



Climate Change & Health Report

April 2018

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Introduction

New Orleans is on the front line of climate change. While New Orleans is no stranger to hurricanes and warm temperatures, the effects of climate change are becoming a regular part of life in New Orleans. Tornados, marsh fires, extreme heat days, air quality alert days, and flooding are occurring more frequently in addition to sea level rise in the Gulf of Mexico. As climate change events continue, the health of New Orleanians will be impacted by these environmental changes. In 2016-2017, the New Orleans Health Department (NOHD) completed a climate vulnerability assessment to examine the climate change projections for New Orleans, potential health outcomes, and determine steps to adapt, mitigate, and respond to these health threats. This report provides an overview of those findings and ways NOHD will work to improve the health outcomes related to climate change.

What Is Climate Change?

Climate change is a long-term change in global or regional climate pattern. This can apply to any changes in climate including temperature, precipitation, and wind patterns among other effects.

Global warming is the increase in Earth's temperature over time. Global warming is one aspect of climate change. Global warming is primarily caused by an increase of greenhouse gas concentrations.

The earth's average temperature has risen by 1.5°F 1880 to 2012. ¹ In addition, an increase of 0.5°F to 8.6°F is projected over the next few centuries. While an increase of one degree Fahrenheit seems undetectable to the human body, to the earth's surface the effects have detrimental consequences to the environment, climate, and weather. ²

After the Industrial Revolution, there was an increase of greenhouse gases in the atmosphere. Like a greenhouse, "greenhouse gases" trap heat energy in the atmosphere. The more that gases are trapped, the more heat that gets trapped. This trapped heat, in addition to the sun's radiation, increases the Earth's air temperatures, which increases the temperature of the oceans and changes weather patterns.

Modernizing cities such as heating and cooling buildings, generating electricity, and powering vehicles caused fossil fuels to be burned at increasing rates. Greenhouse gases including methane, nitrous oxide, and carbon dioxide released in the atmosphere can remain for thousands of years and affect current and future generations. ³

¹ IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1–30, doi:10.1017/CBO9781107415324.004.

² U.S. EPA. 2016. Climate change indicators in the United States, 2016. <https://www.epa.gov/climate-indicators/downloads-indicators-report>.

³ U.S. Environmental Protection Agency. 2016. Climate change indicators in the United States, 2016. Fourth edition. EPA 430-R-16-004. www.epa.gov/climate-indicators.

Across the world, the rise in Earth's temperature is causing the following environmental impacts:

- **Rise in Sea Level:** While the rate of increase varies by region, some areas in the Gulf Coast have experienced increases of more than eight inches from 1960 to 2015. Coastal Louisiana has one of the highest rates of relative sea level rise in the world, due in part to the subsidence, or sinking, of the land.⁴ This leads to an increase in areas experiencing coastal flooding. The loss of barrier islands and wetlands increases the severity of hurricanes on coastal areas as these landforms have previously slowed and weakened tropical storms as they make landfall.
- **More severe weather events:** Recently, the United States has experienced an increase of extreme precipitation occurrences in the form of intense single-day events. In recent years, a larger percentage of precipitation has come in the form of intense single-day events. Nine of the top 10 years for extreme one-day precipitation events have occurred since 1990.⁵
- **Changes in Precipitation:** On average, total annual precipitation has increased over land areas in the United States. Since most precipitation is coming in single-day events, there are longer periods of drought between the severe weather events.⁶
- **Poor Air Quality:** Increasing ground-level ozone and/ or particulate matter due to climate change is harmful to human health. It is estimated by the year 2050 there will 1,000 to 4,300 additional premature deaths nationally per year due to ozone and particle health effects.⁷ As temperatures get warmer and there is a decrease in frosts, it allows for ragweed plants to pollen longer in the water. This increases the length of time each year that millions of people experience allergies.
- **Increased vectors:** Vectors such as mosquitoes can spread diseases including Zika and West Nile Virus to human populations. Many vectors are influenced by factors including temperature and water. Extreme precipitation events and increasing temperatures are allowing for longer life spans and increased populations for the mosquitoes that can transmit mosquito-borne illnesses.
- **Increased temperatures:** Unusually hot summer days have become more common over the last few decades, however the occurrence of unusually hot summer nights has increased at an even faster rate.⁸

Project Overview

This document is to serve as the culminating report for a two-year project examining climate and health in New Orleans and will serve as a guide for the New Orleans Health Department (NOHD) in decision making related to climate change. NOHD used the Centers for Disease Control and Prevention (CDC) BRACE framework to examine the climate change projections for

⁴ National Oceanic and Atmospheric Administration. 2016. Sea Level Trends. <https://tidesandcurrents.noaa.gov/sltrends/>

⁵ U.S. EPA. 2016. Climate change indicators in the United States, 2016. <https://www.epa.gov/climate-indicators/climate-change-indicators-heavy-precipitation>

⁶ U.S. EPA. Climate change indicator in the United States, 2016. <https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-precipitation>

⁷ U.S. Centers for Disease Control and Prevention. 2014. Climate Change and Health. https://www.cdc.gov/climateandhealth/effects/air_pollution.htm

⁸ U.S. EPA, 2016. Climate change indicators in the United States, 2016. <https://www.epa.gov/climate-indicators/climate-change-indicators-high-and-low-temperatures>

New Orleans and associated health impacts focusing on the risk factors of heat, vectors, and air quality. These community conversations allowed health department employees to hear from New Orleanians and identify the highest risk neighborhoods and develop best adaptive practices and strategies within those neighborhoods.

While sea level rise and flooding are important risk factors of climate change, the impacts of these factors are currently being addressed by numerous community groups and other City departments and agencies. Therefore the primary focus of this document will be on adaptation strategies for heat, vectors, and air quality.

This project was funded by the Public Health Institute and Kresge Foundation.

[Building Resilience Against Climate Effects \(BRACE\)](#)

Building Resilience Against Climate Effects (BRACE) is a five step process that allows health officials to develop strategies and programs to help communities prepare for the health effects of climate change. This process was used as an outline for this climate and health project. Due to the timeframe of this project, NOHD developed a modified rapid version of the BRACE framework using existing research and data.

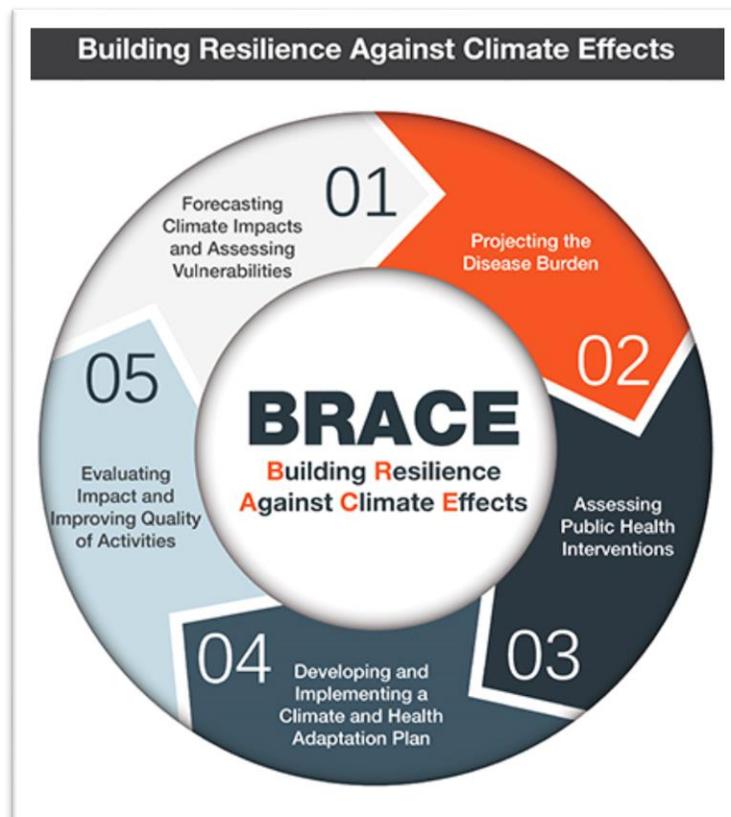


Figure 1. BRACE framework is a five-step process to facilitate climate readiness in public health.⁹

Climate Impacts in New Orleans

New Orleans like most of the world is already seeing signs of climate change and these impacts will only continue to get more severe in the future. Currently, climate researchers are projecting the following impacts on New Orleans:

1. Rising temperatures and an increase in extreme heat days
2. Changes in annual precipitation with more extreme precipitation events
3. Sea level rise
4. Increase in vectors
5. Decrease in air quality

Rising Temperatures and Extreme Heat

Average universal temperatures are predicted to rise with substantial increases in summer and minimal increases in winter. In addition, extreme heat events are predicted to increase in duration, frequency, and intensity.¹⁰ In New Orleans and the surrounding metro area, increasing temperatures are further compounded by the urban heat-island effect. The urban heat-island effect occurs when metropolitan communities experience a peak in rising temperatures due to an increase in built structures, pavement, impermeable surfaces, pollution, overcrowding, overproduction of waste heat and chemicals (industrial processes), and decreased vegetation that would normally absorb heat. The increase in built impermeable surfaces such as buildings, contribute to the entrapment of heat and prevent the release of moisture back into the environment, causing the overall temperatures to rise.¹¹

Precipitation and Extreme Precipitation

Increasing temperatures will cause changes in weather patterns and sea level rise for coastal Louisiana. New Orleans is located in a transition zone between wetter climates to the Northeast and drier climates to the Southwest which will create periods of drought and periods of increased precipitation over time.¹² Increased precipitation, either annually or during extreme single-day precipitation events are likely to result in either localized flooding from direct rainfall or aerial flooding caused by the overtopping of rivers and waterways. Severe thunderstorms and hurricanes will become more common and these storms may be stronger than what New Orleans has seen historically. These storms may include tornados or high winds that can cause infrastructure damage such as power outages in addition to flooding.

⁹ Center for Disease Control and Prevention. October 2, 2015. CDC's Building Resilience Against Climate Effects (BRACE) Framework. Retrieved from <https://www.cdc.gov/climateandhealth/BRACE.htm>

¹⁰ Needham, H., Shafer, M., Dobson, J. (2013, January). *NOAA Technical Report NESDIS 142-2, Regional Climate Trends and Scenarios for the U.S. National Climate Assessment, Part 2. Climate of the Southeast U.S.* Retrieved from http://www.nesdis.noaa.gov/technical_reports/NOAA_NESDIS_Tech_Report_142-2-Climate_of_the_Southeast_U.S.pdf

¹¹ US EPA. Heat Island Effect. <https://www.epa.gov/heat-islands>. September 28, 2017.

¹² Needham, H., Shafer, M., Dobson, J. (2013, January). *NOAA Technical Report NESDIS 142-2, Regional Climate Trends and Scenarios for the U.S. National Climate Assessment, Part 2. Climate of the Southeast U.S.* Retrieved from http://www.nesdis.noaa.gov/technical_reports/NOAA_NESDIS_Tech_Report_142-2-Climate_of_the_Southeast_U.S.pdf

Sea Level Rise

Global sea levels are predicted to rise between two and six feet over the next 100 years.¹³ This rise in the Gulf of Mexico will reduce coastal wetlands area. These areas protect those in New Orleans against coastal flooding and storm surge. As the sea level rises, it places a greater burden on the levee protection system surrounding the city and the internal storm water drainage systems to work adequately. Heavy rains and storm surge events in many low-lying coastal areas including New Orleans may experience drainage problems, as the city's drainage pumps try to remove the water in a timely manner. "In the Gulf region, nearly 100% of the 'most socially vulnerable people live in areas unlikely to be protected from inundation'..."¹⁴ The people that will be most at risk from the effects of sea level rise will also be those that have limited economic resources to mitigate such effects. This will continue to make quality of life and equity issues more extreme.

The rise in sea levels will cause saltwater intrusion, which threatens fresh drinking water from the Mississippi River. This causes increasing pressure to water and energy utilities. The sea level rise and intrusion of saltwater will also affect many of the industries that people in Louisiana depend on for work including the fishery, agricultural, and oil and gas industries. Some roads in Louisiana, such as Louisiana State Highway 1 that is used to transport oil and gas resources, are sinking which prevents the delivery of goods during high tide or severe storms. It is estimated that a shutdown of this highway for 90 days would result in a loss of \$7.8 billion for the nation¹⁵.

