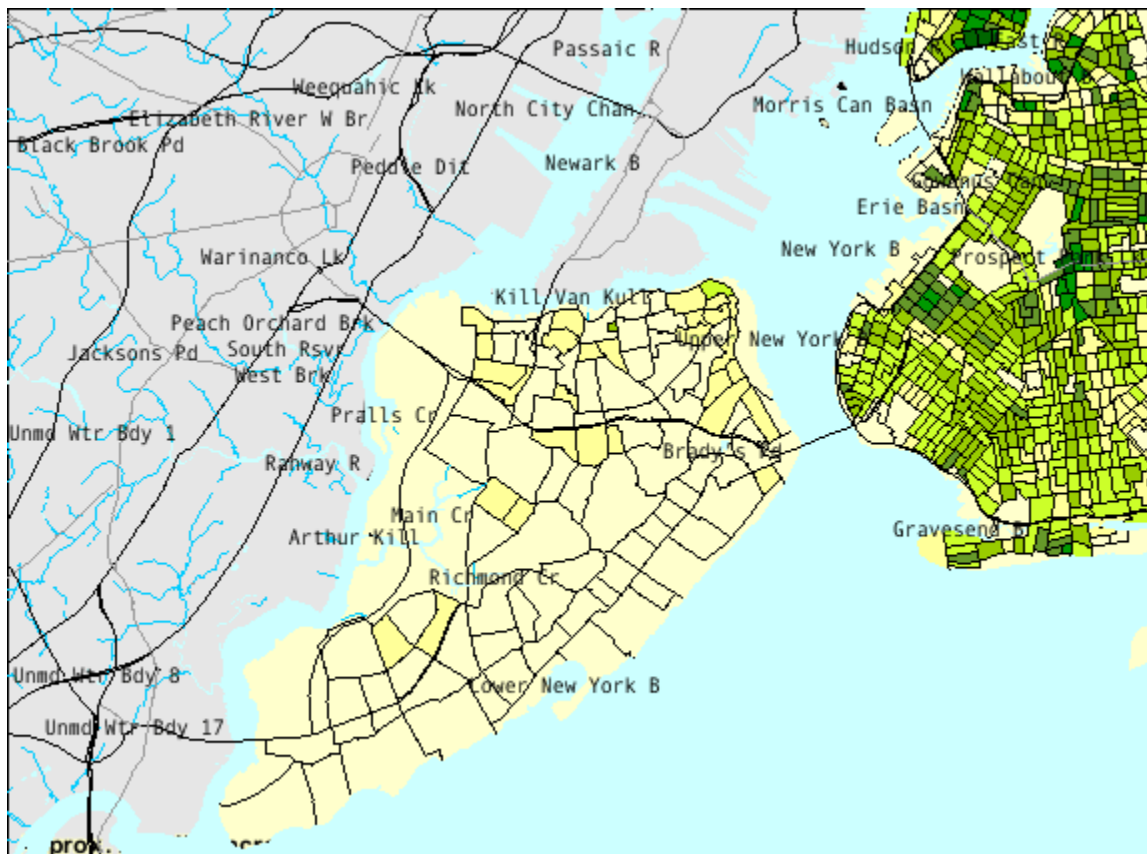
Features



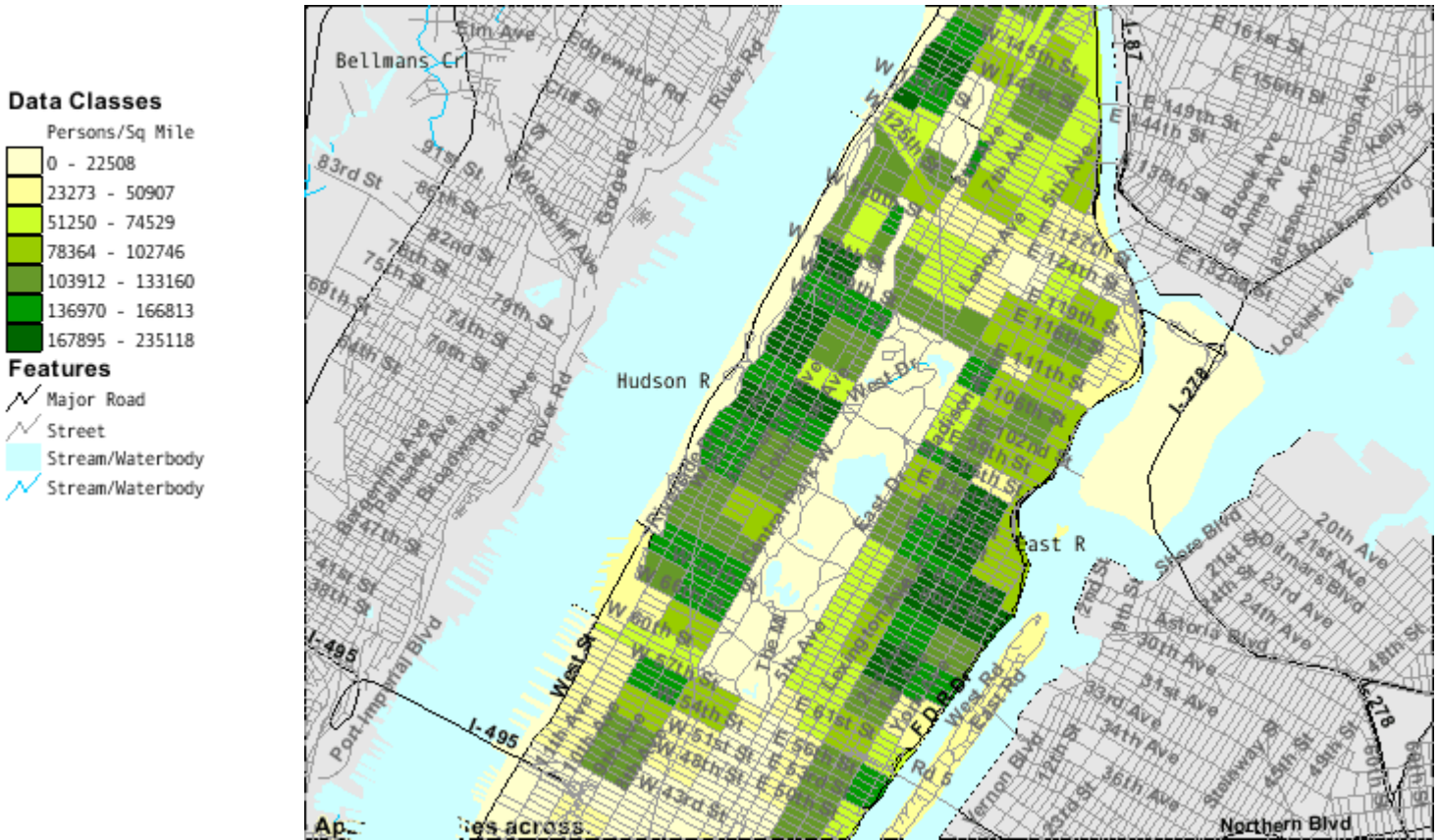
Brooklyn
and
Queens



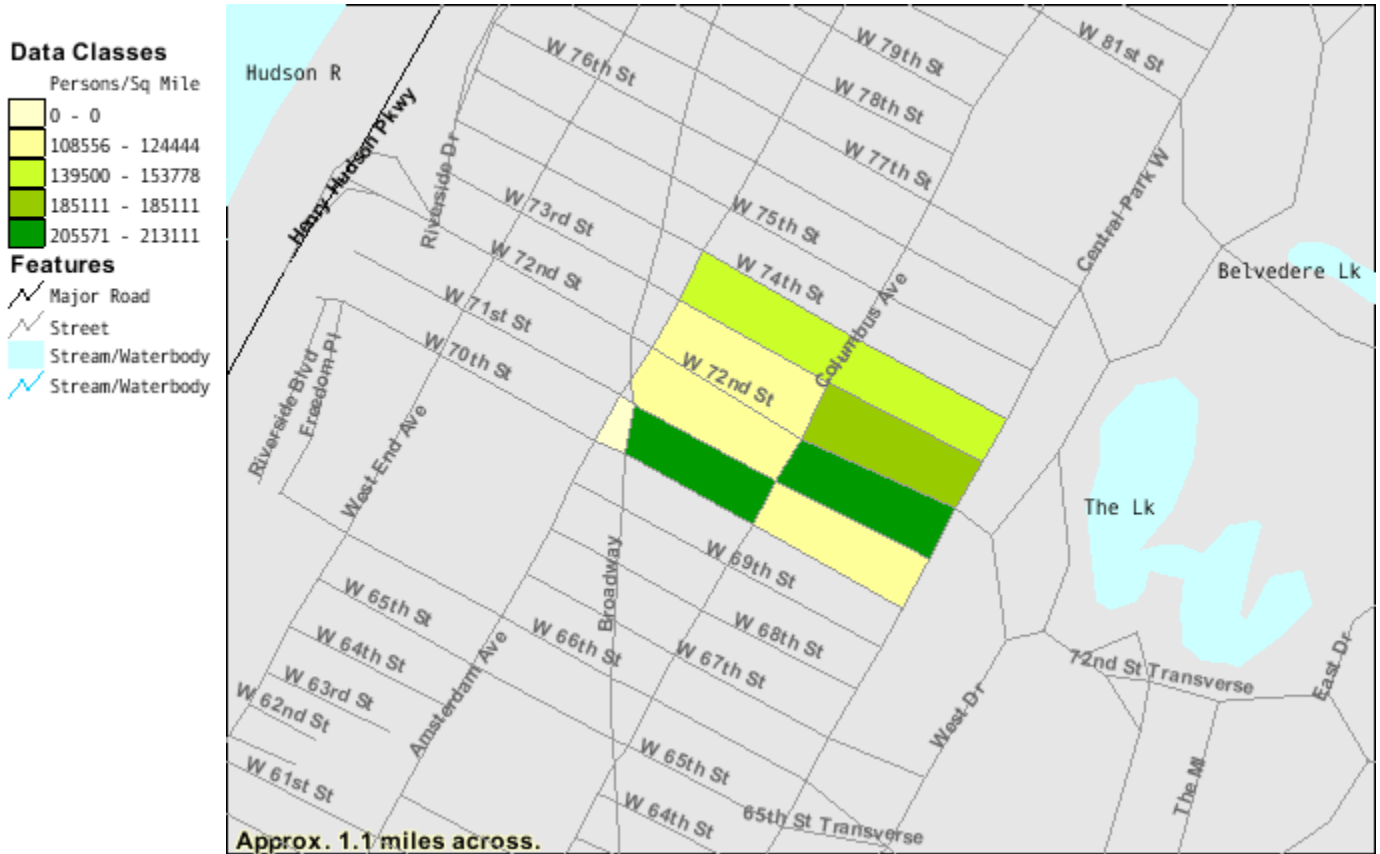
Staten Island



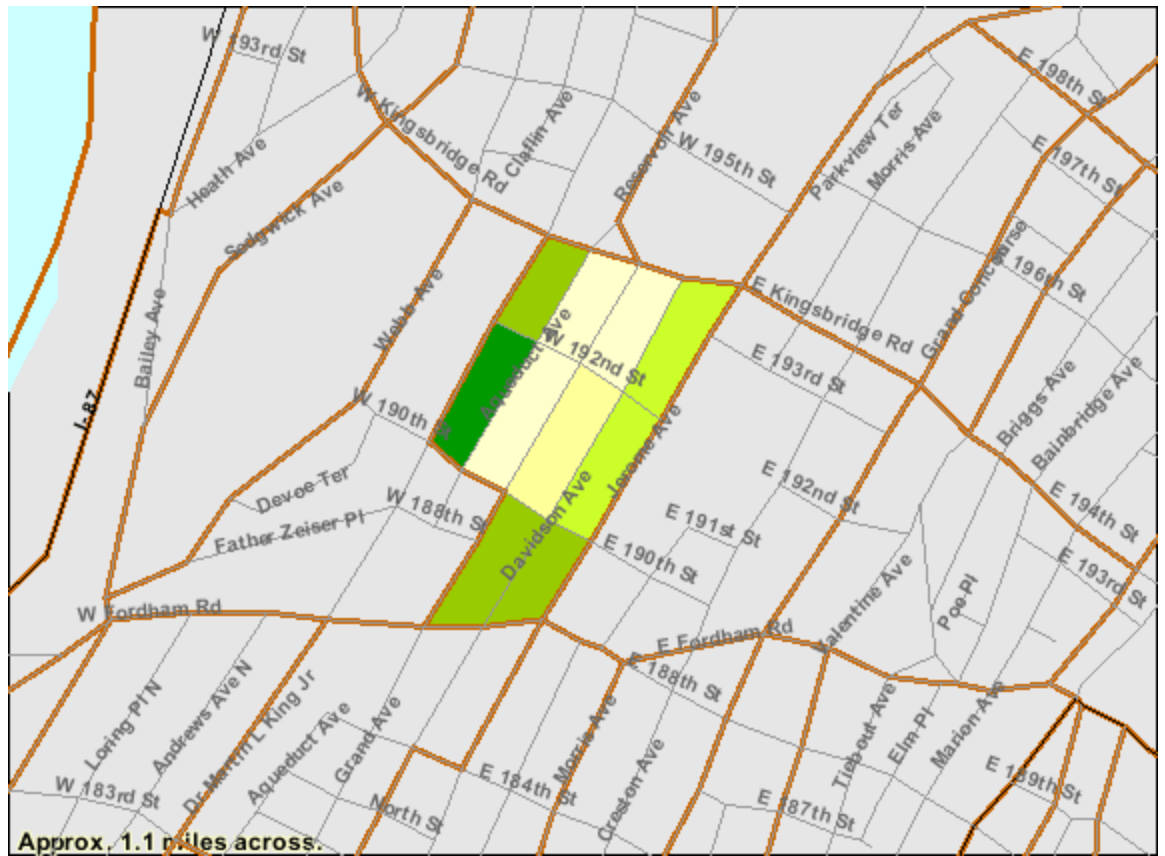
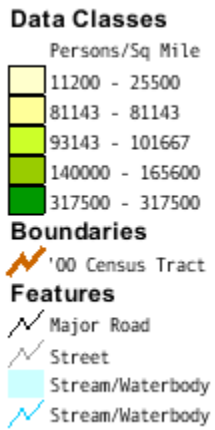
And here is density by block in Manhattan in 2000. You can see that some rich areas on either side of Central Park show very high density.



Here is my block on West 72nd Street, the long dark green block between Columbus and Central Park West. It's a block of high-rise apartment buildings on West 72nd, and a mixture of high rise and 5-story townhouses on the other side on 71st. My building is 15 stories, with 140 apartments.



