



CLIMATE CHANGE IN JACKSON COUNTY

**AN EXAMINATION OF THE HEALTH
IMPACTS OF CLIMATE CHANGE**

INTRODUCTION

In July and August of 2017, a series of storms produced hazardous flooding conditions throughout multiple areas of Jackson County. For the safety of residents, multiple roads, highways, beaches, parks, and hiking trails were temporarily shut down. While no individual weather event can be linked directly to climate change, severe storms like those experienced in the summer of 2017 are typical of what is to be expected due to a changing climate.

Weather variability will most likely continue in Jackson County with climate change increasing health risks related to ecosystems and infrastructure. Therefore, the Jackson County Health Department's (JACOHD) *Climate Change Report*, identifies some of the risks, challenges to individuals, and the required responses to protect the health and wellbeing of Jackson County residents.

REPORT OVERVIEW

JACOHD's *Climate Change Report* contains information regarding the current and future risks of climate change and the potential health impacts. This information was compiled by reviewing locally issued reports and other public data.

This report is intended for community members, emergency planners, local, regional, and state governments, as well as private and community-based organizations that are interested in preparing for climate-related health risks in Jackson County.





Image Source: Jackson County Government

The JACOHD *Climate Change Report* builds a foundation for:

- Understanding how current and future climate changes will impact public health in Jackson County.
- Identifying people/places where adaptations to climate change will be needed the most in our area.
- Exploring ways we can lessen the effects of climate change while building resilience among local communities.

Local climate data comes from *Understanding Long-Term Climate Changes for Kansas City, Missouri* - a report published by Kansas City Water Services and ClimateLOOK that explains how temperature and precipitation will change for the Kansas City region based on future levels of greenhouse gas emissions (GHG).

LIMITATIONS

Health impacts associated with climate change can be difficult to predict. Global climate models cannot perfectly measure and predict each aspect of the Earth's climate. Additionally, much will depend on how well communities adapt to climate change and what steps will be taken at the local, national, and global level to mitigate contributing factors such as GHG emissions. Thus, some of the data, concepts, and recommendations featured in this report will be subject to change.



FORECASTING CLIMATE CHANGES

Climate prediction models take into consideration numerous factors that influence weather such as solar radiation, air circulation, ocean temperatures, cloud cover, etc; however, a particularly important factor is the current and future level of GHG emissions.

Scientists have developed formal emissions scenarios which indicate how temperature and precipitation can change relative to differing amounts of GHGs in our atmosphere. *Understanding Long-Term Climate Changes for Kansas City, Missouri*, highlights two of these emissions scenarios - high and moderate emissions - and the resultant climate changes that will occur by mid-century through the year 2100. The high emissions scenario represents the rate at which we are currently releasing emissions while the moderate scenario projects what will occur with a reduction in emissions.

While a reduction in GHG emissions is important for mitigating additional climate change and its effects, temperature and precipitation changes are expected to occur regardless due to the atmosphere's current levels of GHGs.

KEY FINDINGS:

For future climate, Jackson County is expected to see¹:

- An increase in average annual temperature.
- An increase in days with temperatures reaching over 105°F.
- An increase in the number of days of high precipitation (above 1.5”).
- A decrease in the number of cold days (below 65°F).
- An increase in the number of consecutive days without precipitation.

*The above projected changes are due to existing amounts of GHGs; however the scope and scale of these impacts will vary depending on the future levels of emissions.