Vectors

A vector is an organism that can transmit a disease from species to another. Vectors such as ticks, rodents, and mosquitoes can transmit disease to human through direct contact with these organisms. In southeast Louisiana, the mosquito is one of the most important and prevalent vectors. Mosquitoes thrive in warm, humid weather and can transmit many illnesses such as dengue fever, West Nile fever, and Zika virus disease. Higher temperatures and wetter climates will create more favorable living and breeding conditions for mosquitoes resulting in not only an increase in the population but also a lengthening of the reproductive cycle to include the winter months.¹⁶

¹³ Carbonell, A., Meffert, D. (2009). Climate Change and the Resilience of New Orleans: the Adaptation of Deltaic Urban Form. Retrieved from <http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1342044185050/8756911-1342044630817/V2Chap18.pdf>

¹⁴ Carter, L. M., J. W. Jones, L. Berry, V. Burkett, J. F. Murley, J. Obeysekera, P. J. Schramm, and D. Wear, 2014: Ch. 17: Southeast and the Caribbean. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 396-417. doi:10.7930/JON-P22CB.

¹⁵ Carter, L. M., J. W. Jones, L. Berry, V. Burkett, J. F. Murley, J. Obeysekera, P. J. Schramm, and D. Wear, 2014: Ch. 17: Southeast and the Caribbean. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 396-417. doi:10.7930/JoN-P22CB.

¹⁶ Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp.

Air Quality

The oxides of nitrogen and volatile organic compounds created by human activity, that is contributing to the global warming effect negatively impact air quality and can lead to poor health outcomes in individuals already suffering from respiratory illnesses. Rising temperatures cause these compounds to react and create more conducive conditions for ozone formation and greater air stagnation periods. Air stagnation and wildfire emissions during dry periods will increase particulate matter concentrations. Ozone and particulate matter and the two primary air quality conditions to cause a decrease in lung function and an increase in the hospital or emergency room visits for those with asthma.¹⁷

Another side effect of global warming involves the early arrival of spring and late arrival of winter. This shift in seasons lengthens the pollen season from as much as two weeks before spring and up to four weeks into the fall.¹⁸

New Orleans's Vulnerabilities to Climate Change

As previously discussed, New Orleans' geographic location makes the city vulnerable to environmental changes caused by climate change. Some New Orleanians are better prepared to mitigate and respond to the impacts of climate change while others may need assistance to reduce their vulnerability to climate change. Both social vulnerability and pre-existing health risks will impact an individual's ability to protect themselves against the negative impacts of climate change.

Social Vulnerability

According to the CDC the most significant variables that determine the social vulnerability of an individual are their 1. Socio-economic status, 2. Household composition and disability, 3. Minority status and language, and 4. Housing and transportation.¹⁹

Socio-economic status is a measure of a person's sociological and economic position based on income, employment, and education variables concerning other individuals. An individual's access to healthcare, financial, and educational resources is directly linked their socioeconomic status. The 2015 American Community Service (ACS) estimated that 27.7% of New Orleanians were living in poverty.²⁰ This population group carries a high burden of chronic health conditions and have limited resources to protect themselves from climate changes. Those in poverty often live in substandard housing which may not provide adequate refuge from the outdoor climate.

¹⁷ Anderson H, et al. BRACE Midwest and Southeast Community of Practice. 2017. Climate and Health Intervention Assessment: Evidence on Public Health Interventions to Prevent the Negative Health Effects of Climate Change. Climate and Health Technical Report Series. Climate and Health Program, Centers for Disease Control and Prevention.

¹⁸ Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2.

¹⁹ Centers for Disease Control and Prevention. (July 10, 2014). The Social Vulnerability Index. Retrieved from <https://svi.cdc.gov/>

²⁰ U.S. Census Bureau. (2010). Quick Facts: New Orleans City, Louisiana. Retrieved from <http://www.census.gov/quickfacts/table/PST045215/2255000>

Household composition measures age, family structure (traditional two or single-parenting), and disability variables. Children under the age of 18 years old, seniors over the age of 65 years of age and those individuals with disabilities are more likely to require transportation, financial support, medical care, or assistance during an extreme environmental event.

As of 2010, adults older than 65 accounted for 11% of New Orleanians;²¹ 32.9% of which live alone.²² Seniors' high burden of chronic illnesses, medical conditions, social segregation, financial status, higher sensitivity to heat and air pollution may pose a greater risk of accidents, emergencies, and death during extreme weather events.

Seniors contend with physiological limitations due to the natural aging process, medical conditions, and weakened immune system. Over time, respiratory function declines and lungs undergo physiological changes that impair normal breathing. These changes make seniors more sensitive to the adverse health effects of air pollution. Air pollution may exacerbate asthma and Chronic Obstructive Pulmonary Disease (COPD) and increase the risk of heart attack for those who have diabetes. The aging process also impairs thermoregulatory response, but, illnesses and medications such as those for mental disorders and heart disease may impair the mechanism that controls body temperature.²³

Living in poverty with limited access to healthcare, transportation, and social services can influence the risk of exposure and capacity to adapt to climatic changes.

Disability refers to physical, mental, developmental, intellectual, or sensory conditions that limit an individual's movement, decision-making, sense, or ability to function independently. People with disabilities may be less mobile and unable to travel to seek shelter or assistance. They may also have greater difficulty receiving and understanding information for health precautions and safety. As of 2010 census data, New Orleans reports 10.2% of its population with some disability.²⁴

Several factors may influence the effects of climate change and may exacerbate health outcomes in children over time. These factors include children's physiological, metabolic, behavioral, and dependency differences from adults. Due to the smaller size of children, they have a greater surface area-to-body mass ratio which impairs their ability to regulate body heat, rendering them more susceptible to heat related illnesses. Children are also more likely to be exposed to environmental toxins and poor air quality due to thinner skin layers and higher respiratory rates than adults. These conditions can lead to children being exposed to higher concentrations of pollutants than adults in the same environment. Children's outdoor activity, behaviors, and environmental interactions will impact their health due to climatic changes. Children are more

²¹ U.S. Census Bureau. (2010). *Quick Facts: New Orleans City, Louisiana*. Retrieved from <http://www.census.gov/quickfacts/table/PST045215/2255000>

²² The Data Center. (2015, December 15). *Lower Garden District Statistical Area*. Retrieved from <http://www.datacenterresearch.org/data-resources/neighborhood-data/district-2/lower-garden-district/>

²³ Gamble JL, Hurley BJ, Schultz PA, Jaglom WS, Krishnan N, Harris M. (2013). Climate Change and Older Americans: State of the Science. *Environmental Health Perspectives*. 121:15–22; retrieved from <https://ehp.niehs.nih.gov/wp-content/uploads/121/1/ehp.1205223.pdf>

²⁴ U.S. Census Bureau. (2010). *Quick Facts: New Orleans City, Louisiana*. Retrieved from <http://www.census.gov/quickfacts/table/PST045215/2255000>

likely to spend more time outdoors than adults, inviting greater exposure to air pollutants and environmental agents as well as insect vectors.²⁵ Per the 2010 U.S. Census, 6.4% of the New Orleans' population is under five years old, and 21.3% is under 18 years old.²⁶

Minority status and language refer to race, ethnicity, and English language proficiency variables. The immigrant community has grown considerably in the New Orleans area since the aftermath of Hurricane Katrina. While the African-American population in New Orleans remained the majority at 59.5% in 2015, the percentage of Hispanics in New Orleans rose to 5.6% in 2015, and the Asian population increased to 3.1%.²⁷ More than half of New Orleans residents report suffering from a chronic illness, but African-Americans are twice as likely to suffer from asthma or other breathing problems, 1.6 times more likely to have diabetes, and 1.65 times more likely to have hypertension or high blood pressure than whites.²⁸

Due to real estate policies that reinforced racial segregation and historic settlement patterns tied to topography, communities of color in New Orleans live on average in areas of lower elevation at greater risk of flooding than white people.²⁹ Additionally, these lower income areas have fewer resources to mitigate and protect themselves or their homes from the effects of climate change.

Language barriers play a significant role in the difficulty in dissemination of information in these circumstances, but cultural barriers are also important to keep in mind. Immigrants may rely on a close network of family and friends for information gathering, support, and assistance, they may be unfamiliar to the environmental impacts of the area, or there may be a lack of interpretation or native language speaking resources such as radio, television, or social media.

Housing and transportation types will impact an individual's exposure to the environmental changes associated with climate change. How well a home is sealed determines a person's exposure to outdoor air quality and mosquitoes. For example, people living in a home without air conditioning are more likely to open windows to remain cool, but exposing them to outdoor air. If those window have screen with holes or no screens, mosquitoes will be able to enter the home creating more opportunities for mosquito bites and the transmission of mosquito-borne illnesses. Homes that flood or leak may have mold which will create indoor air quality impacts on people with respiratory illnesses.

Approximately 1.25% of New Orleans metro area residents live in homes without air conditioning, and cannot readily cool down to protect themselves against heat-related illnesses associated with

²⁵ Sheffield, P. E., and Landrigan, P. J. (2011). Global Climate Change and Children's Health: Threats and Strategies for Prevention. *Environmental Health Perspectives*. 119:291-298.

²⁶ U.S. Census Bureau. (2010). *Quick Facts: New Orleans City, Louisiana*. Retrieved from <http://www.census.gov/quickfacts/table/PST045215/2255000>

²⁷ U.S. Census Bureau. (2015). *Quick Facts: New Orleans City, Louisiana*. Retrieved from <http://www.census.gov/quickfacts/table/PST045215/22071>

²⁸ The Kaiser Family Foundation. (2010). *New Orleans Five Years after the Storm: A new Disaster amid Discovery*. Menlo Park, CA. Retrieved from <https://kaiserfamilyfoundation.files.wordpress.com/2013/02/8089.pdf>

²⁹ U.S. Census. (2010). *FEMA Flood Insurance Rate Map, Revised Preliminary 2014*

extreme heat events.³⁰ Many low-income residents are reluctant to turn on fans or air condition to cool down due to high energy costs.

Homeless individuals are at an even greater disadvantage because they have no refuge from the heat, mosquito vectors, and poor air quality. The homeless population has a high prevalence of respiratory, cardiovascular, and mental conditions as well as substance abuse. Prolonged exposure to outdoor living makes this group more vulnerable to effects of extreme weather events. Individuals who are not able to seek shelter will be inevitably exposed to storms and hurricanes, increasing their probability of drowning, injury, infectious disease, and death. Substance abuse and mental health may also limit their decision-making capacity or impair judgment to seek appropriate shelter, take medications, and make other health and wellness decisions.

While NOHD encourages the use of public transportation, riding bikes, and walking, and in fact these modes are important for reducing reliance on combustion engine cars and thereby reducing tailpipe emissions and related greenhouse gasses, these transportation modes put people outdoors and increase exposure to poor air quality, heat, and vectors making people who are reliant of these modes of transportation more susceptible to negative health outcomes.

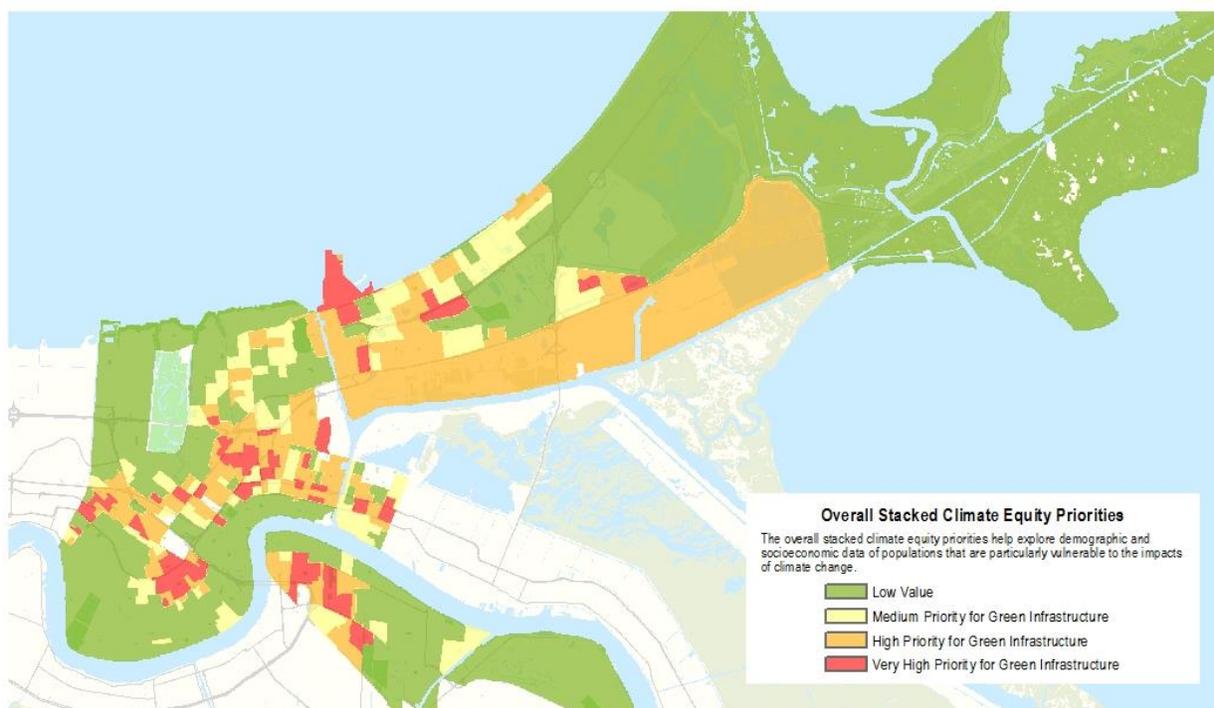


Figure 2: Map of block groups based on overall social vulnerability. Analysis of social vulnerability was completed by The Trust for Public Land based on EPA EJ Screen and American Community Survey data.