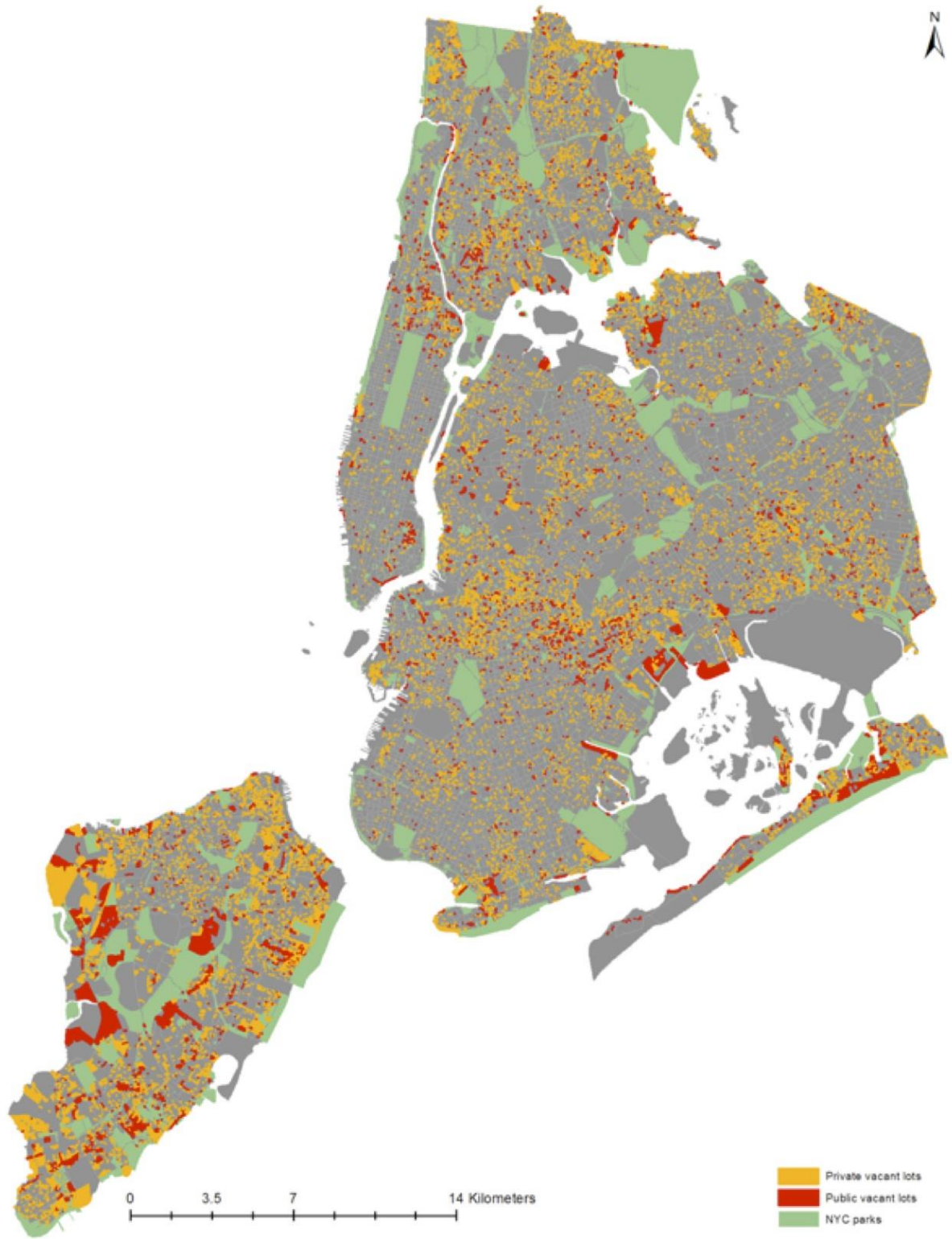
Here is the densest block I found, in the west Bronx, with 317,500 people per square mile.



Here's a Google Earth picture of it.



A Paradox: Vacant Lots in New York City



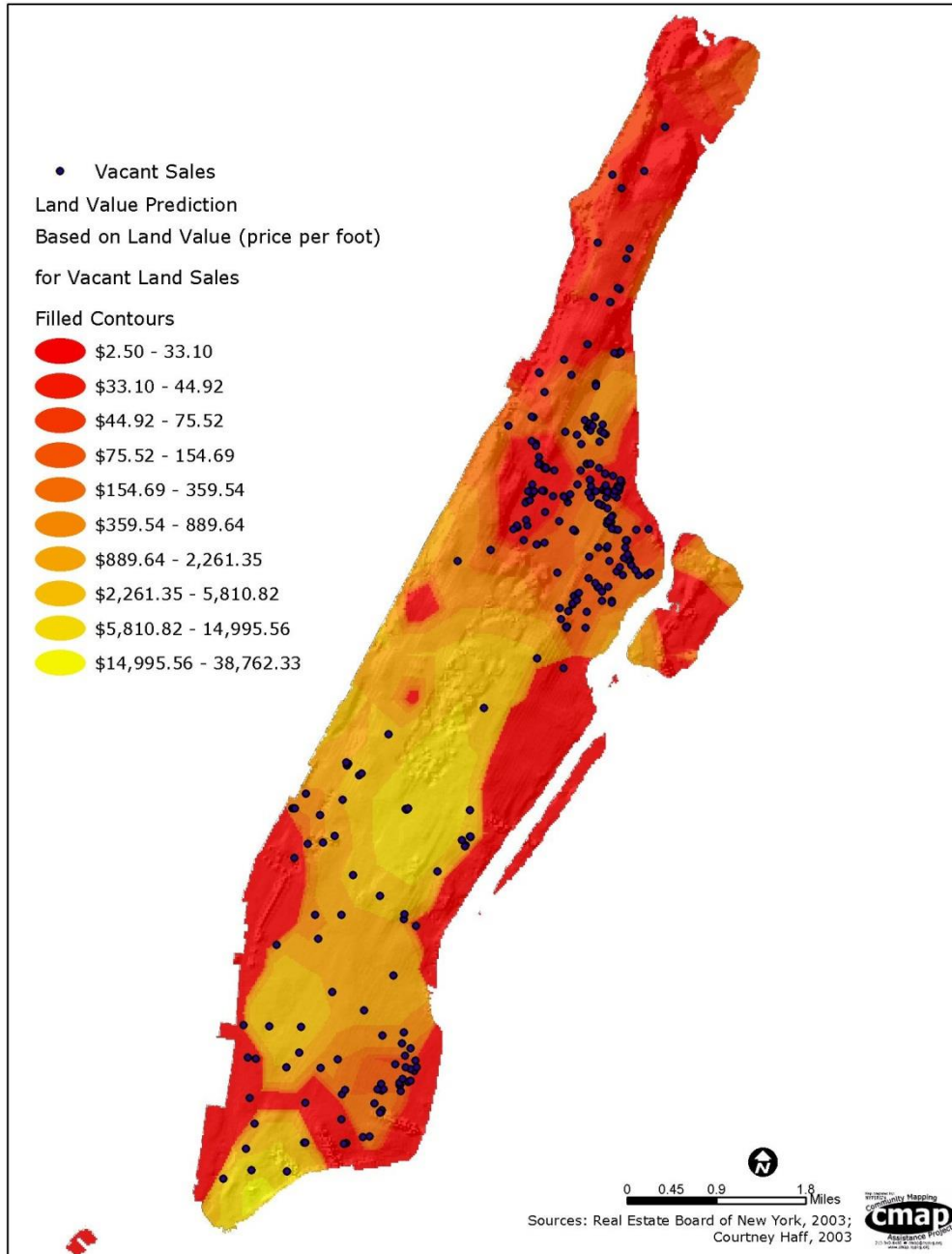
B. What Determines Population Density?

The history and resources of a geographical area determine population density. The Americas are more lightly populated and Europe or Asia because -- after native populations were largely wiped out -- the Americas were settled more recently by immigrants. People predictably cluster around high-value natural resources. The most important of these are transportation centers notably good harbors. New York City was settled around the harbor. Denver was settled around the rail center.