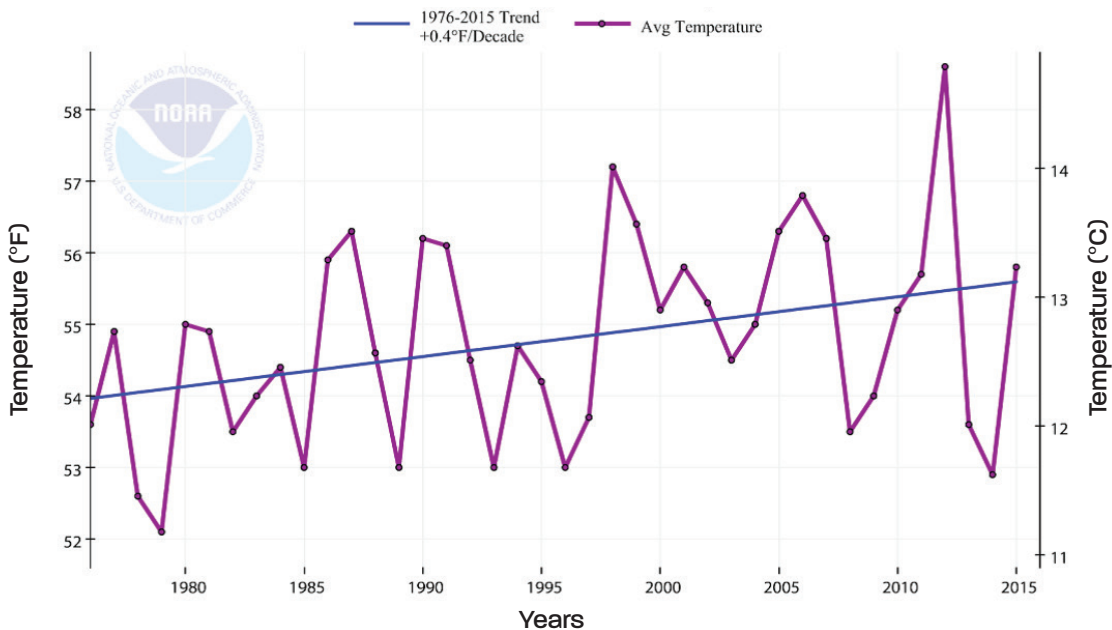
MISSOURI'S CURRENT WEATHER AND CLIMATE

Missouri has the continental climate typical of the Midwest. It's weather conditions range from frigid and windy winters to hot and humid summers. Over the course of the year, the temperature varies from 12°F to 90°F with temperatures rarely getting below 0°F or above 100°F. Precipitation varies across the state with a low of 34" in the northwest to a high of 50" in the southeast. Average annual precipitation for the entire state is around 44".²

HOW MISSOURI'S CLIMATE HAS CHANGED

Over the past four decades, the average annual temperature and amount of precipitation in Missouri has steadily increased as shown in the figures below.

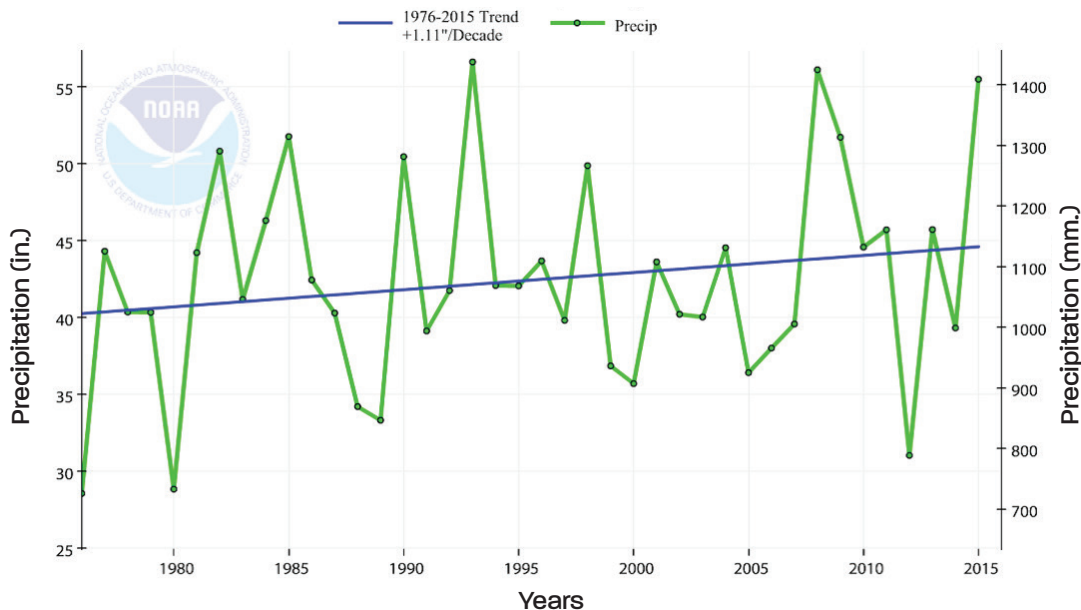
FIGURE 1. Average Temperature by Year, Missouri, 1975-2015