³⁰ U.S. Census Bureau. (2011). *2011 American Housing Survey*. Retrieved from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=AHS_2011_C03AOM&prodType=table

Prevalence of Chronic Diseases

Across the United States, health trends indicate that the vulnerability to climate change is increasing. The aging populations are living longer and having more incidents of chronic health problems. In 2001, 1 in 14 Americans were diagnosed with asthma and chronic respiratory disease and diabetes rates are also increasing.

In 2016, New Orleans ranked 46th out of 64 parishes in the state of Louisiana for health outcomes.³¹ Almost a third of the population reported adult obesity and over three quarters are monitored for diabetes.³² Since 20% of New Orleanians are uninsured,³³ there may be many more undiagnosed cases of chronic illness. The following conditions will directly impacts a person's susceptibility to climate change impacts.

- **Respiratory Diseases:** Illnesses such as asthma and COPD impact a person's ability to breathe properly due to decreased lung function. New Orleans carries 6,317 cases of pediatric asthma and 23,614 adult cases. COPD plagues 22,397 adult residents.³⁴
- **Cardiovascular Disease (CVD):** range of conditions affecting the heart including Coronary Artery Disease and Atherosclerosis which may result in angina, arrhythmia, heart attack or heart failure. 3.9% of New Orleanians reported that their physicians told them they had a heart attack, 3.8% were diagnosed with angina or coronary heart disease, and 5.3% had a stroke.³⁵
- **Chronic Kidney Disease (CKD):** gradual loss of kidney function over time. Two leading causes of CKD are diabetes and high blood pressure. In Louisiana, 8,200 people are on dialysis for kidney disease.³⁶
- **Obesity:** weight that is higher than what is considered as a healthy weight for a given height.³⁷ In 2013, a reported 31.4% of New Orleans' adults were obese, while 16.7% of high school students qualified for the range.³⁸

³¹ Orleans (OR) County, Louisiana (2016). Retrieved from County Health Rankings & Roadmaps.

<http://www.countyhealthrankings.org/app/louisiana/2016/rankings/orleans/county/outcomes/overall/snapshot>

³² Orleans (OR) County, Louisiana (2016). Retrieved from County Health Rankings & Roadmaps.

<http://www.countyhealthrankings.org/app/louisiana/2016/rankings/orleans/county/outcomes/overall/snapshot>

³³ Orleans (OR) County, Louisiana (2016). Retrieved from County Health Rankings & Roadmaps.

<http://www.countyhealthrankings.org/app/louisiana/2016/rankings/orleans/county/outcomes/overall/snapshot>

³⁴ American Lung Association. (2016). *State of the Air 2016*. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/sota/city-rankings/states/louisiana/orleans-parish.html>

³⁵ New Orleans Health Department. (2013, June). *Healthy Lifestyles in New Orleans*. Retrieved from <http://www.nola.gov/nola/media/Health-Department/Publications/Healthy-Lifestyles-in-New-Orleans-Community-Health-Data-Profile-final.pdf>

³⁶ National Kidney Foundation of Louisiana. (2016). *Kidney Disease*. Retrieved from <http://kidneyla.org/kidney-disease/>

³⁷ Centers for Disease Control and Prevention. (2016). *Overweight and Obesity*. Retrieved from <https://www.cdc.gov/obesity/adult/defining.html>

³⁸ New Orleans Health Department. (2013, June). *Healthy Lifestyles in New Orleans*. Retrieved from <http://www.nola.gov/nola/media/Health-Department/Publications/Healthy-Lifestyles-in-New-Orleans-Community-Health-Data-Profile-final.pdf>

- Diabetes: the body's inability to produce or respond to the hormone insulin, which regulates carbohydrate metabolism resulting in elevated levels of glucose in the blood and urine. In New Orleans, 10.3% of residents have been diagnosed with diabetes.³⁹
- Mental Illness: Individuals who experience severe weather events are more likely to suffer from PTSD and individuals suffering from mental health illness are less likely to access to proper healthcare. Medications for the treatment of mental illness can also limit one's ability to regulate body temperatures.⁴⁰

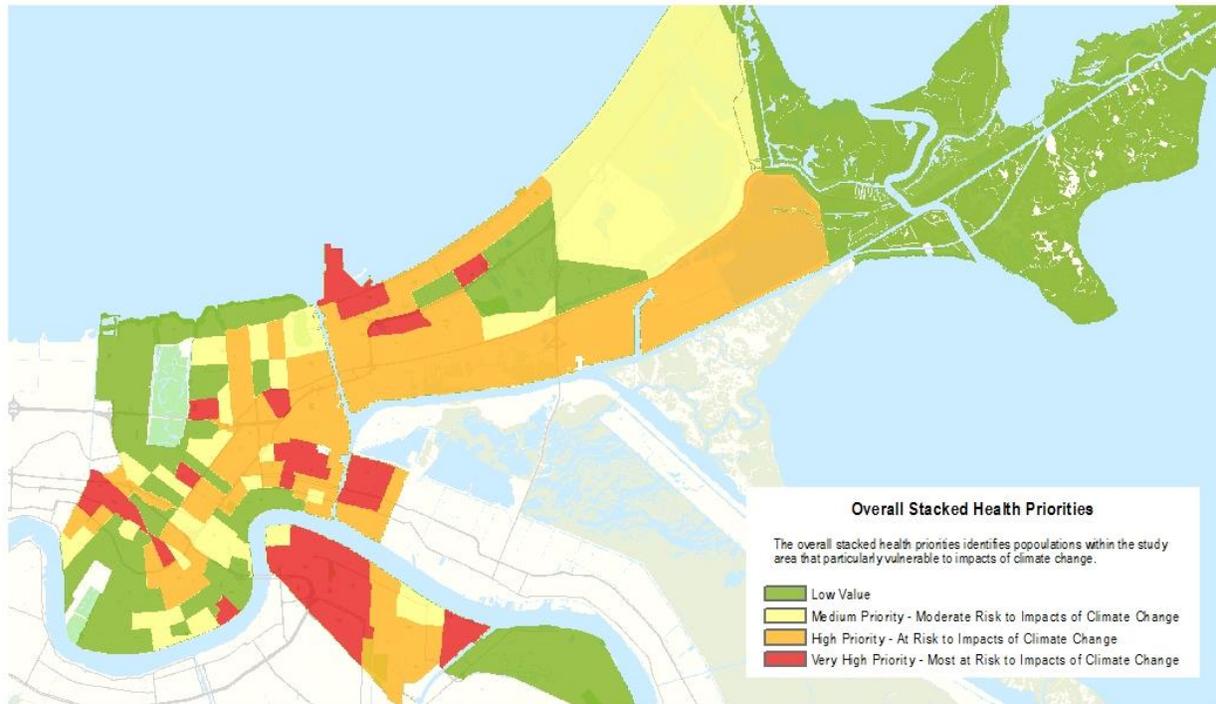


Figure 3: Map of census tracts based on prevalence of hypertension, diabetes, kidney disease, cardiovascular disease, cerebrovascular, and respiratory illness in adults seeking primary care from participating clinics. Analysis of data was completed by The Trust for Public Land based on data from the Louisiana Public Health Institute.

Projecting Disease Burden

Heat

New Orleans has a warm, humid, temperate climate with warm seasons lasting from May through September. Annual and seasonal temperatures are expected to rise, as well as the number, duration, and intensity of extreme heat events. Across the Southeast United States, average annual temperatures are predicted to increase between 3°F to 5°F from 2041 to 2070. This shift

³⁹ New Orleans Health Department. (2013, January). *New Orleans Community Health Improvement Report*. Retrieved from <http://www.naccho.org/uploads/downloadable-resources/UPDATED-NOLA-Community-Health-Improvement-Final-Report.pdf>

⁴⁰ U.S. Center for Disease Control and Prevention. Evidence on Public Health Interventions to Prevent the Negative Health Effects of Climate Change. 2017.

would result in a larger increase in average summer temperatures between 3°F to 5°F, and a smaller increase in average winter temperatures between 2.5°F to 5°F. If greenhouse emissions continue to increase, temperatures could rise as much as 6°F to 7°F by 2100.⁴¹ Continuous warm weather including warm nights can impact the body's ability to regulate temperature causing a number of serious medical conditions. In 2016, New Orleans experienced 43 nights in a row with night time temperatures over 80°F.⁴²

In addition to long term weather temperature changes, short term extreme temperature events can cause conditions such as heat rash, heat illness and heat stroke. The CDC defines an extreme heat event as “an extended period of time (several days or more) with unusually hot weather conditions that potentially can harm human health.” With climate change impacts, these events are predicted to last longer (by 10 to 20 more days), be more severe, and happen more frequently. Extreme heat events that have previously occurred once every twenty years are predicted to occur every two to four years. In the U.S., the number of days during which temperatures reach 100° F may increase from less than 10 to between 20 and 90 by 2099.⁴³ Heat is number one weather-related killer in the United States.⁴⁴

Heat Vulnerability Factors

Demographics: Human beings have extraordinarily efficient internal regulating systems to maintain a stable core temperature. Humans are also highly adaptable and able to respond to environmental changes physiologically over time.

As living conditions and technological advances have improved, people have migrated to other parts of the world, and the physical and genetic differences that had initially enabled them to adapt to certain areas of the world are no longer necessary. But people must still acclimatize to hot weather as climate change increases overall temperatures. Heat tolerance is a complex series of physiological processes in response to heat stress. The body's reaction to heat includes a decrease in heart rate, body, and skin temperature responses, as well as perceived exertion. The body will increase the onset and rate of sweat, as well as cardiac function and blood distribution. Not everyone can improve their heat tolerance or acclimatize to threatening temperatures over a short period.

The variable inability to adapt to drastic changes in the environment can be attributed to specific demographic indicators such as race, ethnicity, and socioeconomic status (income, education, and occupation). Indicators of high vulnerability to extreme heat events include those with a lower socio-economic status and African-Americans. There is no scientific data to support why racial differences are associated with heat vulnerability but rather these differences may be linked to

⁴¹ Needham, H., Shafer, M., Dobson, J. (2013, January). *NOAA Technical Report NESDIS 142-2, Regional Climate Trends and Scenarios for the U.S. National Climate Assessment, Part 2. Climate of the Southeast U.S.* Retrieved from http://www.nesdis.noaa.gov/technical_reports/NOAA_NESDIS_Tech_Report_142-2-Climate_of_the_Southeast_U.S.pdf

⁴² Fritz, A. The Washington Post. The Mind Boggling Heat Record That No One Is Talking About. September 26, 2016