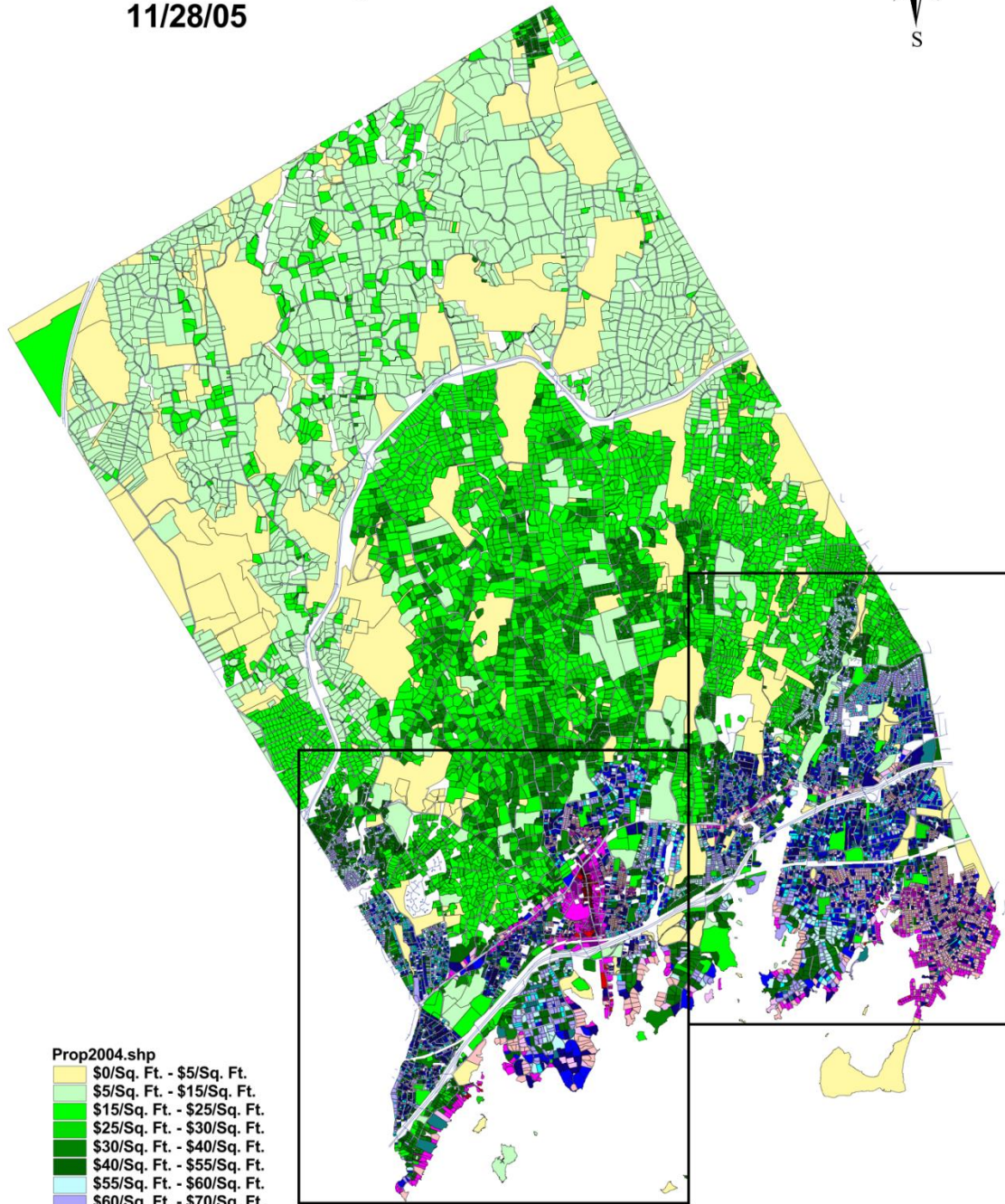
Even more predictably, people cluster near other people. As Adam Smith observed in the first chapter of *The Wealth of Nations*, high productivity arises from cooperation and specialization – limited by “the extent of the market.” Hence, high density makes for high productivity. It creates high economic value as reflected in real estate values. It is not a coincidence that the highest land values and the highest density population in the US are in the same place: New York City.

Here’s a 2003 land value map of Manhattan, showing order of magnitude differences over short distance, ranging from \$2.50 a square foot to \$38,762 a square foot. The highest values are in the midtown office area just south of Central Park, and just around Wall Street at the southern tip.

On the following page is a land value map of Greenwich, CT. Most of the value is in the downtown area, or a very pricy residential area on the coast.

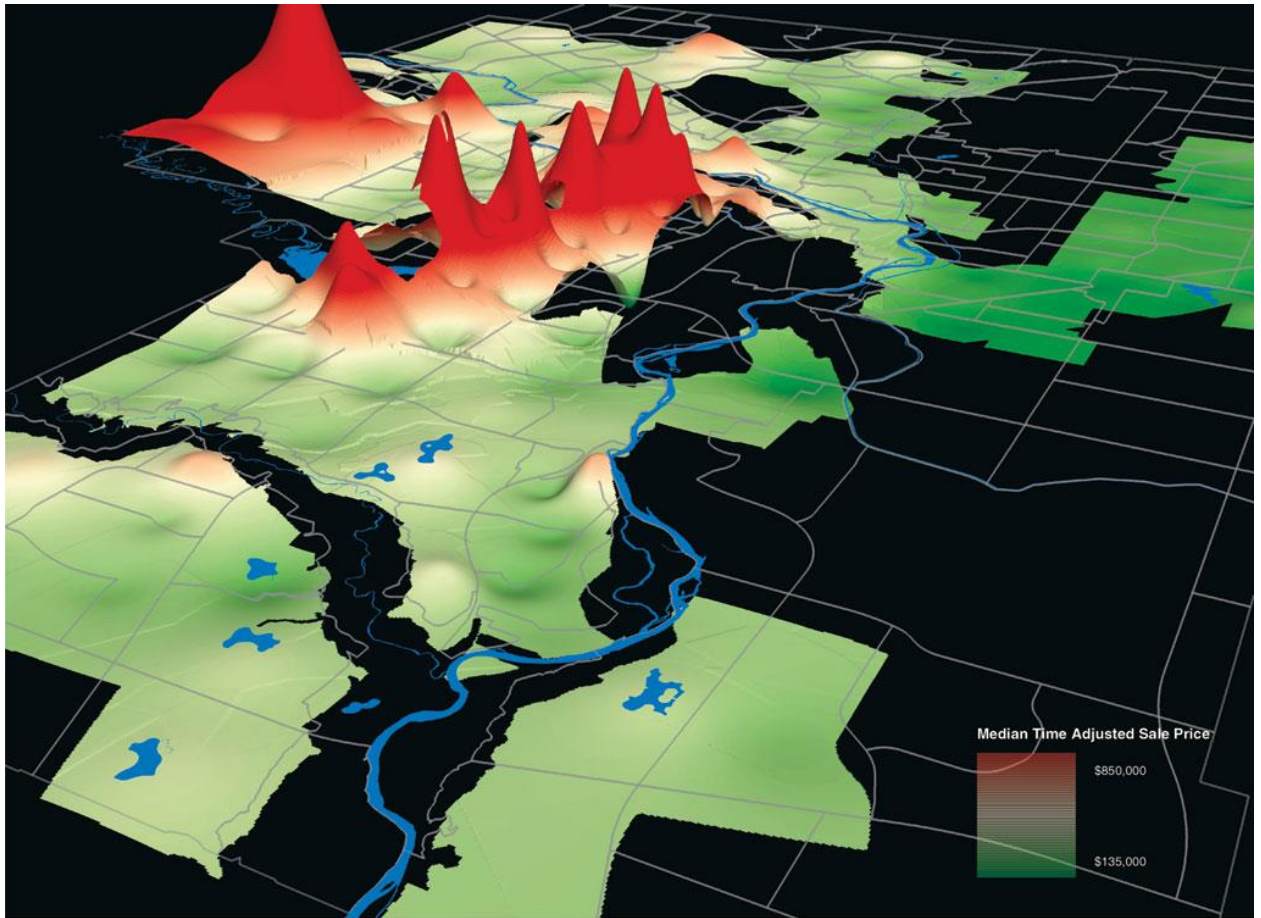


Greenwich, CT 2005 Revaluation Land \$/Sq Ft and Zoning 11/28/05



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- \$0/Sq. Ft. - \$5/Sq. Ft.
 - \$5/Sq. Ft. - \$15/Sq. Ft.
 - \$15/Sq. Ft. - \$25/Sq. Ft.
 - \$25/Sq. Ft. - \$30/Sq. Ft.
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 - \$140/Sq. Ft. - \$280/Sq. Ft.
 - \$280/Sq. Ft. - \$525/Sq. Ft.
 - \$525/Sq. Ft. - \$805/Sq. Ft.
 - \$805/Sq. Ft. - \$1305/Sq. Ft.
- Cline_0503.shp





Here is a map of the Canadian city of Calgary, showing land values in three dimensions, from http://www.esri.com/mapmuseum/mapbook_gallery/volume20/images/large/state69_b.jpg

C. How does Density Relate to Poverty and Inequality?

As seen above, high density is associated with high wealth and high land values. However in any geographical location, large or small, there will be some inequality or outright poverty. There will also be relatively low land values where those poor people live.