Source: KC Water Services & Climate Look, Understanding Long-Term Climate changes for Kansas City, Missouri, 2016

Average annual temperature in Missouri has increased from 53.6°F to 55.8°F.

FIGURE 2. Average Precipitation by Year, Missouri, 1975-2015



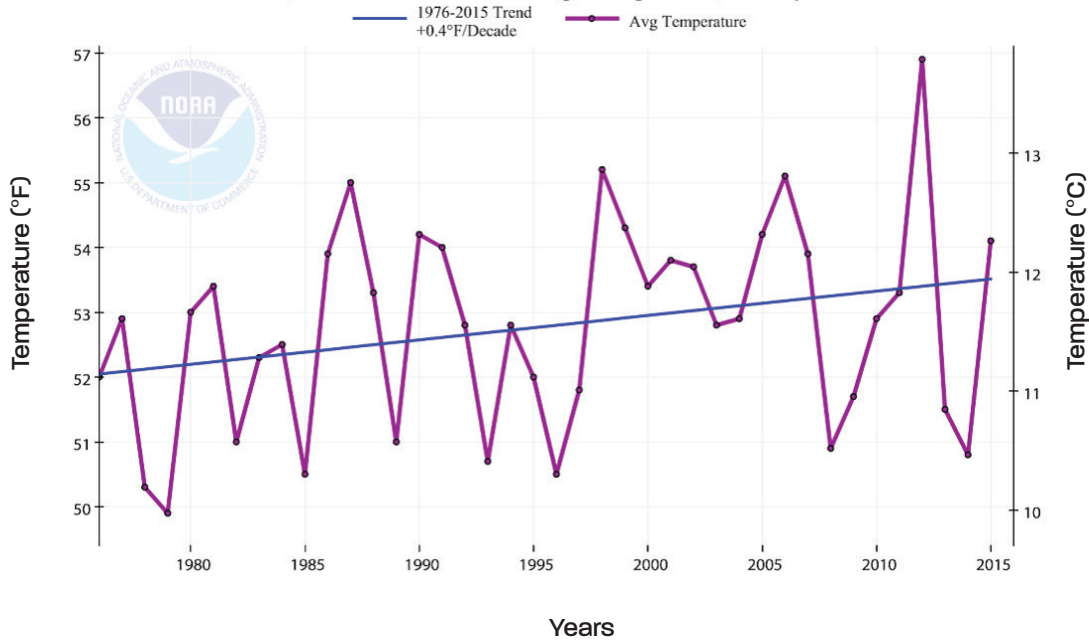
Source: KC Water Services & Climate Look, Understanding Long-Term Climate changes for Kansas City, Missouri, 2016

Average annual precipitation for Missouri statewide has increased from 40.1" to 44.5".

HOW JACKSON COUNTY'S CLIMATE HAS CHANGED

Missouri's Climate Division 1, which includes Jackson County, has also seen an increase in annual temperatures and amount of precipitation as shown in the figures below.

