

THE INEVITABLE INTERSECTION

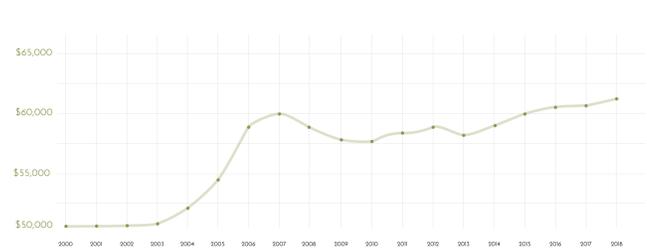
Taking a deeper look into the relationship between Salt Lake City's environmental health and the strength of its economy.

ECONOMIC STRENGTH

Gross domestic product (GDP) is the total value of goods and services produced over a given period of time and is used to measure the strength and growth of an economy. GDP per capita was used to evaluate the strength of the economy, meaning it is the total number of good or services produced per person in Salt Lake City over a year-long period.

Salt Lake City Annual Gross Domestic Product Per Capita

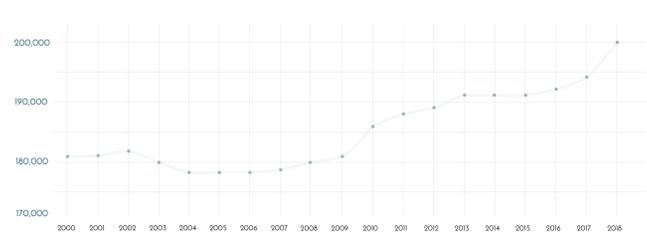
According to the U.S. Bureau of Economic Analysis, Utah had the second-largest GDP increase at 4.3% in 2018. For Utah as a whole, this has been a consistent theme as the GDP grew 2.7% in 2017, 3.9% in 2016 and 4.0% in 2015. The Salt Lake metropolitan area also falls in line with this growth as seen in 2018 by the 3.0% increase in GDP. This economic growth can be attributed to factors such as the fast-growing labor force and workforce-related migrations. Companies have large incentives to relocate to Utah because the state provides well-educated workforces, relatively affordable cost of living, and a growing economy.



Lee, Jason. "Utah Economy among the Fastest Growing in U.S. Here's Why." *Deseret News*, Deseret News, 28 Mar 2019. www.deseret.com/2019/3/28/32669577/utah-economy-among-the-fastest-growing-in-u-s-here-s-why
 "Salt Lake City, Utah Population 2019." *Salt Lake City, Utah Population 2019* (Demographics, Maps, Graphs). worldpopulationreview.com/us/cities/salt-lake-city/
 "Salt Lake City Population." (2019-10-29). Retrieved 2019-11-30. <http://worldpopulationreview.com/us/cities/salt-lake-city/>

Salt Lake City Population Growth

Since 2006, Salt Lake City's metropolitan area population has been on the rise, and over the past three years the rate of population increase has been rising at a more rapid pace. In 2017 the annual population rate reached 3.2%, which is the highest annual rate over the past couple decades. While the population growth could potentially strengthen the economy, the influx of people entering the state creates concerns about the quality of the air. This growth will increase the number of cars on the road, which will consequently cause industrial, commercial, and residential emissions to increase as well.



"Salt Lake City Population." (2019-10-29). Retrieved 2019-11-30. <http://worldpopulationreview.com/us/cities/salt-lake-city/>

WHAT'S AT STAKE?

In 2017, Salt Lake City's population grew at twice the rate than it had in 2016, going from 194,653 to 200,554 people. The population, however, wasn't the only extreme change for the valley. The number of days that were considered unhealthy reached 58 days which was 30 days more than the previous year. Ski resorts reported the least amount of snow on their bases since 1970 at 288 inches. Salt Lake's gross domestic product has been on a consistent rise since 2013. While it is often easier to consider economic strength and environmental health as two independent variables, they simply are not.