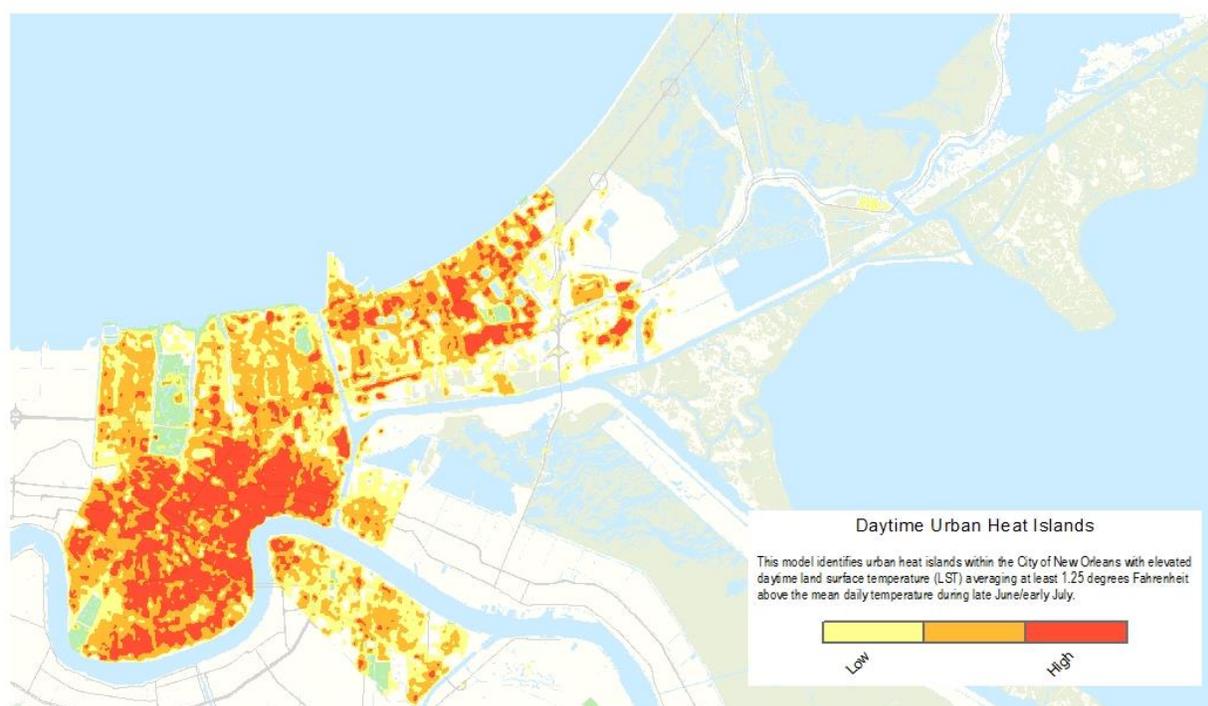
⁴³ Center for Disease Control. (nd). *Climate Change and Extreme Heat Events*. Retrieved from <https://www.cdc.gov/climateandhealth/pubs/ClimateChangeandExtremeHeatEvents.pdf>

⁴⁴ U.S. Centers for Disease Control and Prevention. 2017. Evidence on Public Health Interventions to Prevent the Negative Health Effects of Climate Change.

poorer physical health, less education, substandard housing infrastructure, employment conditions (working outdoors), and access to air conditioning, which are more common within these groups.

Adults aged 65+ are more likely to experience a heat-related illness than any other age group. In addition, since 1979 more than 9,000 Americans have died as a direct result of heat-related illnesses. When heat is reported as a contributing factor for deaths the death rate is much higher. Additionally, the 27.7% of New Orleanians living in poverty are more at risk of heat-related illness. They may be one of the 1,703 residents who are homeless, without shelter from the heat's harsh impact.⁴⁵ They may also lack resources to cool themselves or to know what precautions to take to protect their health. Population groups within the combination of these variables may be most affected due to the compounded vulnerability impacts.

Housing Factors: The structural integrity of a home, as well as its location within the city, affect the degree to which an occupant will be exposed to heat as well as their protective adaptive capacity to temperature changes. Within a metropolitan area, an area that is significantly warmer than its surrounding areas is often referred to as an *urban heat island* (UHI). The urban heat island effect occurs due to vast areas of paved surfaces, dense housing, and lack of tree cover. Those living in the hotspots of an urban center will experience hotter temperatures and may have less access to shade to provide relief from the heat while outdoors, making them more likely to suffer heat-related illnesses.



⁴⁵ UNITY of Greater New Orleans. (2015, August). A Home for Every New Orleanian. Retrieved from <http://unitygno.org/wp-content/uploads/2015/08/A-Home-for-Every-New-Orleanian.pdf>

Figure 4: Map of elevated temperatures at least 1.25°F above mean daytime temperature. This analysis was completed by The Trust for Public Land based on LANDSTAT data.

As of 2011, approximately 1.25% of New Orleans metro area households did not have air conditioning, and thus occupants were more prone to heat exhaustion.⁴⁶ Even if homes are equipped with air conditioning units (central or window unit) or fans, people may be reluctant to use them due to the high cost of electricity. Cities like New Orleans can offer cooling centers in air-conditioned facilities to provide residents temporary relief from extreme heat. However, housing factors such as high crime rates may inhibit residents from leaving their home to seek refuge at a cooling center or even opening windows and doors to cool the house down.⁴⁷ Lack of access to transportation may also impede families from traveling to cooling centers or any other public place with air conditioning. Some New Orleanians live in neighborhoods without means to public or street car lines or may be in the 9.1% of New Orleanians that do not have a vehicle.⁴⁸ Both conditions diminish the individual's ability to take steps to protect themselves from heat exhaustion.

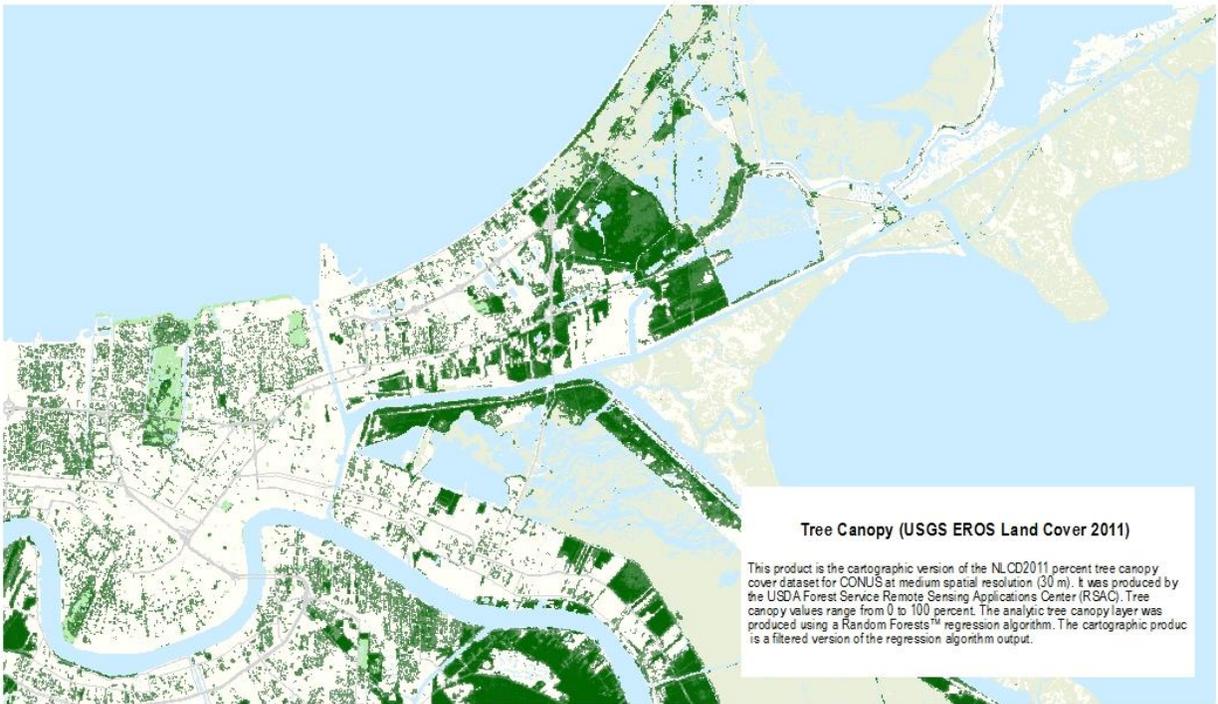


Figure 5: Map of New Orleans Tree Canopy by USGS EROS Land Cover.

Lifestyle Factors: Lifestyle and daily routines can also determine exposure to high temperatures and extreme heat. Population groups that enjoy the outdoors - who exercise, play, work, or spend

⁴⁶ U.S. Census Bureau. (2011). *2011 American Housing Survey*. Retrieved from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=AHS_2011_C03AOM&prodType=table

⁴⁷ Pacific Institute. (2012, July). *Social Vulnerability to Climate Change in California*. Retrieved from <http://www.energy.ca.gov/2012publications/CEC-500-2012-013/CEC-500-2012-013.pdf>

⁴⁸ The Data Center. (2015, December 15). *Lower Garden District Statistical Area*. Retrieved from <http://www.datacenterresearch.org/data-resources/neighborhood-data/district-2/lower-garden-district/>

more time outside - are more exposed to heat and thus are more likely to experience heat-related illnesses.

Social isolation is another important factor for determining heat-related illness and death vulnerability. Socially isolated individuals, especially seniors or those with handicaps or disabilities, cannot leave their home unaccompanied, and those who may need special transportation may lack access to information networks to receive updates on extreme heat safety precautions. Furthermore, this population group may lack family and community support to confirm good health and ensure proper protection against heat events. Nearly 33% of seniors in New Orleans live alone and may be at greater risk of injury during extreme heat phenomena.⁴⁹

Health Factors: Pre-existing health conditions can increase an individual's vulnerability to heat-related illnesses. Conversely, heat can also worsen existing chronic health conditions. As previously detailed, conditions that increase vulnerability to heat-related illnesses include kidney disease, cardiovascular disease, respiratory illness, diabetes, obesity, alcoholism, and conditions treated with antipsychotic medications, like dementia.

Rising temperatures and an increase in extreme heat events result in an increase of heatstroke and other heat-related illnesses. Heat-related illnesses range from minor afflictions such as heat rash, heat exhaustion, and heat cramps, to more serious conditions like heat stroke. Symptoms associated with these illnesses vary from skin irritations, headaches, nausea, and fainting, to death. Extreme heat and rising temperatures also worsen chronic conditions, like cardiovascular disease, cerebrovascular disease, respiratory disease, kidney disorders, and diabetes, because they interfere with the body's ability to regulate its core temperature.

Heat waves may further result in a loss of electrical power, compromising food and water safety and jeopardizing the health of those who depend on electricity for their medical needs.⁵⁰ Heat waves kill people and cost communities substantial resources. In 2006, a heatwave in California that lasted for two weeks led to 655 deaths, 1,620 hospitalizations, 16,000 ER visits, and 152,095 outpatient visits.⁵¹ In total, the heat wave cost \$5.4 billion, equating to a cost approximately \$148,792 per 1,000 people. For New Orleans and its nearly 400,000 residents, a similar event could be estimated at the cost of nearly \$60 million.⁵²

Both heat and climate change can affect mental health and lead to mental illness. Higher temperatures may lead to depression and other mental health disorders. Higher temperatures are associated with increasing suicide rates.⁵³

⁴⁹ The Data Center. (2015, December 15). *Lower Garden District Statistical Area*. Retrieved from <http://www.datacenterresearch.org/data-resources/neighborhood-data/district-2/lower-garden-district/>

⁵⁰ U.S. Global Change Research Program. (2016). *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Retrieved from <https://health2016.globalchange.gov/>

⁵¹ Natural Resources Defense Council. (2011, November). *Health and Climate Change: Accounting for Costs*. Retrieved from <https://www.nrdc.org/sites/default/files/accountingcosts.pdf>

⁵² Natural Resources Defense Council. (2011, November). *Health and Climate Change: Accounting for Costs*. Retrieved from <https://www.nrdc.org/sites/default/files/accountingcosts.pdf>

⁵³ U.S. Global Change Research Program. (2016). *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Retrieved from <https://health2016.globalchange.gov/>

Mental health impacts are not exclusively caused by heat. Climate changes can increase anxiety as people are forced to adapt with weather patterns that are out of the norm and contemplate future uncertainty and instability. Climate change will also include extreme weather events which may lead to increases in posttraumatic stress disorder (PTSD). Relatedly, extreme weather events are further accompanied with increased rates of individuals reporting suicide and suicidal thoughts. After Hurricane Katrina, for example, the rate of suicidal thoughts rose from 2.8% to 6.4% in New Orleans.⁵⁴

Based on New Orleans Emergency Medical Services (EMS) call data, heat-related 9-1-1 calls are highly correlated with daily high temperatures and more than 50% of the calls occurred between 11:00am and 3:00pm which is the hottest time of the day. The heat map below shows the locations of the heat-related calls within the city for 2015-2016. The Louisiana Department of Health reports that the rate of black New Orleanians seeking care for heat in emergency

⁵⁴ U.S. Global Change Research Program. (2016). *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Retrieved from <https://health2016.globalchange.gov/>

departments was 0.49 per 1000 residents from 2010-2012. The rate for white New Orleanians seeking care for heat-related illness in emergency departments was 0.23 per 1000 residents.