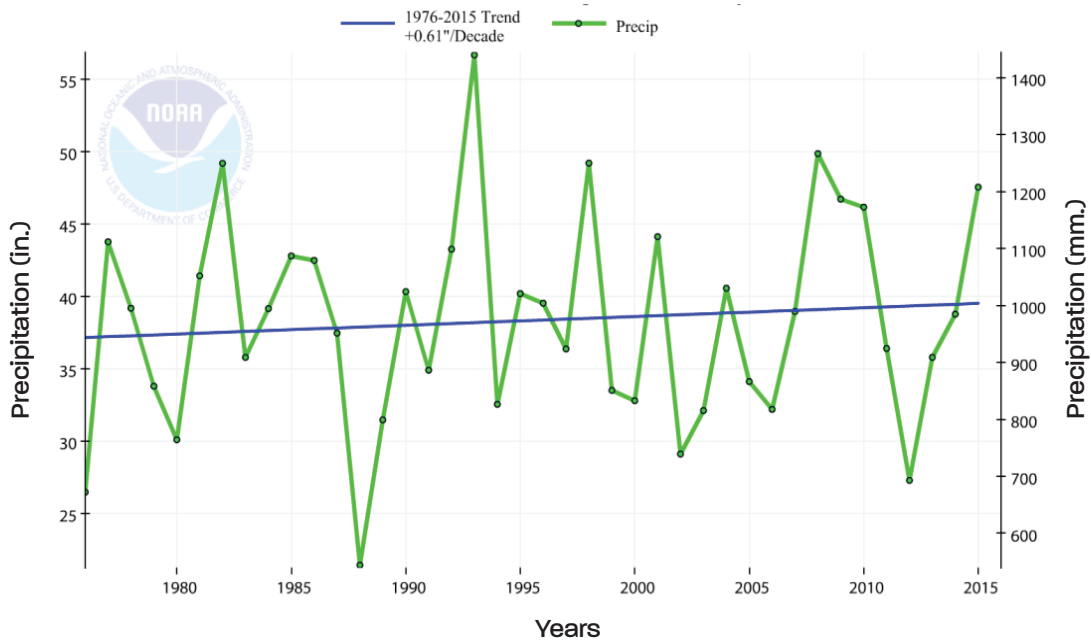
FIGURE 3. Average Temperature by Year, Missouri Climate Division 1, 1976-2015



Source: KC Water Services & Climate Look, Understanding Long-Term Climate changes for Kansas City, Missouri, 2016

Average annual temperature for Missouri Climate Division 1 has increased from 52°F to 54.2°F.

FIGURE 3. Average Precipitation by Year, Missouri Climate Division 1, 1976-2015



Source: KC Water Services & Climate Look, Understanding Long-Term Climate changes for Kansas City, Missouri, 2016

Average annual precipitation for Missouri Climate Division 1 has increased from 37.5" to 40.0".



PROJECTED CLIMATE CHANGES FOR THE JACKSON COUNTY AREA

The following tables show the observed annual climate indicators for the last forty years as well as what is to be expected for the rest of the century based on the two possible future emissions trends.

	1976 - 2015	2021 - 2060		2061 - 2100	
	Observed	High Emissions	Moderate Emissions	High Emissions	Moderate Emissions
Temperature (°F)	56.5	60.3	60.3	64.4	63.4
Heat Wave Daytime Temperature (°F)	100.3	105.3	103.5	111.4	107.5
Heat Wave Nighttime Temperature (°F)	79.8	83.9	83.4	90.2	87.2
Number of Days Max. Temp. Greater than 105°F	0.7	6.3	3.6	21.9	9.8
Number of Days Min. Temp. Less than 70°F	36.4	84.4	77.0	114.9	99.7
Cold Wave Nighttime Temperature (°F)	1.4	5.6	5.0	10.8	10.8
Number of Freeze - Thaw Cycles	4.4	3.8	3.3	2.9	2.9
Cooling Degree Days	1662.8	2414.3	2287.0	3270.0	2846.2
Heating Degree Days	4790.3	4137.1	4015.3	3496.4	3420.6
Spring Frost	April 02	April 01	March 26	March 24	March 16
Fall Frost	October 31	November 07	November	November 16	November 10
Frost Free Days	212.5	219.7	224.5	237.0	238.4