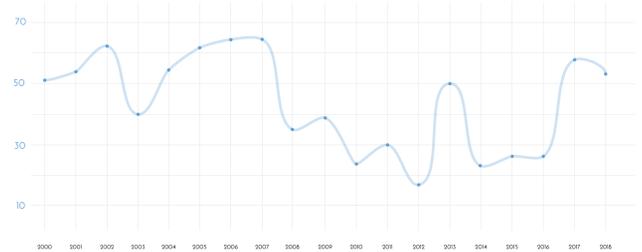
It is no secret that Salt Lake City's air quality is an issue. Ten of the past eighteen years have reported over 50 days of unhealthy air quality. While many of Salt Lake's air quality issues have to do with the environment, there are other factors in play as well. Similarities between economic growth and the air quality, lead to mapping out the environmental and economic trends from 2000 to 2018. While these trends are not necessarily proven, the research showed that there was an inevitable correlation between the two.

ENVIRONMENTAL HEALTH

The Environmental Protection Agency (EPA) has been monitoring Utah's air quality since 1999. This organization measures the amount of particulate matter in the air and rates the air by good, moderate, unhealthy to sensitive groups, and hazardous to all. The number of days from 2000-2018 that fell under unhealthy to sensitive groups or unhealthy to all was recorded to measure the air quality's impact on environmental health.

Salt Lake City Air Quality

Utah repeatedly exceeds the healthy air standards set out by the EPA and fails to meet requirements to clean the air. The state is starting to feel the repercussions of its bad air quality. A study done by the State of Utah on the Point of the Mountain Development Commission found that 69% of people said the top reason they would move out of Utah is because of air quality. While the population continues to grow and GDP continues to rise, the air quality is taking a hit. In 2016 there were 28 unhealthy days and in 2017 that number more than doubled with 58 unhealthy days. This will continue to be an issue if not addressed.

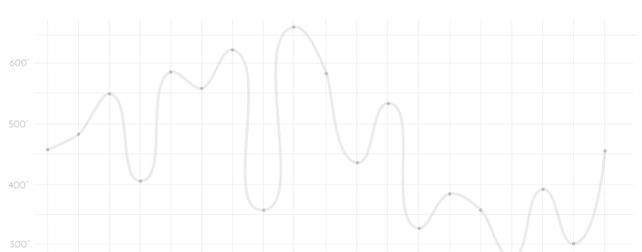


"Air Quality Index Report." EPA, Environmental Protection Agency, 4 Apr 2019. www.epa.gov/oaqobr/air-quality-data/air-quality-index-report

"Point One Report." *Point of the Mountain*, pointofthemountain.com/phase-one-report

Salt Lake City Snowfall History

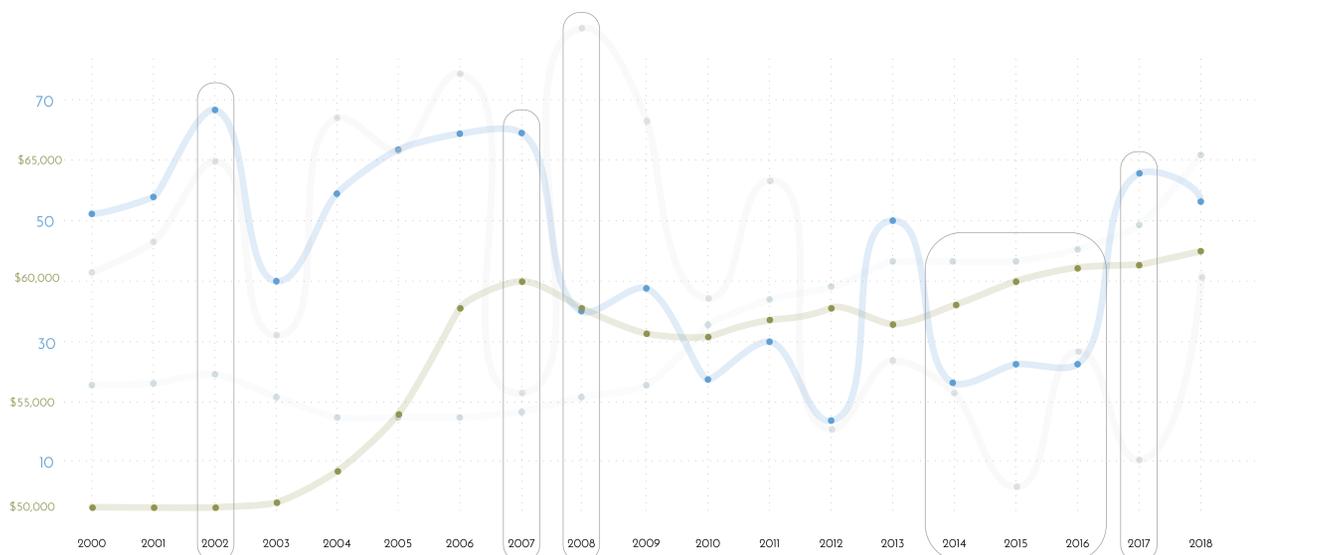
Snow and Salt Lake City have a unique relationship. Utah is often known for having the greatest snow on earth because of the unique light fluffy power caused by the Great Salt Lake. The snow also plays a major role in air quality. When a big storm hits the city, it will clear the valley of the layer of smog and inversion in the air. You will often find that years with high snowfall can also have fewer days with unhealthy air quality. The snowfall per year is the most consistent variable of the research but still plays a role in understanding correlations between environmental health and economic strength.