The interesting question is whether, on average, inequality is greater in denser, richer areas or in less dense, poorer areas?

Henry George argued that in a great city like New York, poverty and inequality were greater than in frontier towns with which he was familiar in California.

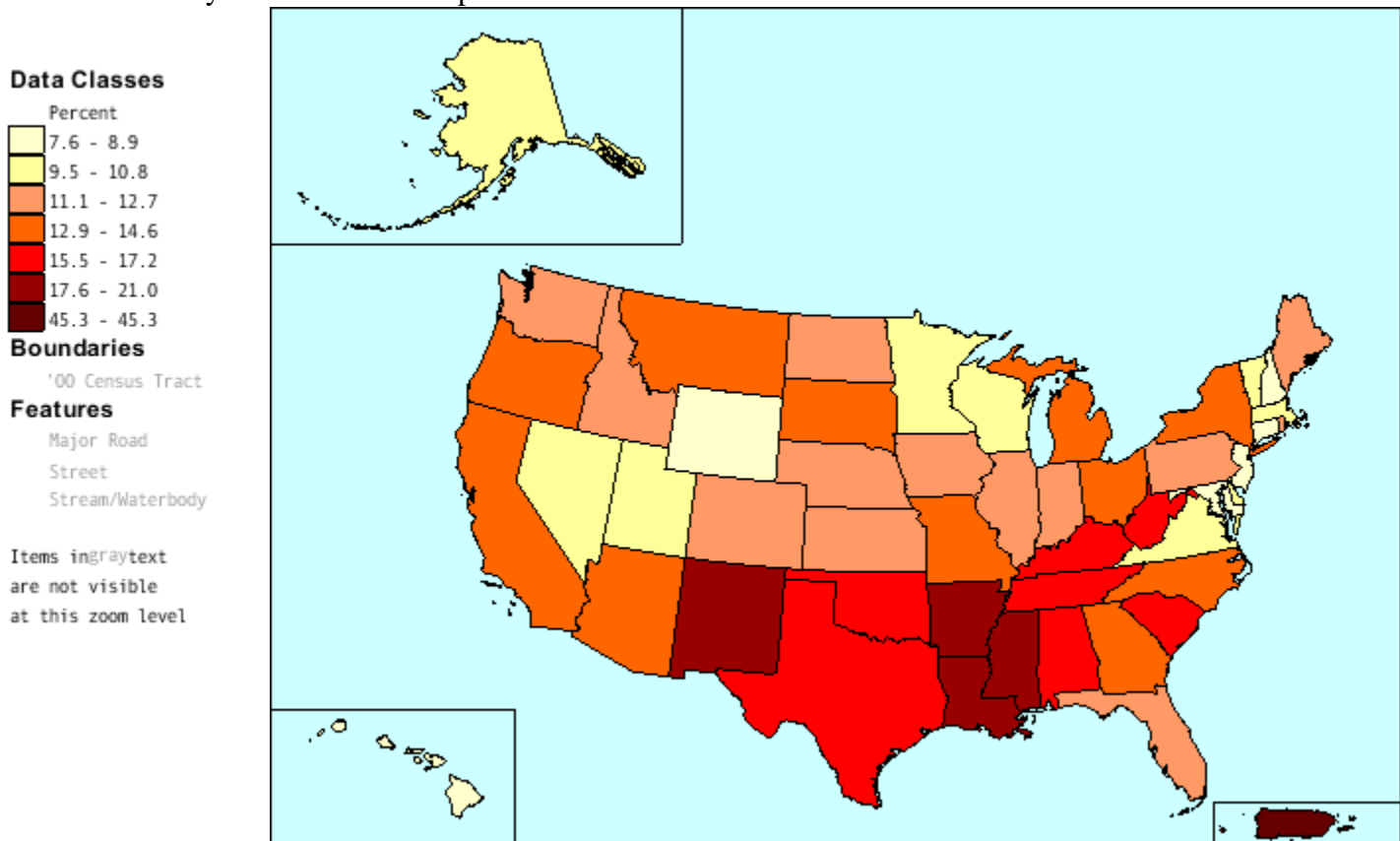
But how does inequality in New York City, or New York State, compare with inequality in other states?

New York is a bad example, because it's really two states: the New York City SMSA, and a relatively poor, declining rural hinterland.

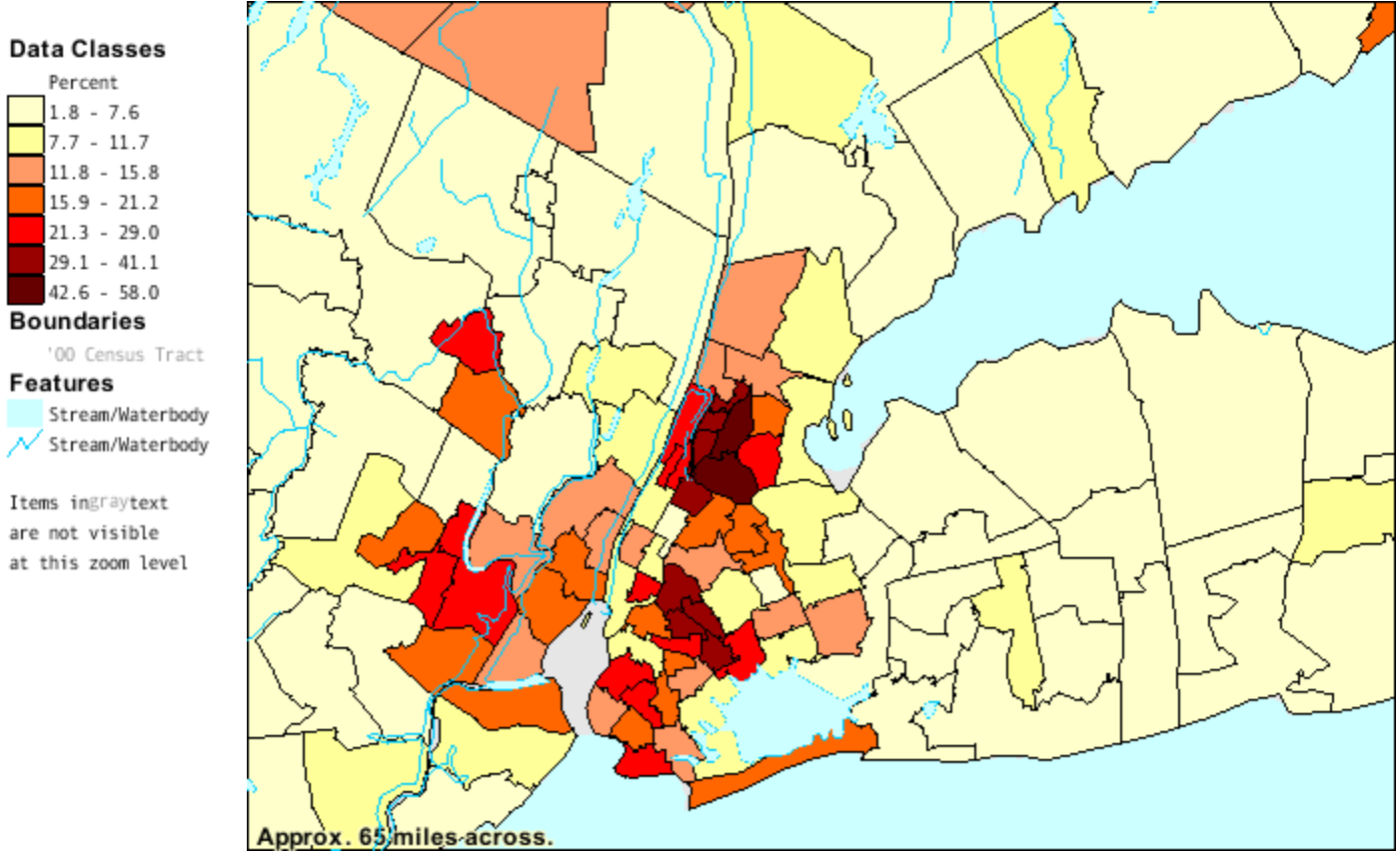
On average, lower density areas are both poorer and more unequal. For real poverty, go to rural Mississippi.