Source: KC Water Services & Climate Look, Understanding Long-Term Climate changes for Kansas City, Missouri, 2016

	1976 - 2015	2021 - 2060		2061 - 2100	
	Observed	High Emissions	Moderate Emissions	High Emissions	Moderate Emissions
Precipitation (inches)	38.8	40.2	40.2	44.6	41.1
Max. 1-day Precipitation (inches)	3.4	3.5	3.5	4.0	3.7
Max. 5-day Precipitation (inches)	5.5	6.2	5.9	7.0	6.1
Max. 15-day Precipitation (inches)	7.5	8.8	8.4	10.4	8.9
Number of Days with 1.5" of rain or more	5.0	5.6	5.3	9.3	8.3
Number of Days with 4.0" of rain or more	0.3	0.4	0.3	0.6	0.4
Max. Consecutive Dry Days	30.9	33.0	32.2	39.5	42.8

Source: KC Water Services & Climate Look, Understanding Long-Term Climate changes for Kansas City, Missouri, 2016



HEALTH IMPACTS

Changes in climate can impact human health in several different ways. For instance, climate change can influence the Earth's environments and expose certain populations to environmental threats such as heatwaves, infectious disease agents, air pollution, and flooding.³ These threats can directly or indirectly harm the health and wellbeing of communities.

Understanding how our climate is changing, and how those changes may affect people's health, can lead to informed decisions for addressing climate change and setting public health priorities.

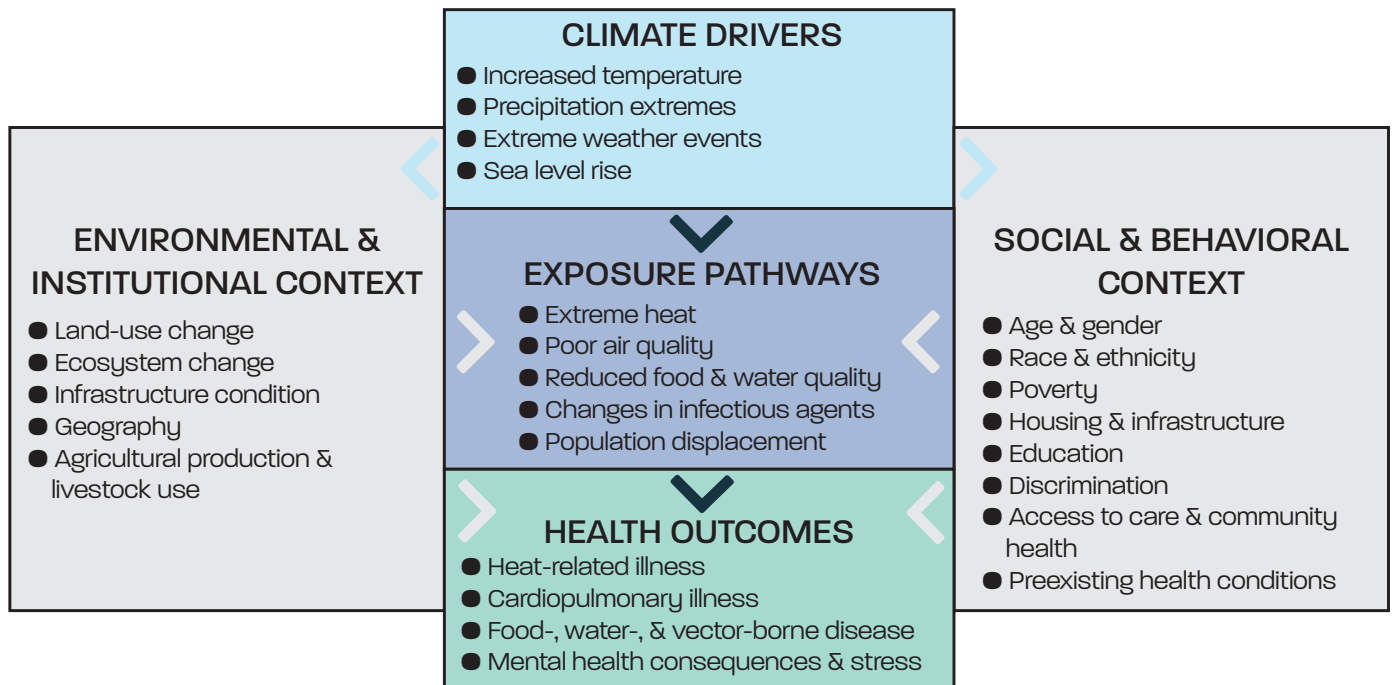
KEY FINDINGS:

In Jackson County:

- More extreme heat events will likely increase the risk of heat-related illness and death.
- Warmer average temperatures and higher levels of precipitation could result in more cases of vector-borne, food-borne, and water-borne illnesses.
- Allergy seasons in the region are likely to last longer with higher concentrations of pollen.
- Increased temperatures and changes in wind circulation could result in reduced air quality.
- Precipitation extremes such as flooding and drought could result in death, injury, population displacement, mental health problems, and water quality issues.
- Decreased agricultural productivity driven by climate change could lead to food insecurity, reduced food quality, and malnutrition.



FIGURE 5. Climate Change and Health



U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, 2014

The health impacts of climate change are complex. The purpose of the above diagram is to show how multiple factors, not just climate change, impact human health.

Social & behavioral factors, which include the social determinants of health, and health behaviors influence the vulnerability of individuals. Environmental & institutional factors, which include natural and built environments, governance, and institutions influence vulnerability at larger scales. All of these influencing factors shape an individual's or community's exposure, sensitivity, and adaptability to climate change.³

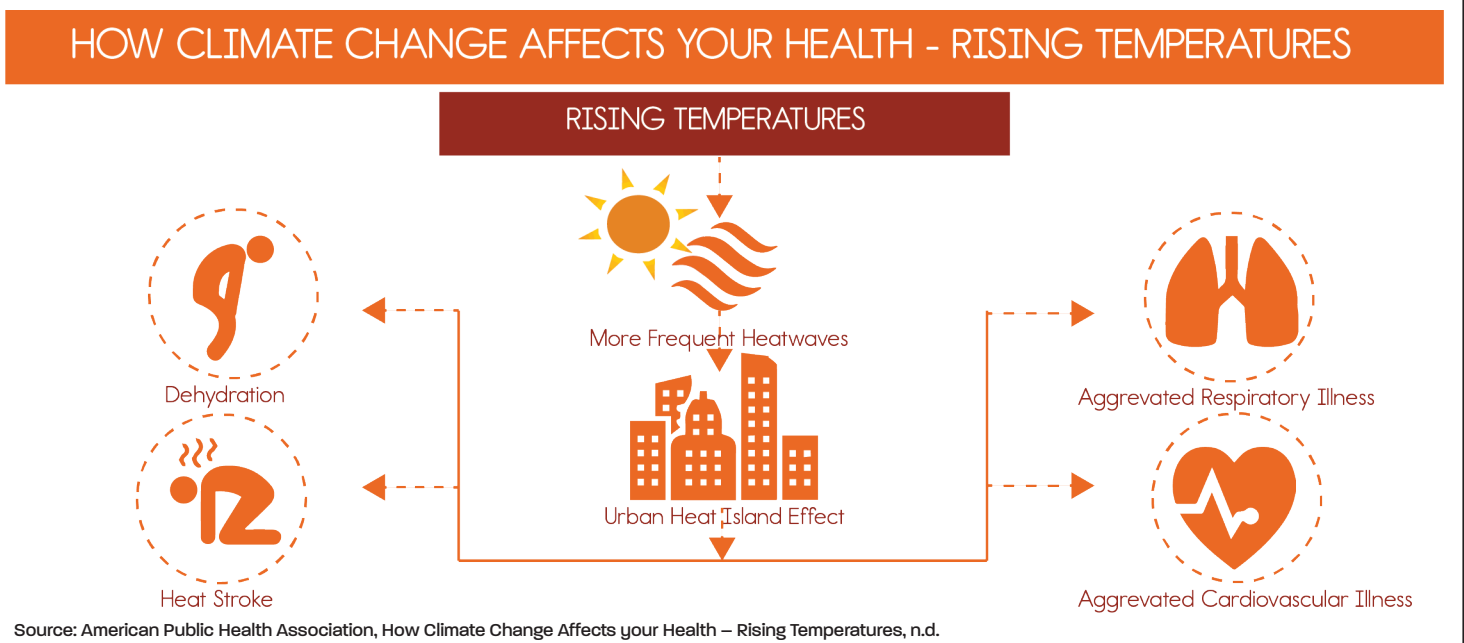
This section reviews what climate-driven exposures are expected for the Jackson County region based on both local climate predictions and the local environment as well as the resulting potential health risks for residents.