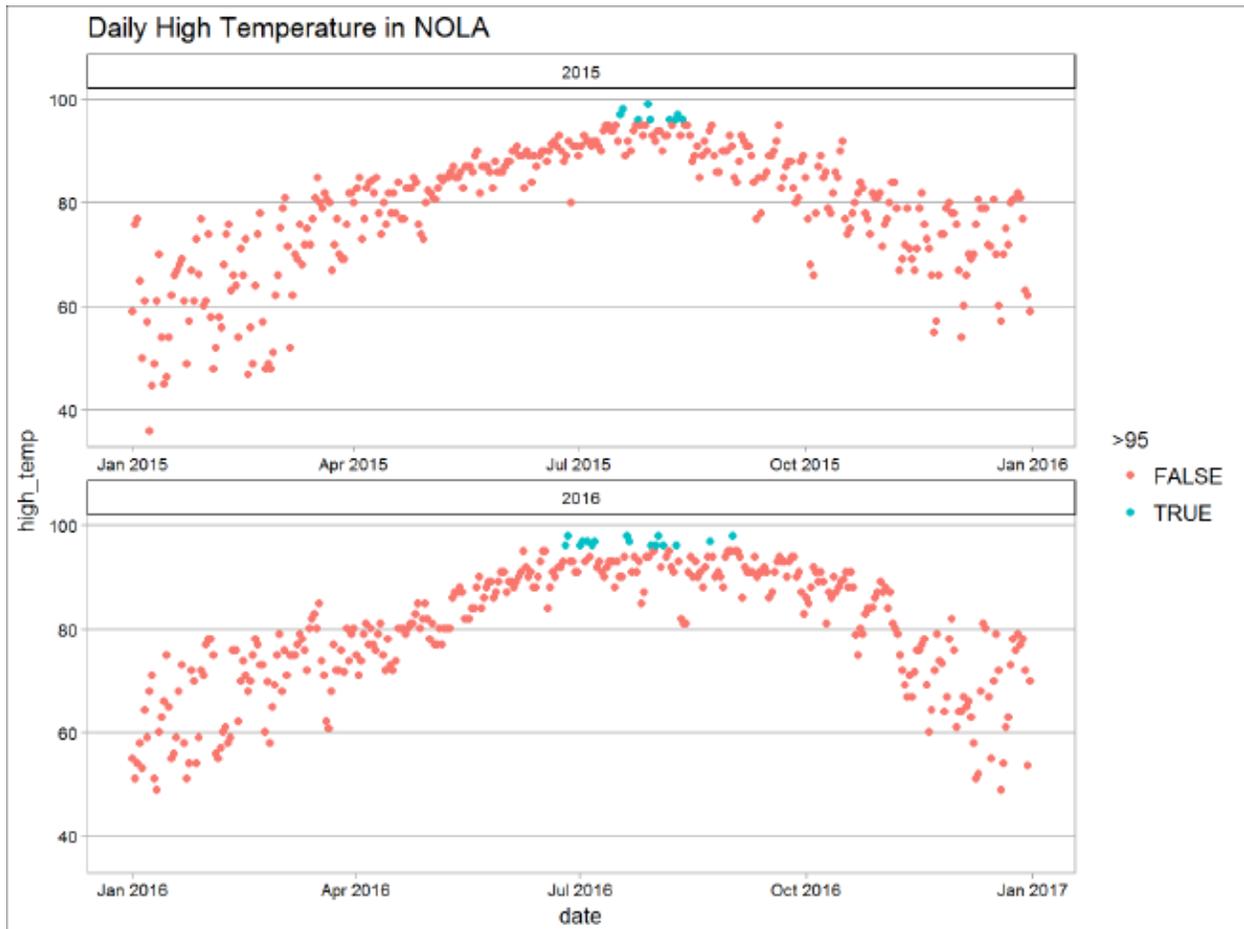


Figure 6: Recorded high daytime temperatures for 2015 and 2016. Blue dots are days when New Orleans Emergency Medical Services received heat-related calls for service.

Density of EMS Calls - Moderate Temperatures

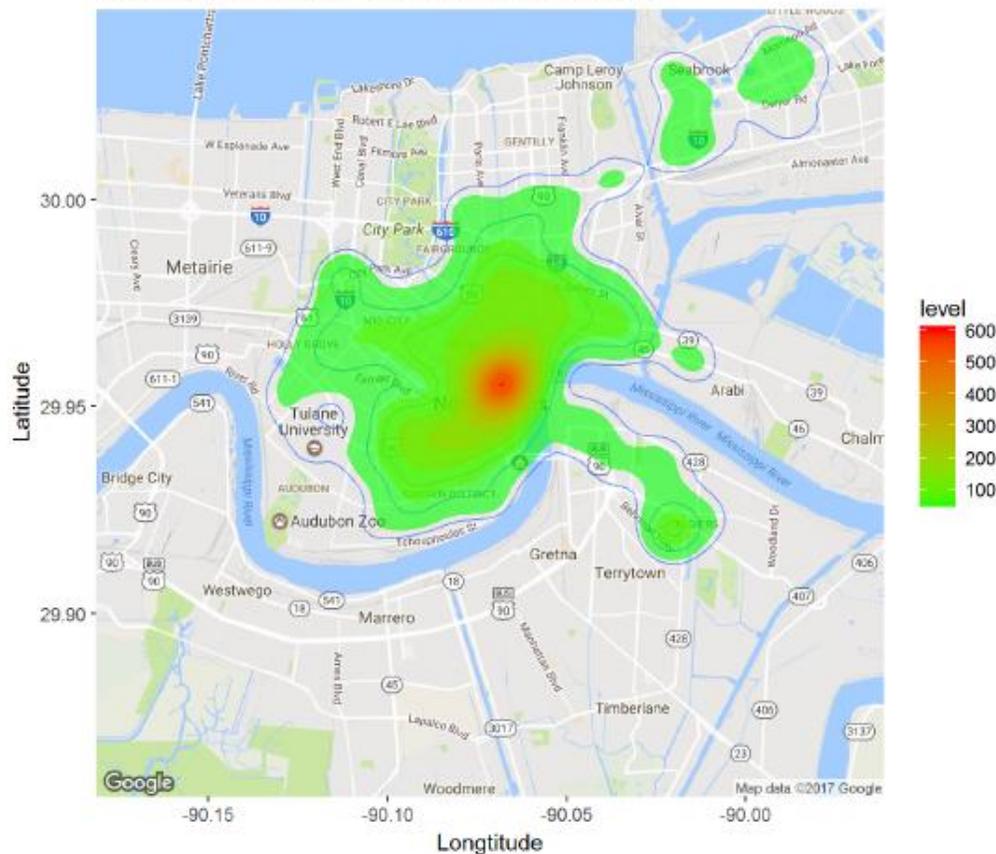


Figure 7: Heat map of locations where New Orleans Emergency Medical Services received heat-related calls for service in 2015 and 2016.

Air Quality

Congress passed the Clean Air Act (CAA) in 1970 to protect the public's health and welfare from the potential effects of air pollutants. The CAA requires the EPA to establish ambient air quality standards for six common air pollutants: particulate matter (also known as particle pollution), ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, and lead.

Air Quality Index (AQI) - The AQI is an index for reporting daily air quality. This measure reflects how clean or polluted the air is and the associated health effects. The AQI focuses on health effects someone may experience within a few hours or days after breathing polluted air. EPA calculates the AQI for five major air pollutants regulated by the CAA and establishes national air quality standards to protect public health. The AQI ranges from 0 to 500. As the AQI value increases, so does the air pollution concentration and related health risks. AQI values of 50 or less represent good air quality with little health concerns, whereas an AQI value of 300 represents hazardous air pollution with high risk to affect public health. AQI values of 100 or less are considered satisfactory, and AQI values greater than 100 are considered unhealthy for special population groups and to all as levels continue to increase.

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51 to 100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health alert: everyone may experience more serious health effects.
Hazardous	301 to 500	Health warnings of emergency conditions. The entire population is more likely to be affected.

Figure 8: The Air Quality Index table provides each of the 6 levels of health concern and their meaning.⁵⁵

Air quality is predicted to worsen with rising temperatures, causing and worsening chronic health conditions. In particular, particulate matter and ozone levels will increase with heat and air stagnation periods. Heat, methane emissions, and other chemicals present in the air are all factors that contribute to ozone formation. New Orleans, with its proximity to refineries and chemical plants, already receives an unhealthy dose of toxic chemicals, which are ripe for ozone formation.

Particulate matter (PM) is a mixture of small, solid, and liquid particles from different compounds within the environment. PM levels rise with air stagnation episodes that accompany periods of heat. Other factors that are conducive to particulate matter presence include a high concentration of industrial manufacturing areas, proximity to oil refining, combustion, and diesel vehicle traffic. Wildfires, which are more likely with higher temperatures, also release more particulate matter into the air.⁵⁶

Air pollution is costly to communities and citizens alike. In 2002 across America, 288 million Americans were exposed to unsafe ozone smog levels, based on the EPA's standard at that time of 80 ppb. Air pollution during this period led to 795 premature deaths, 4,150 hospitalizations, and

⁵⁵ Air Now. August 31, 2016. Air Quality Index. <https://www.airnow.gov/index.cfm?action=aqibasics.aqi>

⁵⁶ American Lung Association. Particle Pollution. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/outdoor/air-pollution/particle-pollution.html>

365,000 outpatient visits. Furthermore, 485 people visited the ER for asthma, and ER respiratory-related visits totaled 8,459. The total health costs were \$207 million; which is a normalized cost of \$46,449 per 1,000 people.⁵⁷

Air Quality Vulnerability Factors

Age, health status, lifestyle, socio-economic and environmental factors may determine vulnerability to poor air quality. These factors may also interact with individual susceptibility, exposure and limited adaptive or coping capacity to take proper precautions to protect from harmful air.

Environmental Factors: Where New Orleanians live, work, and play can determine the amount of exposure they have to factors that put one at a greater risk of being affected by air pollution.

An area pre-disposed to poor air quality can be as small as a city block or as large as several neighborhoods, depending on the magnitude of the source of compromised air quality. Often, exposure to compromised air quality falls along racial and socioeconomic lines, where poor, black communities are disproportionately exposed.⁵⁸

Chemicals already present in the air are the most important factor in determining which neighborhoods are predisposed to poor air quality, when associated with climate change. Climate change creates heat that reacts with chemicals already present in the environment which can worsen overall air quality.⁵⁹

Air stagnation periods associated with climate change keeps chemicals present in an area for longer periods of time and lengthen exposure. Air stagnation refers to a period when an air mass remains over a geographic area for an extended time. This phenomenon normally occurs when there is no rain or winds to clean or move the dirty air. For example, on January 13, 2017, the NWS issued an air stagnation advisory for southeastern Washington and northeastern Oregon. Forecasters expected conditions of light winds and limited mixing in the air, trapping pollution at ground level where people breathe.⁶⁰

Areas surrounding industrial facilities and highways with increased diesel traffic are hotspots for a ready-made cocktail of chemicals. When Chalmette Refinery has an accident, releasing toxic emissions into the air, those chemicals can be blown into New Orleans, impacting the air quality our residents breathe. New Orleanians living close to the railroad tracks face higher exposure rates as rail cars transporting chemicals manufactured along the Mississippi River travel by and have occasional accidents, releasing chemicals into their neighborhoods.⁶¹

⁵⁷ LDH. (2012). Saint Louis Encephalitis. Retrieved from http://ldh.louisiana.gov/assets/oph/Center-PHCH/Center-CH/infectious-epi/Annuals/LaIDAnnual_EncephalitisSLE.pdf

⁵⁸ Pacific Institute. (2012, July). Social Vulnerability to Climate Change in California. Retrieved from <http://www.energy.ca.gov/2012publications/CEC-500-2012-013/CEC-500-2012-013.pdf>

⁵⁹ American Lung Association. (2017). Health Effects of Ozone and Particle Pollution. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/sota/health-risks/>

⁶⁰ Q13 News Staff. January 14, 2017. Air stagnation advisory for parts of Washington, Oregon <http://q13fox.com/2017/01/14/air-stagnation-advisory-for-parts-of-washington-oregon/>

⁶¹ Louisiana Bucket Brigade. (2016, August 28). *iWitness Pollution Map*. Retrieved from <http://map.labucketbrigade.org/reports>

Additionally, the nitrous dioxide found in diesel emissions is ripe for ozone formation with increased heat. Diesel emissions are not the only cause for worry, as even dust and debris from tires and brake pads can contribute to particulate matter. Pollution near highways is linked to asthma attacks, decreased lung function, and premature death from cardiovascular disease.⁶²