Here are some maps.

Here's the percent below poverty level by State, for 2006 to 2008. (The official poverty level is about \$22,000 a year for a family of four.) The national figure is 13.2 per cent. Notice that poorer areas tend to be in the south. These are also lower density areas. Both poverty and lower density are relics of slave plantations.

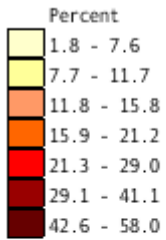


Here is the 2000 New York City SMSA map for percent below poverty, by Public Use Microdata, the smallest areas available for this data. The east Bronx is clearly the poorest area.



Here is a closeup:

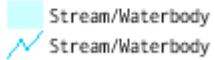
Data Classes



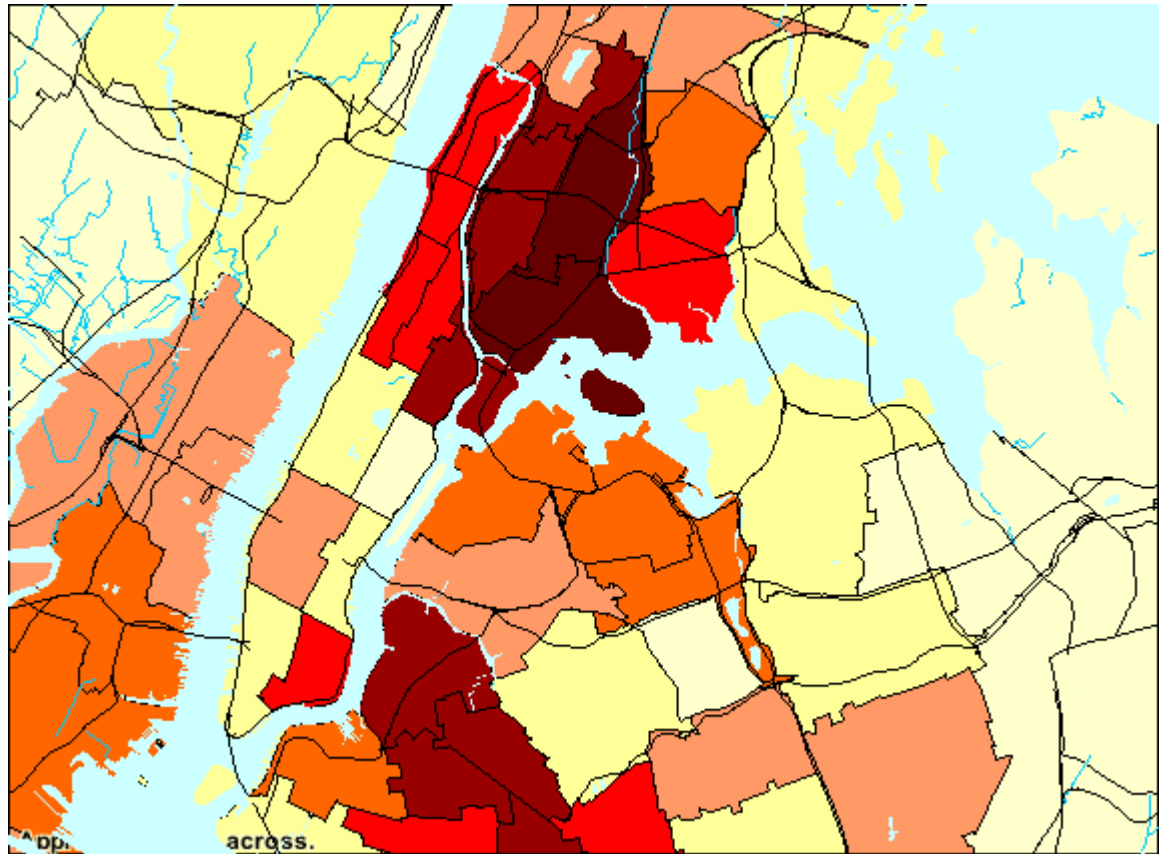
Boundaries

'00 Census Tract

Features

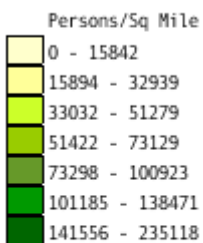


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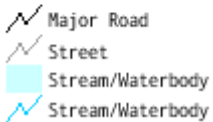


And here again for comparison on is the density map of

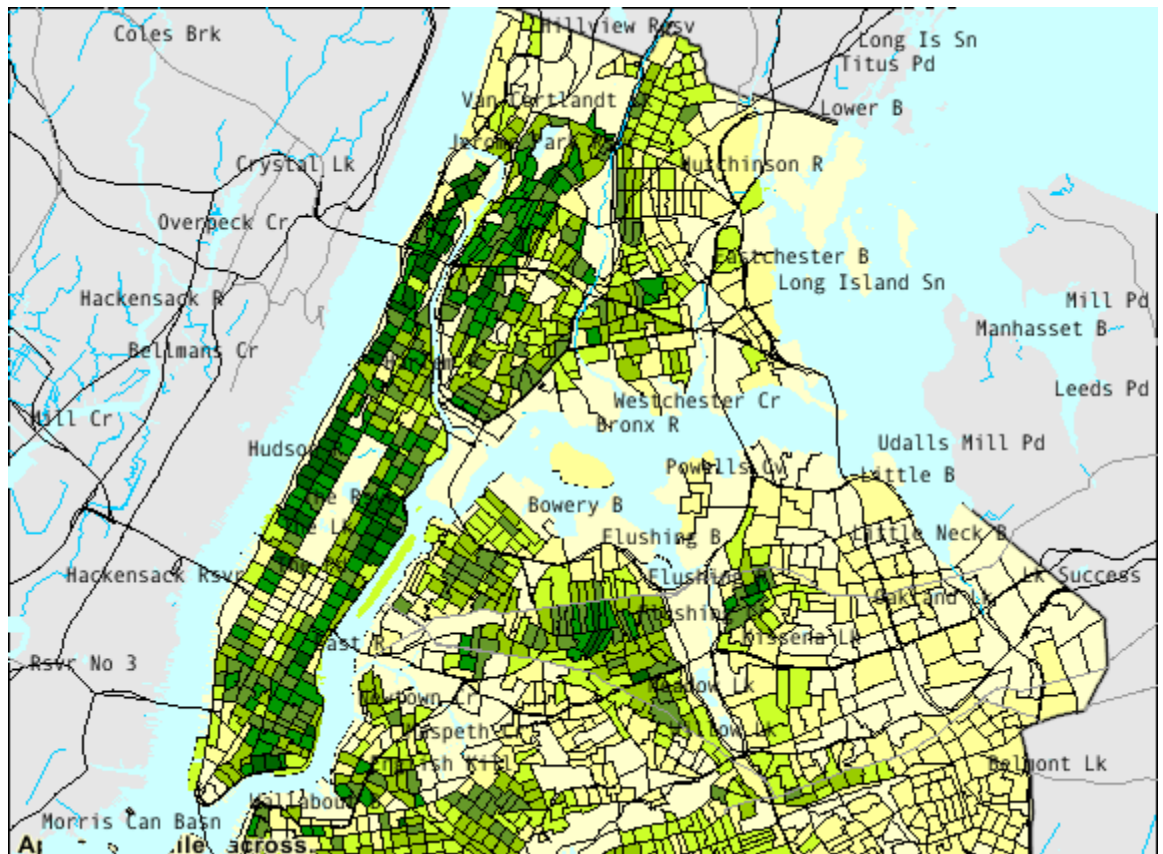
Data Classes



Features



Manhattan and the Bronx.