Free The Powder Gloves. "A 100 Year Snowfall History from 1945-2018." *Free The Powder Gloves*. www.freethepowder.com/blog/report/blog/677205-also-utah-snowfall-history-from-1945-2014

QUESTIONING THE CROSSOVER

An overlay of GDP, population growth, air quality, and snowfall to visualize the crossovers in environmental health and economic strength.



Over the past 18 years, 2002 had the worst air quality. With 67 harmful air quality days, the air was polluted to an unhealthy level for over two months. The amount of snow at the base was relatively high at 550 inches, so what was the cause for such a drastic spike? The 2002 Winter Olympic Games could be one explanation for this peak.

Since 2003, GDP has been on a steady rise. In 2007, it reached a high of \$60,843 before the recession hit in 2008. This was also the second year in a row that the number of unhealthy days reached 64 days, which is the 2 second-highest year for air quality. The snowfall at resort bases dropped from 633" in 2006 to 356" in 2007.

In 2008, the recession hit and GDP fell about \$2,000 per year for the next 3 years. While the GDP declined, resort bases reported 300 more inches than 2007 at 654". In addition, 2008 only reported 36 unhealthy air quality days compared to 2007's 64 days.

For the first time over the past 18 years, GDP and population all grew at a consistent rate. In 2014, 2015, and 2016, GDP increased at about \$1,000 per capita per year while the population is growing around 1,500 per year. The air quality also stayed consistently low at 23 unhealthy days in 2014, 28 days in 2015, and 27 days in 2016.