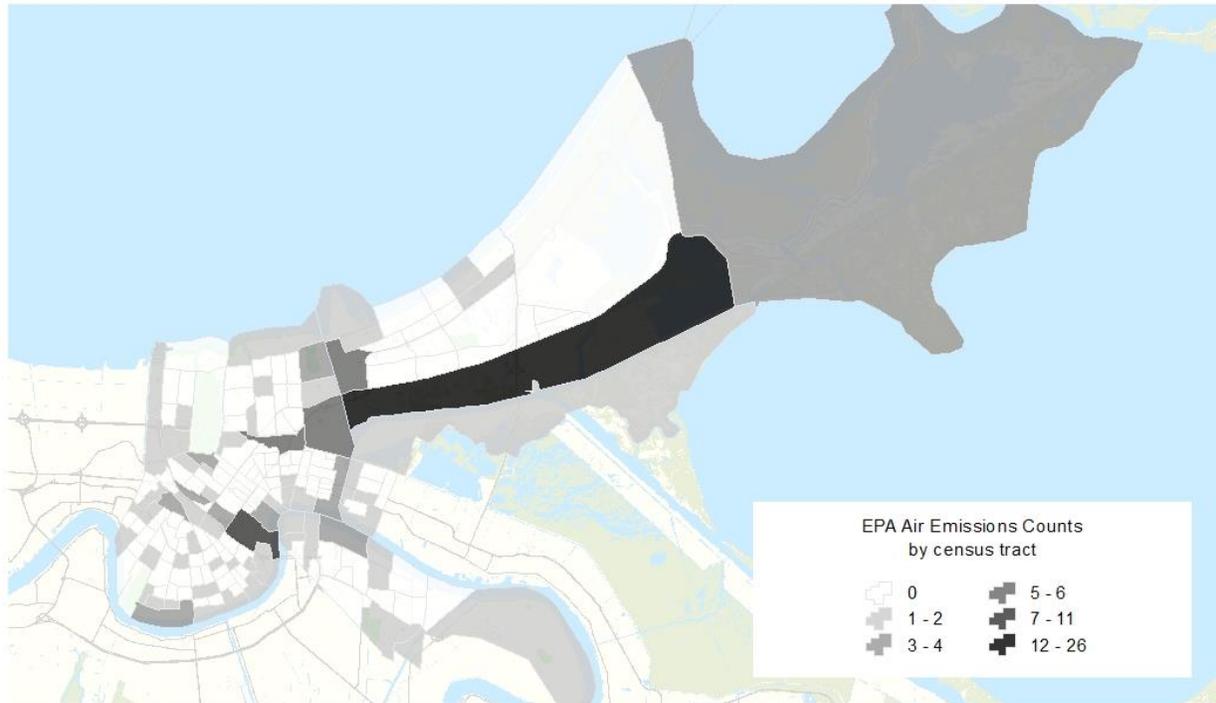


Figure 9: Map of census tracts where the facilities release air emissions as regulated by EPA.

⁶² <http://www.lung.org/our-initiatives/healthy-air/outdoor/air-pollution/highways.html>



Figure 10: Map of census tracts where EPA reported toxic releases in 2014-2016.

Lifestyle Factors: Those who work outside face the natural elements such as sun, rain, wind, nitrous oxide, and air pollutants. Working outside increases an individual’s exposure, especially impacting those working near chemicals, like those transported through New Orleans’ railroads.

Enjoying the great outdoors may now come with a cost. Children and adults who play and exercise outdoors make themselves more vulnerable to the health effects of air quality. Physical activity, in particular, makes people more vulnerable because the active body needs more oxygen, which leads to the breathing of more air, including pollutants than would otherwise be required.

Working on a construction site or playing soccer in the park, and related activities accompanied with exposure to the outdoors should be noted, but exposure from work or play cannot immediately compare to the amount of exposure someone living on the streets receives. The homeless spend a significant amount of time outdoors, breathing in pollution, exposed to harsh temperatures, and pests. A majority of the homeless population reside under Interstate 10 for easy access to resources and services as well as pan-handling. Inevitably, these groups face significant vehicle exhaust exposure from traffic congestion in the area. Furthermore, the homeless are not likely have easy access to medical care or networks to receive information or advice on precautions to take for protecting themselves from air pollution and for getting help when a medical condition arises.⁶³

⁶³ Pacific Institute. (2012, July). *Social Vulnerability to Climate Change in California*. Retrieved from <http://www.energy.ca.gov/2012publications/CEC-500-2012-013/CEC-500-2012-013.pdf>

Health Factors: Current health status may determine how much a person will be affected by adverse air quality. Respiratory and cardiovascular health, as well as diabetes status, can make a patient more susceptible to further health complications from breathing dirty air.

Having diminished respiratory system capacity from a respiratory disease, one's body is already hindered in handling the further stress that air pollution places on it. Asthma and allergies, in particular, interfere with breathing and may be worsened with polluted air. Asthma is a financial burden, costing communities, directly and indirectly, \$2,600 for just one case, which may be prevented or limited through clean air policies.⁶⁴ Asthma – and related illnesses – may also result in lost productivity from missed days at work and school.

Some research suggests that women are particularly vulnerable to air pollution because it may affect women's reproductive health. Research also suggests that those with obesity may face higher risk from ozone pollution.⁶⁵

Studies on the effects of air pollution by race have suggested that African Americans may be at greater risk of health effects from hazardous pollutants.⁶⁶ Furthermore, those with low socioeconomic status have an increased risk of premature death from air pollution and higher rates of asthma.⁶⁷ The Louisiana Department of Health reports that the age-adjusted aggregate rates of individuals seeking emergency department care for asthma is 9.2 per 1000 residents for black residents while this rate is 1.8 per 1000 residents for white residents in New Orleans. The rates significantly differ for both races depending on the zip code where they live. Zip codes closer to the downtown area and highly populated areas have significantly higher rates of emergency department visits for asthma.

Patients with cardiopulmonary and cardiovascular disease are more susceptible to poor air quality because their systems struggle to deal with the added stress of breathing in pollutants.⁶⁸

Just as ozone and particulate matter exposure have been linked to causing related health problems, they may also worsen these existing conditions. Breathing in harmful pollutants has also been linked to the occurrence of an abnormal heartbeat.⁶⁹ Those with diabetes also face a greater risk of suffering harm from particulate pollution because of their already elevated risk of cardiovascular disease.⁷⁰

⁶⁴ U.S. Global Change Research Program. (2016). The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Retrieved from <https://health2016.globalchange.gov/>

⁶⁵ American Lung Association. (2017). Health Effects of Ozone and Particle Pollution. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/sota/health-risks/>

⁶⁶ American Lung Association. (2017). Disparities in the Impact of Air Pollution. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/outdoor/air-pollution/disparities.html>

⁶⁷ American Lung Association. (2017). *Disparities in the Impact of Air Pollution*. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/outdoor/air-pollution/disparities.html>

⁶⁸ Pacific Institute. (2012, July). Social Vulnerability to Climate Change in California. Retrieved from <http://www.energy.ca.gov/2012publications/CEC-500-2012-013/CEC-500-2012-013.pdf>

⁶⁹ American Lung Association. (2017). Health Effects of Ozone and Particle Pollution. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/sota/health-risks/>

⁷⁰ American Lung Association. (2017). Health Effects of Ozone and Particle Pollution. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/sota/health-risks/>

Breathing in air pollution can cause respiratory and cardiovascular illnesses, as well as premature death, associated with diminished lung function. Moreover, air pollution can also worsen existing respiratory and cardiovascular conditions.⁷¹ It may impede the development of children and adolescents and could harm reproductive health. With multiple pollutants in the air, their effect is compounded; for example, one may be more reactive to ozone pollution with the presence of other pollutants in the air.⁷²

Short and long term exposure alike have serious detrimental health effects. Illnesses can range from asthma attacks to chronic respiratory conditions. Immediate respiratory problems include asthma attacks, shortness of breath, increased risk of respiratory infections, and aggravated conditions for those with chronic respiratory problems.⁷³ The intensity of asthma attacks and corresponding hospitalization rates increase with higher air pollution. Those with allergies may experience worsened reactions with the presence of high ozone and particulate matter levels.⁷⁴

Children's respiratory systems are particularly affected due to higher exposure and limited physiological development. Children, who are still developing physiologically, may have their lung function growth impeded by exposure to air pollution. After birth, 80% of the lungs' alveoli (tiny air sacs that take oxygen into the body) develop. Dirty air impedes this development and can also cause infections, which children's immune systems are not as well-equipped to fight. Furthermore, children often face greater exposure while playing outside and breathe more frequently, taking in more pollution over time. Later in life, these children who grow up with pollution exposure may not have fully developed lungs which may never function at their maximum capacity.⁷⁵

Ozone and PM affect not only the respiratory system but the cardiovascular system as well. Breathing in both compounds has been linked to an elevated risk of a cardiac arrhythmia, which in turn, is linked to an increased risk of stroke, heart attack, congestive heart failure, and premature death. Seniors and those with existing cardiovascular conditions are the most at risk for heart attacks related to pollution. Additionally, high ozone days are associated with more emergency room visits for heart disease.⁷⁶

Studies have shown that ozone and particulate matter increases the risk of premature death.⁷⁷ Higher ozone levels have been associated with an increased risk of death from respiratory illness. Chronic exposure to PM pollution can shorten life by as much as one to three years.⁷⁸ Evidence

⁷¹ U.S. Global Change Research Program. (2016). *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Retrieved from <https://health2016.globalchange.gov/>

⁷² American Lung Association. (2017). *Ozone*. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/outdoor/air-pollution/ozone.html>

⁷³ U.S. Global Change Research Program. (2016). *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Retrieved from <https://health2016.globalchange.gov/>

⁷⁴ American Lung Association. (2017). *Ozone*. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/outdoor/air-pollution/ozone.html>

⁷⁵ American Lung Association. (2017). *Children and Air Pollution*. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/outdoor/air-pollution/children-and-air-pollution.html>

⁷⁶ American Lung Association. (2017). *Ozone*. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/outdoor/air-pollution/ozone.html>

⁷⁷ American Lung Association. (2017). *Ozone*. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/outdoor/air-pollution/ozone.html>

⁷⁸ American Lung Association. (2017). *Particle Pollution*. Retrieved from <http://www.lung.org/our-initiatives/healthy-air/outdoor/air-pollution/particle-pollution.html>

also suggests that PM exposure could cause cancer and that women and their reproductive organs may be especially affected because ozone pollution may harm infants who may be born with lower birth rates and decreased lung function.

Vectors

Vectors are insects or animals that transmit diseases such as ticks, mosquitoes, and rodents. Warmer weather and increased precipitation make New Orleans a more favorable habitat for these pests. During climate change, not only will vector populations increase, but their disease transmission season will also lengthen.⁷⁹

In south Louisiana, the most common and threatening vector is the mosquito. Orleans Parish is home to at least three types of mosquitoes: *Aedes aegypti*, *Aedes albopictus* and *Culex quinquefasciatus*. The *Ae. aegypti* is responsible for the transmission of dengue, yellow fever, and Zika viruses. The *Ae. albopictus* is known to transmit dengue and chikungunya viruses; but has also proven experimentally to be a competent vector to transmit other arboviruses such as yellow fever, West Nile, and Zika viruses. *Culex quinquefasciatus* or southern house mosquito is the primary vector for St. Louis encephalitis and West Nile viruses.

Vectors pose a bigger threat due to the diseases they transmit, in particular, those that have been found in Louisiana: West Nile fever, yellow fever, Lyme disease, dengue fever, and potentially Zika virus disease.

Vector-transmitted epidemics, such as the recent Zika virus disease outbreak, will become more frequent as vector populations increase. Vector-borne disease outbreaks claim lives and cost local communities' valuable resources. The West Nile virus outbreak of 2002 in Louisiana caused 24 premature deaths, 204 hospitalizations, 135 emergency room visits, and 5,800 outpatient visits. The total health-related costs reached \$207 million; which is a normalized cost of \$46,449 per 1,000 people.⁸⁰

Mosquito populations thrive in warm climates. Frequent rains make for flower pots and wheelbarrows full of water, which are prime breeding grounds for mosquito eggs. The warmer weather will also lengthen mosquito season or the period when mosquitoes bite people and can transfer disease.⁸¹

In addition to higher populations from warmer, wetter weather, increased flooding will displace rodents from their habitats and bring them into closer and more frequent contact with humans. Thus, rodent-borne diseases will also be more likely to be transmitted to humans.