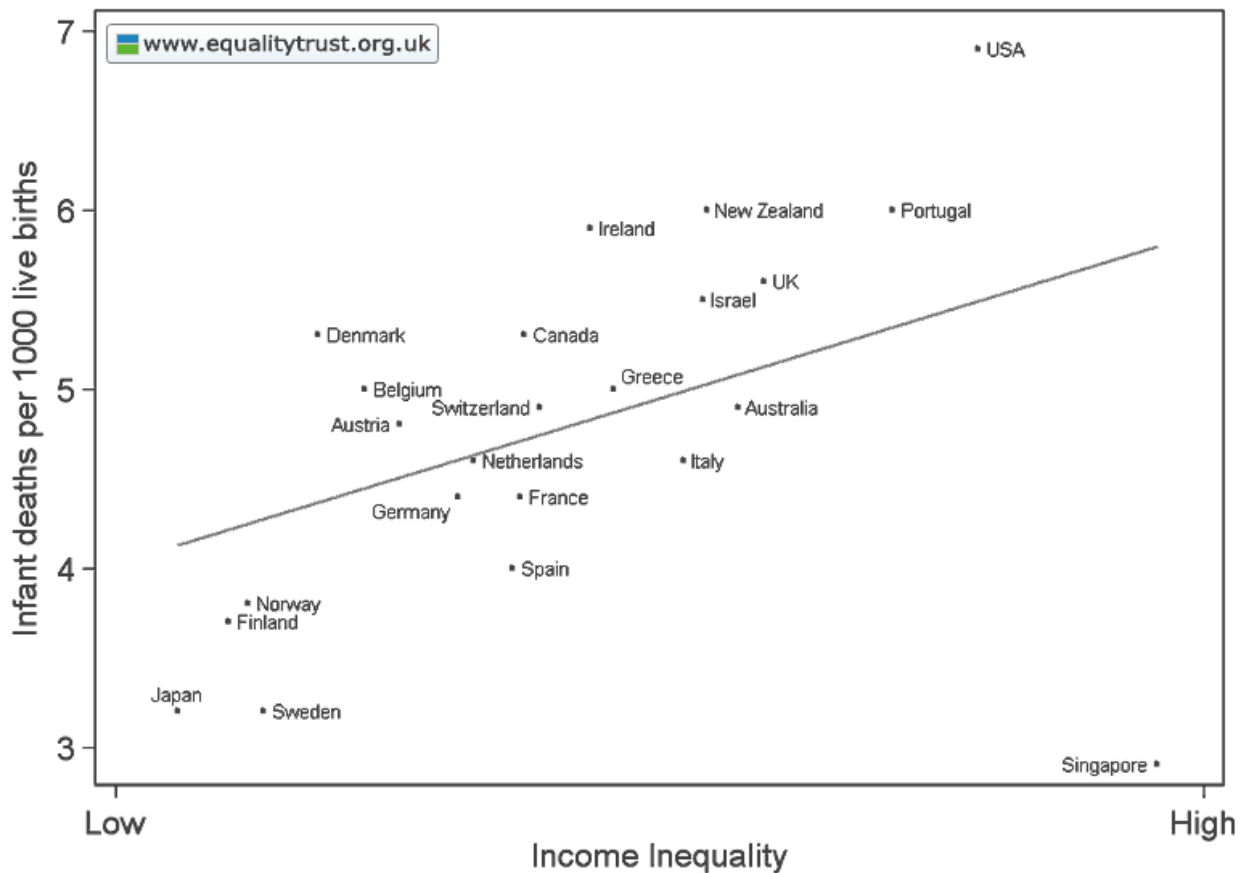


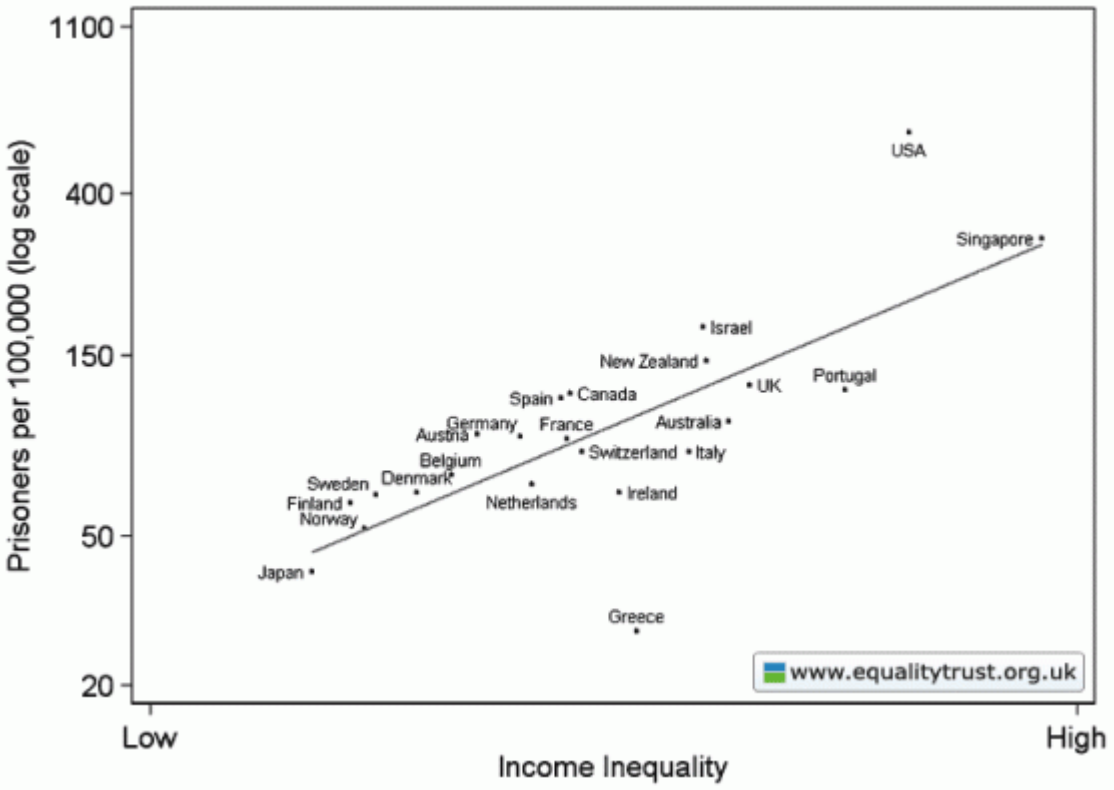
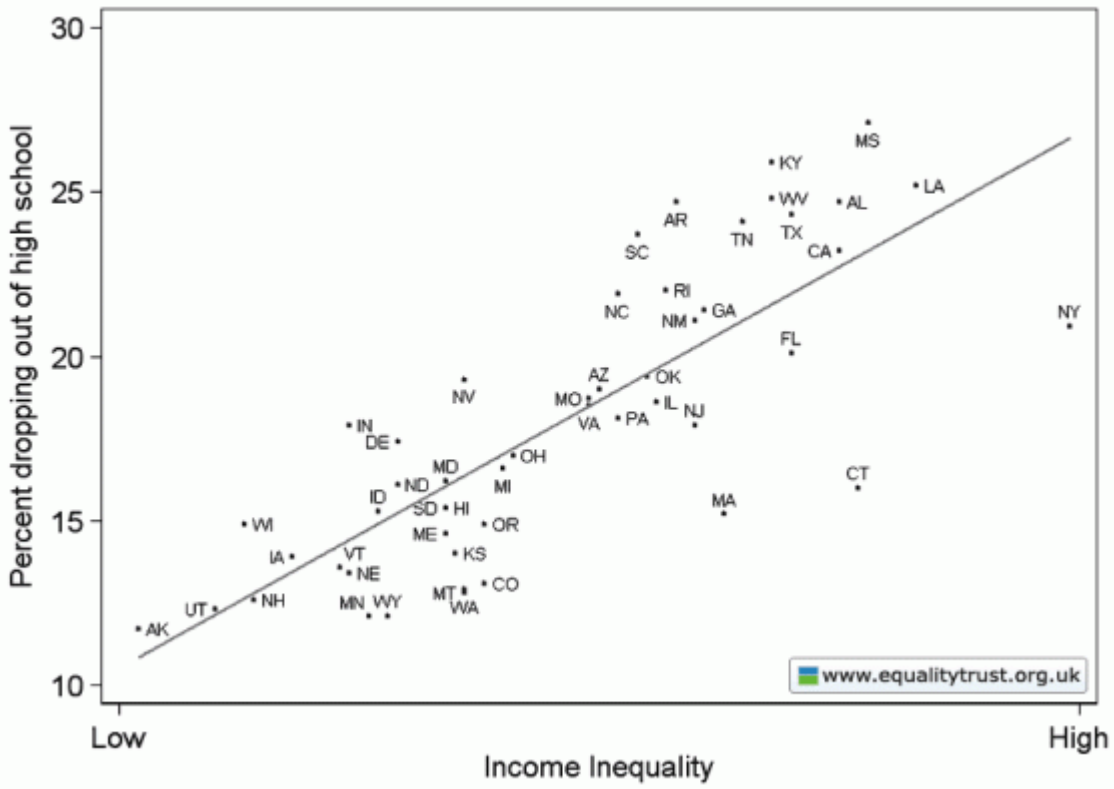
D. The Link between Inequality and Dysfunction—from the Spirit Level: Why Equality is Better for Everyone.