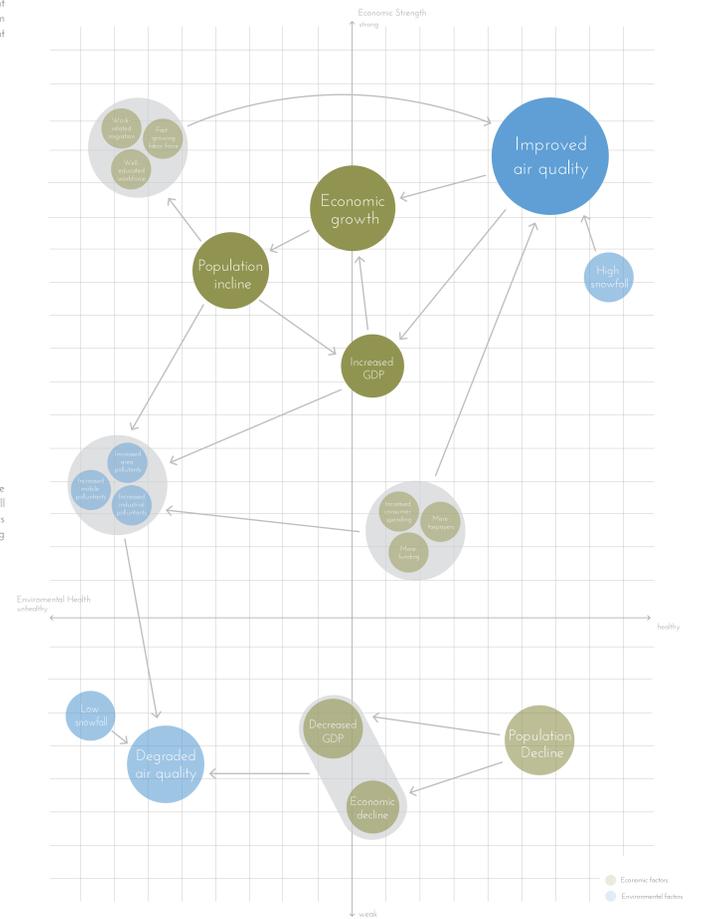
In 2017, Salt Lake City's population had exponential growth, with 6,000 people moving into the city. While the GDP only increased by \$1,500, environmental health was at an all-time low. Ski resort bases only saw 288 inches of snow, which was the lowest they had seen since 1970. The air quality felt these growth repercussions with the 58 unhealthy air days - more than double 2016's 27 days.

The chart below is a map of the air quality rating for everyday from 2000-2018. The air quality is measured by the amount of PM 2.5, which is a fine particle not visible to the eye as a single unit that can create a haze in large amounts. The Environmental Protection Agency then categorizes the amount of PM 2.5 by good, moderate, unhealthy to sensitive groups (pregnant women, children, elderly, etc...), and hazardous to all. From this chart, we are able to understand that the most unhealthy days occur between November, December, January, and February.

Understanding that air is the most unhealthy during the winter helps to show the importance and context of researching snowfall. To conduct research on Salt Lake City's economy, gross domestic product and population were used as they are the best indicators of economic strength and growth. These four metrics were able to give the project insights into the fluctuation and trends in the data that directed research on environmental health and economic strength.

DRAWING THE CONNECTIONS

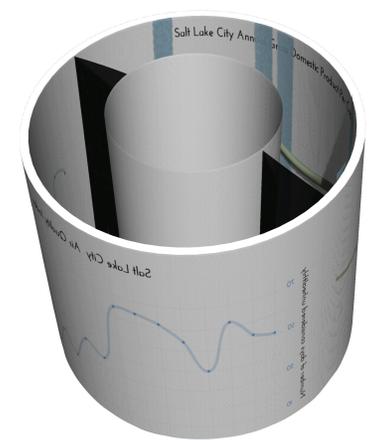
Drawing connections between the different factors that play a role in the relationship between environmental health and economic strength.



This graph is using four different metrics measured against each other. The relationships are proportional, only showing fluctuations in value specific to each metric.

- PRIMARY FACTORS**
 - Number of days considered Unhealthy by the EPA
- SECONDARY FACTORS**
 - GDP per capita
 - Population growth
 - Snowfall per year

VIRTUAL EXPERIENCE



Drawing connections between data sets and graphs can be hard to do in a two-dimensional setting. Using virtual reality gives the opportunity to show connections in a more dynamic and engaging way. The experience has two sides: economic growth and environmental health. While walking through the experience the outer walls will have graphs that reach the ceiling. On the inner walls 'portholes' give insights to corresponding trends.

As you follow the path, blue bars will appear. The blue bars highlight the years in which there was a crossover between environmental health and economic strength. The bars appear and disappear as you continue along the path.

Black transparent screens signify the changes between the environmental and economic sides of the experience. The screens will disappear once you pass, but then reappear as you are about to enter the other side.

Each side of the experience has a graph that reaches to the ceiling. One graph is Salt Lake City's Gross Domestic Product per capita and the other is the number of days considered unhealthy in Salt Lake City.

'Portholes' are placed along the central circular wall. Each porthole contains and a snapshot of information that highlights a crossover between environmental health and economic strength.