Vector Vulnerability Factors

Lifestyle Factors: Louisiana is nicknamed the *sportsman's paradise* because of its abundant and diverse wildlife. From fishing to hunting, from hiking to sightseeing, Louisiana offers a broad

⁷⁹ U.S. Global Change Research Program. (2016). *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Retrieved from <https://health2016.globalchange.gov/>

⁸⁰ Natural Resources Defense Council. (2011, November). *Health and Climate Change: Accounting for Costs*. Retrieved from <https://www.nrdc.org/sites/default/files/accountingcosts.pdf>

⁸¹ Climate Institute. (2007-2010). *Human Health*. Retrieved from <http://climate.org/archive/topics/health.html>

range of outdoor activities and adventures for all ages. In the warmer months, Louisiana offers water environments for charter-fishing, rodeo fishing, crabbing, shrimping or for sailing among the Gulf of Mexico's beautiful islands. In the winter months, Louisiana offers hunters a wide variety of opportunities from pursuing waterfowl and rabbits to the more exotic deer and alligators. Other outdoor activities available to locals and tourists include bird and wildlife watching, camping and picnicking, and photography. Due to its unique environment, more than 7.3% of New Orleanians work outdoors. This population group is more likely to encounter vectors and therefore, have a greater chance of disease transmission.

New Orleans is also known as the Festival Capital of the world, celebrating approximately 130 festivals throughout the year. In 2014, New Orleans attracted over 9.5 million visitors from all over the world.⁸² The influx of tourists in and out of the New Orleans area also poses a risk of introducing vector-borne illnesses into the community.

Health Factors: Individual current health status is a crucial factor in determining vulnerability.

Zika

The Zika virus epidemic, which has garnered much media attention since 2015, was first identified in Uganda in 1947 and has since spread to Brazil and in recent months, has reached the U.S. States of Florida and Texas. The primary vector for Zika virus is the *Ae. aegypti* mosquito but the *Ae. albopictus* is also capable of carrying and transmitting the disease.

For the one in five infected individuals who display symptoms, they may experience fever, rash, joint pain, and conjunctivitis (red eyes). The Zika virus can also be transmitted to a fetus during a woman's pregnancy and may cause severe congenital disabilities, such as microcephaly and other serious brain malformations.⁸³ Zika virus can also be transmitted sexually from men and women to their partners.

As of November 10, 2016, the Louisiana Department of Health reported 39 total confirmed travel-related cases of Zika virus disease throughout the State; 15 of them in the Orleans Parish.⁸⁴

Chikungunya

Chikungunya means "that which bends up" in the Makonde language of Africa. In 1952, the first case of Chikungunya was detected in the Makonde Plateau between Mozambique and Tanzania. Even though chikungunya is most prevalent in Africa, Asia, and the Indian subcontinent, since 2007 there have been outbreaks in Europe and the Americas.⁸⁵

The Chikungunya virus causes fever and severe joint pain, which is often debilitating and may vary in duration, typically occurring over weeks but can last as long as several years. Other symptoms include muscle pain, nausea, fatigue, and rash. The mortality rate for the virus is approximately 1 in 1,000, with most complications occurring with the elderly and those with

⁸² New Orleans Festival Guide. (April, 2015). Retrieved from

<http://www.neworleansonline.com/tools/infographics/new-orleans-festivals-2015.html>

⁸³ Center for Disease Control. (2016, August 31). *Zika Virus*. Retrieved from <https://www.cdc.gov/zika/>

⁸⁴ Louisiana Department of Health. (November 10, 2016). Louisiana reports additional West Nile and Zika virus cases. Retrieved from <http://www.dhh.louisiana.gov/index.cfm/newsroom/detail/3990>

⁸⁵ World Health Organization. (April 2016). Chikungunya. Retrieved from <http://www.who.int/mediacentre/factsheets/fs327/en/>

chronic medical conditions. In 2015, the LDH reported seven cases of probable or suspected Chikungunya.⁸⁶ This disease is endemic in the Caribbean and other parts of the world and could potentially spread to New Orleans area.⁸⁷ The likelihood exists because the two species of mosquitoes responsible for the local transmission of Chikungunya are found in South Louisiana: *Ae. aegypti* and *Ae. albopictus*.

Yellow Fever

More than 41,000 people died in New Orleans from yellow fever from 1817 to 1905.⁸⁸ New Orleans has since been able to control yellow fever through modern technology such as vaccinations, better drainage systems, and city-controlled mosquito spraying. The *Ae. aegypti* or yellow fever mosquito is the responsible vector for transmitting the disease within a population. Since the *Ae. aegypti* mosquito is one of the most common mosquitoes in Louisiana, the potential for re-emerging epidemics remain high.

Most of those infected with the yellow fever virus will exhibit a range from mild to no symptoms at all. Symptoms include fever, nausea, muscle pains, and headaches. Fifteen percent of symptomatic cases develop into a severe form of the disease which includes jaundice, severe fever, and bleeding organ failure.⁸⁹ Yellow fever is not currently found in the U.S. and is mostly prevalent in Africa and South America. Travel related cases could result in local transmission and permanent re-introduction of this disease back into the area.

Lyme Disease

Even though Lyme disease was first recognized in the 1970s, reports of similar clinical cases have been described since the late 1800s. The disease was named after Lyme, Connecticut, where an outbreak of the disease was first reported. The signs of illness included swollen knees, paralysis, skin rash, headaches, and severe chronic fatigue. In 1981, Willy Burgdorfer established the connection between the deer tick and the disease. He discovered that the deer ticks carry the bacteria that causes the disease. The medical community honored Willy Burgdorfer by naming the bacteria known to cause Lyme disease *Borrelia burgdorferi*.⁹⁰

Ticks are the primary vectors that transmit Lyme disease. Fifty percent or more of infected patients that are symptomatic experience rash, fever, headaches, and fatigue. If left untreated, severe symptoms may develop including loss of facial movement ability, joint pains, severe headaches, heart palpitations, and more. Even with treatment, some people may continue to experience joint pain, fatigue, and memory problems for at least six months, with possible recurring symptoms for years.⁹¹ In the early stages, blood tests of infected patients often read negative.⁹² Therefore,

⁸⁶ Louisiana Department of Health. (n.d). Fight the Bite. Retrieved from <http://new.dhh.louisiana.gov/index.cfm/page/1930>

⁸⁷ Center for Disease Control. (2015, November 16). *Chikungunya Virus*. Retrieved from <http://www.cdc.gov/chikungunya/>

⁸⁸ Louisiana Division New Orleans Public Library. (2003). Yellow Fever Death in New Orleans, 1817-1905. Retrieved from <http://nutrias.org/facts/feverdeaths.htm>

⁸⁹ Center for Disease Control. (2016, July 12). *Yellow Fever*. Retrieved from <https://www.cdc.gov/yellowfever/symptoms/index.html>

⁹⁰ Bay Area Lyme Foundation. (2017). History of Lyme Disease. Retrieved from <http://www.bayarealyme.org/about-lyme/history-lyme-disease/>

⁹¹ Center for Disease Control. (2016, August 19). *Lyme Disease*. Retrieved from <http://www.cdc.gov/lyme/index.html>

⁹² Center for Disease Control. (2016, August 19). *Lyme Disease*. Retrieved from <http://www.cdc.gov/lyme/index.html>

diagnosis is primarily based on tick exposure and symptoms. However, because Lyme disease cases are rare in the South, doctors may not be able to identify and treat the disease immediately.

In 2012, Louisiana reported three cases of Lyme disease. Lyme disease is more prevalent in the Northeast however, with climate change, vector habitat may extend south towards to Orleans Parish in future.

Dengue Fever

In 1779-1780, the first recognized dengue epidemics occurred almost simultaneously in Asia, Africa, and North America. These epidemics indicate that the virus and vector have been distributed worldwide for many years before the outbreaks.

Dengue fever is a mosquito-borne infection, accompanied by symptoms including fever, headache, vomiting, rash, and joint pain. Most people, 80%, do not experience symptoms or experience only mild ones.⁹³ However, few cases can develop into the severe dengue hemorrhagic fever, which can be fatal. Dengue fever is not prevalent in the U.S. but is endemic in Central and South America, as well as in parts of Africa and Asia.⁹⁴ In 2015, the Louisiana Department of Health reported five probable or confirmed cases of dengue fever.⁹⁵ With climate change, mosquito patterns could shift to import the disease to New Orleans with greater frequency.

West Nile Virus

West Nile was originally isolated and identified in 1937 in the West Nile district of Uganda. Since then, the virus has widely spread throughout the world and can be found in Africa, Middle East, Europe, Central Asia, and North America. West Nile was first reported in New York in 1999. Subsequently, the virus has spread to 47 of the contiguous U.S. States.

West Nile virus is the most common mosquito-borne illness in the U.S. and is found in Louisiana. As of November 10, 2016, the Louisiana Department of Health had reported 45 West Nile virus cases and one death. Out of the 45 cases, “four were asymptomatic 14 were fever cases, a mild illness; and 27 were neuroinvasive disease, a severe illness that can lead to brain damage.”⁹⁶ The total includes one death.⁹⁷ Symptoms include headache, body ache, joint pain, vomiting, diarrhea, rash, fatigue, and weakness. Only one in five infected people will exhibit symptoms.⁹⁸

⁹³ Reiter, P. (2009, May 6). *Yellow Fever and Dengue: A Threat to Europe?* Retrieved from <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19509>

⁹⁴ Center for Disease Control. (2016, January 19). *Dengue*. Retrieved from <http://www.cdc.gov/dengue/index.html>

⁹⁵ Louisiana Department of Health. (n.d). Fight the Bite. Retrieved from <http://new.dhh.louisiana.gov/index.cfm/page/1930>

⁹⁶ Louisiana Department of Health. (November 10, 2016). Louisiana reports additional West Nile and Zika virus cases. Retrieved from <http://www.dhh.louisiana.gov/index.cfm/newsroom/detail/3990>

⁹⁷ Louisiana Department of Health. (November 10, 2016). Louisiana reports additional West Nile and Zika virus cases. Retrieved from <http://www.dhh.louisiana.gov/index.cfm/newsroom/detail/3990>

⁹⁸ Center for Disease Control. (2016, August 30). *West Nile Virus*. Retrieved from <http://www.cdc.gov/westnile/index.html>

Saint Louis Encephalitis

In 1933, an unprecedented outbreak of over 1,000 clinical cases of encephalitis of unknown origin devastated the city of Saint Louis, Missouri and neighboring towns.⁹⁹ Researchers identified the cause of the outbreak to be a virus transmitted to humans mainly via the bite of an infected mosquito. The virus and encephalitis disease acquired their names after the location of the first outbreak in Saint Louis, Missouri (St. Louis encephalitis virus - SLEV).

St. Louis encephalitis is now ubiquitous in most of the U.S. An average of 128 cases are reported annually throughout the nation. The LDH reported sporadic cases in the 1960s and 1970s. In 1980, the LDH reported the first outbreak in New Orleans, with 12 cases, and a second outbreak in 1994 with 16 cases. Notably significant, the LDH also reported an outbreak in Jefferson Parish in 1998.¹⁰⁰

As less than 1% of St. Louis encephalitis infections are clinically apparent, the majority of cases are undiagnosed. Sudden symptoms include fever, headache, dizziness, nausea, and malaise. Most patients recover after a week, but some develop central nervous system infections including stiff neck, confusion, disorientation, dizziness, tremors, and unsteadiness. Severe cases may develop encephalitis and coma.

Assess Public Health Interventions

The NOHD conducted three community meetings in collaboration with the Gulf Coast Center for Law and Policy for New Orleans neighborhoods that pose the greatest risk with climate change. The first meeting was conducted on April 15, 2017 for the New Orleans East community at the Milne Recreation Center. The second meeting was conducted on April 22, 2017 for the New Orleans' Treme, Saint Roch, and 7th Ward communities at the Sojourner Truth Neighborhood Center and the third meeting was held at the Ashe Cultural Arts Center for Central City on May 27, 2017. These community conversations on climate change discussed the impacts of climate change in their communities and allowed participants to provide input on how to develop solutions and prevention techniques.