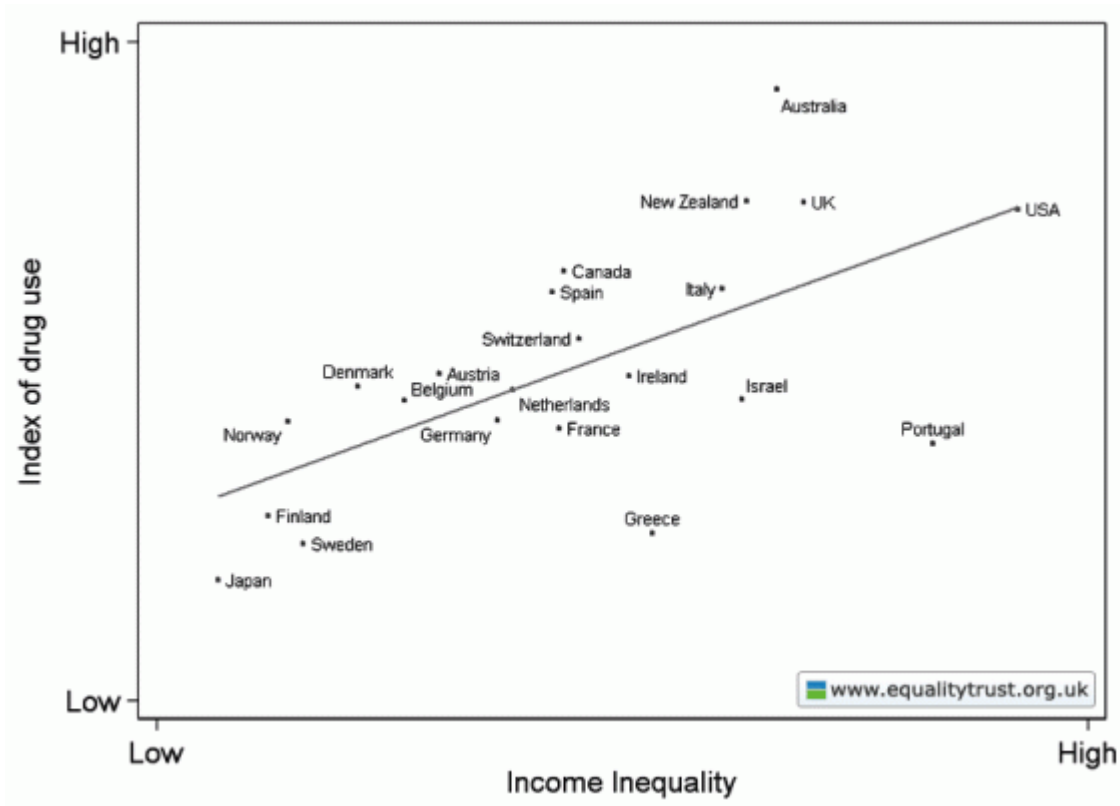
See my review of Wilkinson and Pickett's book.

<http://mccleveland.org/blog/index.php/2010/03/the-spirit-level-why-greater-equality-makes-societies-stronger/> Also see Why Greater Equality Makes Societies Stronger

<http://www.youtube.com/watch?v=4XEVkVCqinc>. In brief, inequality causes a whole array of health and other problems, not only for the poor, but for the whole society. Here are some samples of their statistics from their website, both for modernized countries and for the 50 US states. (Unfortunately, all but one of the graphs posted on their website come from international data; I will scan their graphs for the US.) Wilkinson and Pickett argue that the relationship between these indicators is strong for measures of inequality, but weak to non-existent for measures of income above a basic threshold.







E. What's the Relationship between Poverty, Inequality and the Environment?

As seen, population and economic activity has a powerful tendency to cluster geographically. Any factor that inhibits clustering pushes population and activity out across the landscape. It creates “sprawl”—urban sprawl, agricultural sprawl, forestry sprawl or mining sprawl.

Density affects the choice of technology—higher density means more labor and capital intensive and less resource intensive. Factors that lower density encourage more use of natural resources and less of labor—reducing employment and wages.

What are these density-lowering factors?

1. Public policies that destroy or fail to support urban density and/or subsidize urban sprawl. The “urban renewal” of the 1950’s and 1960’s was a disaster. Jane Jacobs saved lower Manhattan from the highways of Robert Moses, but he did great damage elsewhere. Taxes on buildings and low density zoning discourage infilling; subsidies to roads and utilities encourage sprawl.
2. Monopoly behavior. Monopolists use resources at low intensity, reduce wages, stifle innovation, and substitute imports for local manufactures.

F. If Density is Such a Good Thing, Why Do So Many People Oppose It?

There are three main reasons people object to density.

1. People confuse density with crowding. Population density is people per square mile. Crowding is people per square feet of living or working area. Zip code 10021 on the east side of Manhattan is the richest zip code in the US. It also has very high density but presumably low crowding, as rich people prefer large apartments. On the other hand rural shacks in Appalachia may be quite crowded. The desirability or undesirability of crowding is partly cultural. Middle-class Japanese can live quite comfortably in apartments that would seem cramped to poor New Yorkers.
2. People assume that density means traffic congestion. But that's a problem solvable by higher tolls and parking fees, as London has done. Some of the worst congestion happens in low-density car-dependent cities like Los Angeles and Atlanta. See Don Shoup's article, "Gone Parkin'" posted as [NYT_Gone_Parkin_by_Shoup.pdf](#).
3. People want to keep newcomers out of "their" neighborhoods, especially poorer newcomers. In effect, they want to act like little monopolists!

The Lincoln Institute of Land Policy has a nice section called Visualizing Density, <http://www.lincolninst.edu/subcenters/visualizing-density/> on how good design can make high density attractive and efficient.