⁹⁹ LDH. (2012). Saint Louis Encephalitis. Retrieved from http://ldh.louisiana.gov/assets/oph/Center-PHCH/Center-CH/infectious-epi/Annuals/LaIDAAnnual_EncephalitisSLE.pdf

¹⁰⁰ LDH. (2012). Saint Louis Encephalitis. Retrieved from http://ldh.louisiana.gov/assets/oph/Center-PHCH/Center-CH/infectious-epi/Annuals/LaIDAAnnual_EncephalitisSLE.pdf

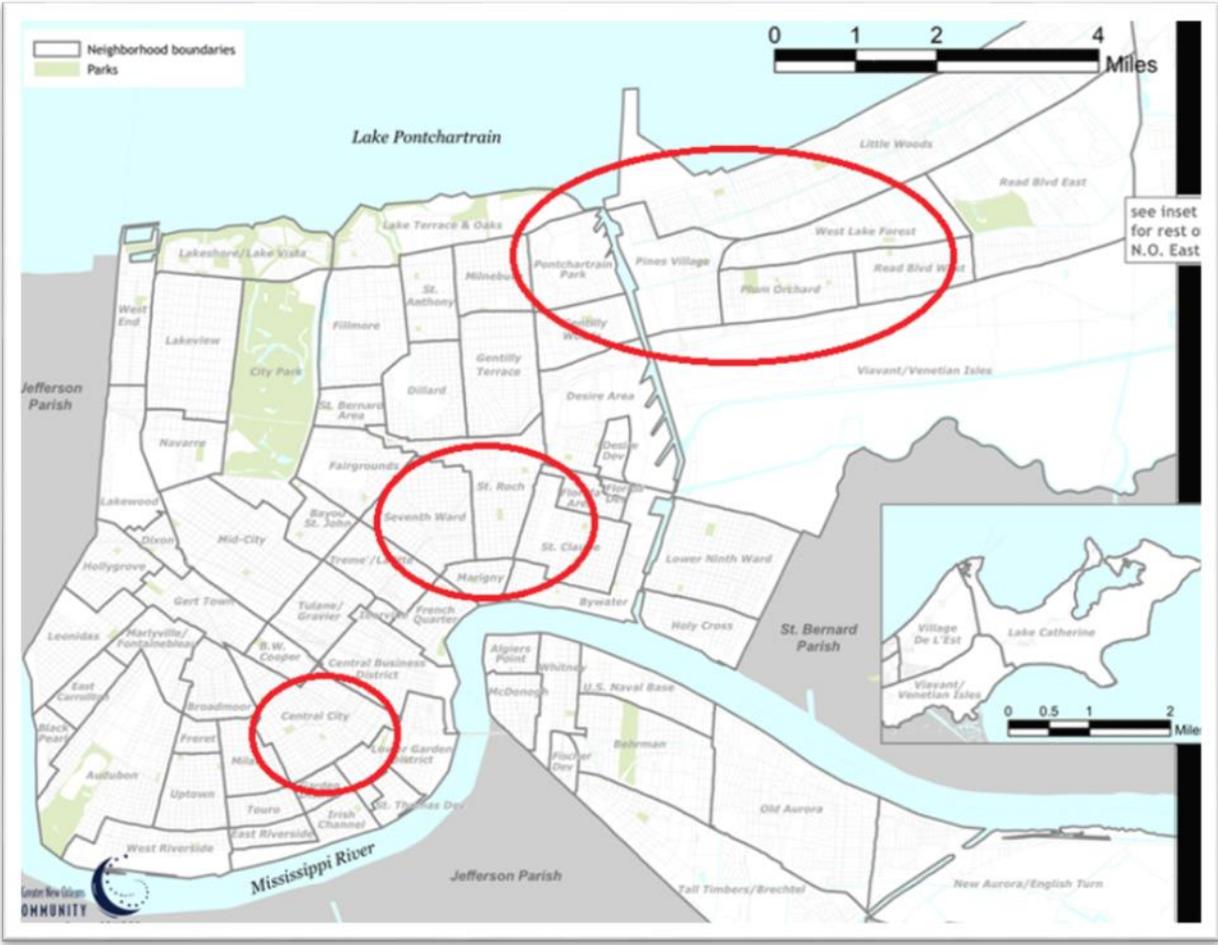


Figure 11: Community conversation locations on climate change.

The following recommendations were gathered during our community climate conversations with Gulf Coast Center for Law and Policy.

Community Recommendations

Community participants indicated they wanted more education on topics of interest affecting South Louisiana; greater governmental regulation and accountability of environmental concerns as well as healthy and safe living conditions for renters; increased investment in public spaces and services such as parks and recreation, public transportation and housing; and lastly, incentivize private industry to become more environmentally responsible by incorporating green construction and sustainable building throughout the building’s life cycle.

Education

- Provide accessible information on home weatherization to maximize energy efficiency. Home weatherization not only saves money but can improve the comfort of the home. Home weatherization includes air sealing, insulating, moisture-controlling, and ventilating the home.

- Creating and disseminating work-force guidelines for employees' rights to return after city-wide evacuation and mandating employers to set reasonable demands for employees' presence during a natural disaster or emergency.
- Launch awareness campaigns on how to safely and effectively prevent the spread of mosquito-borne diseases as well as incorporating climate change into our schools to educate youth on the potential consequences for our region.
- Provide opportunities for citizens to engage with elected officials as well as educating residents on how to develop the necessary skills, motivation, knowledge, and values to make a difference in their community by participating in both political and non-political actions.

Regulation & Accountability

- Ensure industry health and environmental compliance as well as improving standards and practices that can potentially be detrimental to the community over time.
- Incentivize the transition from fossil fuels to renewable energy to reduce carbon-emitting natural gas activities.
- Protect renters from landlords' exploitative practices and ensure rental housing provide safe and comfortable living conditions.
- Enforce restrictions on illegal dumping while educating the public about the human health impacts, environmental damages, and discourage economic development as well as the criminal charges involved from illegal dumping.

Investment into Public Spaces

- Increase investment in green public spaces by creating additional parks in remote or isolated areas and provide natural shaded areas (trees) within parks.
- New Orleans Recreation Development Commission (NORDC) facilities and New Orleans Public Library (NOPL) extend hours of operation, particularly during the weekend and during periods of extreme weather. Access to pools could be extended to Sundays and other parks could install splash parks or other cooling options. Libraries and NORDC facilities should expand public service programming. These facilities have strong ties within the community and are well connected with local groups, nonprofits, schools and business. These relationships need to be strengthened to address community specific needs.
- Invest in creating spaces that bring community members together such as community gardens. Community gardens help to unite neighbors; connect children to nature; beautify neighborhoods by decreasing blighted properties; may serve as rain water detention to avoid flooding; keep away snakes, rodents and other pests; make living are safer by keeping people out within the community and provide healthy food especially in food desserts.
- Improve drainage to avoid flooding and standing water and fill in pot holes to avoid creating mosquito breeding sites.

Investment on Public Services

- Increase reliability public transportation reliability such as adhering to Regional Transit Authority (RTA) schedules and ensures bus stops and streetcar stops provide protection from the elements i.e. shade and cover.
- Provide public, affordable, accessible, and safe housing in particular during emergencies or to those families affected by natural disasters.

- Provide real-time health information on hot days, poor air-quality days, or during emergencies.
- Provide safe and accessible healthcare options.
- Invest in highway sound barriers such as acoustic walls to reduce the noise created by high traffic areas. Excessive and ceaseless noise has irreversible and detrimental effects to nearby residents' human health.
- Subsidize insect repellent.

Private Investment Incentives

- Financial incentives for building weatherization and installation of renewable energy technology, including solar panels especially for rental properties.

GCCLP's Recommendations

- Building trust across communities. Residents lack trust in government officials' ability and willingness to protect their health and well-being. Hurricane Katrina left residents weary of where the City's interests lay both during emergencies (e.g. how and when the decision to mandate an evacuation is made) and after (e.g. who and what gets prioritized during reconstruction).
- Define the word "safe." Many residents expressed not feeling safe to use public spaces, particularly due to crime and violence. The City should reach out to communities to better understand what would make them feel safe, and whether "safe" refers to added police protection and surveillance, improved lighting, or organized neighborhood groups.
- Invest in community cohesion. The City should support neighborhood groups and networks with physical, financial, and educational resources. Strengthened community networks better equip communities to endure extreme weather events (e.g. people with air conditioning in their homes can invite neighbors into their homes during heat waves). The City's sustained relationships with these community networks could also improve the City's ability to disseminate information quickly and effectively as well as organizing to conduct neighborhood activities that can benefit the entire community such as neighborhood clean-up days.
- Undertake public projects and programs that employ unemployed and underemployed populations. With high unemployment rates, the time is ripe for innovative approaches to technical skills training. Training could be provided on house weatherization while the City promotes house weatherization for residential buildings across the city via subsidies and financial incentives. The City could also partner with local organizations already doing work around weatherization, energy efficiency and renewable energy to incentivize the development and employment of this workforce.
- Educate residents about indoor air quality. It is irresponsible to promote house weatherization and insulation without ensuring that people understand factors that may be contributing to poor indoor air quality. If homes that have mold indoors are properly sealed and insulated, the reduced indoor-outdoor air exchange may actually increase residents' exposure to mold and other air-based toxins.
- Implement natural mosquito control and repellent practices and technologies. In addition to spraying for mosquitos, the City could install mosquito repellent plants like lemongrass, lavender and citronella. Additionally, the City could use more native plants to address standing water issues.

Climate and Health Adaptation Plan

The City's *Climate Action for a Resilient New Orleans* lays out strategies to reduce annual greenhouse gas pollution by 50% by 2030. Many of that actions that community members suggested are represented in the City's plan and the Health Department will continue to advocate for these changes to be implemented across the city.

In alignment with the City's Climate Action Plan, the New Orleans Health Department will make the following changes to our operations to reduce greenhouse gas pollution:

- In 2018, NOHD will develop a climate and health policy requiring all programs to recycle within the offices, use less energy by turning off lights and other equipment when not in use, reduce the number of printed materials, reduce idling times by turning vehicles off when not in use for over 10 seconds (except while in traffic), and implement sustainable contracting and procurement policies that promote of the use of local vendors that improve energy efficiency.

In addition to reducing the Health Department's greenhouse gas emissions, NOHD will provide critical information and interventions to assist vulnerable populations during extreme events and to generally prepare for climate change.

Interventions for Heat Stress

Most heat related public health interventions pertain to community heat risk awareness in the form of alert systems, social media, communications, and information on how to prevent or treat heat related syndromes. NOHD will utilize the NOLA Ready alert system to send automated texts, emails, and calls to alert New Orleanains during extreme heat events. In addition, NOHD will work with the Mayor's Office of Communications to send out a press release to inform the local media outlets of heat events. In addition to real time alerts, NOHD will increase education and awareness of the connection between climate change, heat, and health impacts to the general public, physicians, healthcare providers and at-risk individuals enrolled in the New Orleans Special Needs Registry.

In the past, NOHD has opened daytime cooling shelters which have proven not to be very effective. Based on the community conversations, transportation to these shelters has been a problem and many individuals would prefer to stay in their homes or utilize other public spaces. NOHD will advocate for access to cooling by requesting that public building such as recreation centers, pools, libraries, and churches be made available on hot days for individuals who do not have adequate access to air conditioning in their homes. Since night time temperatures play such a critical role in the body's ability to self-regulate temperature, NOHD will provide outreach to homeless populations to encourage them to seek shelter at night on warm nights.

Interventions for Air Quality

According to research, 31.3% of adults diagnosed with asthma reported behavior changes and reduced time outdoors as a result of media alerts regarding poor air quality. Among those whose physicians had advised them to avoid outdoor activities, 57% reported behavior changes and

reduced time outdoors following air quality alerts.¹⁰¹ NOHD will utilize the NOLA Ready alert system to send automated text, emails, and calls to alert New Orleansians when there is a poor air quality or ozone action day. In addition, NOHD will work with the Mayor's Office of Communications to send out a press release to inform the local media outlets of the air quality. In addition to real time alerts, NOHD will increase education and awareness of the connection between climate change, air quality, and health impacts to the general public, physicians, healthcare providers and at-risk individuals enrolled in the New Orleans Special Needs Registry.

Interventions for Mosquito-borne Illnesses

Interventions for vector-borne illnesses vary from immunization, prophylaxis, personal protective measures, and vector population management. Immunization and prophylaxis have the strongest evidence for prevention, however, for most of the vector-borne illnesses threatening New Orleans there is no United States Department of Agriculture (USDA) approved vaccines except for yellow fever. Therefore, environmental vector control strategies such as reduction in mosquito population through adulticidal and larvicidal will have the greatest impact in controlling these diseases.

The NOHD in collaboration with the New Orleans Mosquito, Termite, and Rodent Control Board (NOMTCB) will continue to provide education to the general public on ways to reduce sources of standing water where mosquitoes breed and how to protect themselves from mosquito bites. NOHD will work with community organizations that are promoting the use of green infrastructure to ensure mosquitoes are not breeding in containers such as rain barrels. NOHD will also work with healthcare providers to educate them on access to insect repellent through Medicaid and the importance of testing individuals for mosquito-borne illnesses.

¹⁰¹ U.S. Centers for Disease Control and Prevention. Evidence on Public Health Interventions to prevent the negative health effects of climate change. 2017.