EXTREME HEAT

By mid-century, summer heat waves in Jackson County will increase with more days above 105°F.¹ The Kansas City metropolitan area will further intensify these temperatures rises. Urban heat islands, such as the Kansas City metro, are spaces that are significantly warmer than rural areas due to greater levels of human activity, higher concentrations of buildings and roads, and a lack of green spaces.⁵

Such heat extremes are life-threatening and have been associated with increased hospital visits for those with chronic diseases – in addition to other vulnerable populations including older adults, children, and those of low socioeconomic status.^{6,7,8} Exposure to heat can be a direct cause of death or a contributing factor for mortalities related to cardiovascular, kidney, respiratory, and cerebrovascular disease.^{6,8} Heat-related illnesses consist of heat cramps, heat exhaustion, heat stroke, and other forms of hyperthermia.⁷

FIGURE 6. How Climate Change Affects Your Health - Rising Temperatures



The Earth's overall average temperature is predicted to increase by at least 2.7°F by 2100.⁹ In Jackson County, the average annual temperature is expected to increase faster than the Earth's overall average, 4°F by mid-century and 7°F by end of century.¹ This increase could have a profound effect on our local environment and increase the number and distribution of vector-borne disease, food and water-borne disease, and allergens.

VECTOR-BORNE DISEASE

A vector is an organism such as a mosquito or tick that can transmit disease from human to human or from animal to human.¹⁰ Warmer temperatures combined with heavy rainfall creates conditions wherein vectors thrive. As different parts of the world become warmer and wetter, disease-carrying vectors may increase in population, survive over longer periods of the year, and expand into new areas.^{10,11}

VECTOR BORNE DISEASES INCLUDE:

- Lyme disease, dengue fever, West Nile virus, chikungunya, Rocky Mountain spotted fever, plague, Zika virus and tularemia.
- All of these diseases are considered public health concerns in the US.



CURRENT AND INCREASING RISK OF MOSQUITO-BORNE DISEASE

There are over 50 different types of mosquito within the state of Missouri.¹² The most common are the *Culex* and *Aedes* mosquitoes, which carry diseases.



Culex Mosquito

Culex mosquitoes are known for transmitting West Nile Virus and heartworm disease in pets.¹² *Culex pipiens* and *Culex quinquefasciatus* inhabit more urban spaces while the *Culex tarsalis*, also known as the western encephalitis mosquito, keep to rural areas. Females bite in the evenings and require still, old water to lay their eggs.^{12,13}



Aedes aegypti Mosquito

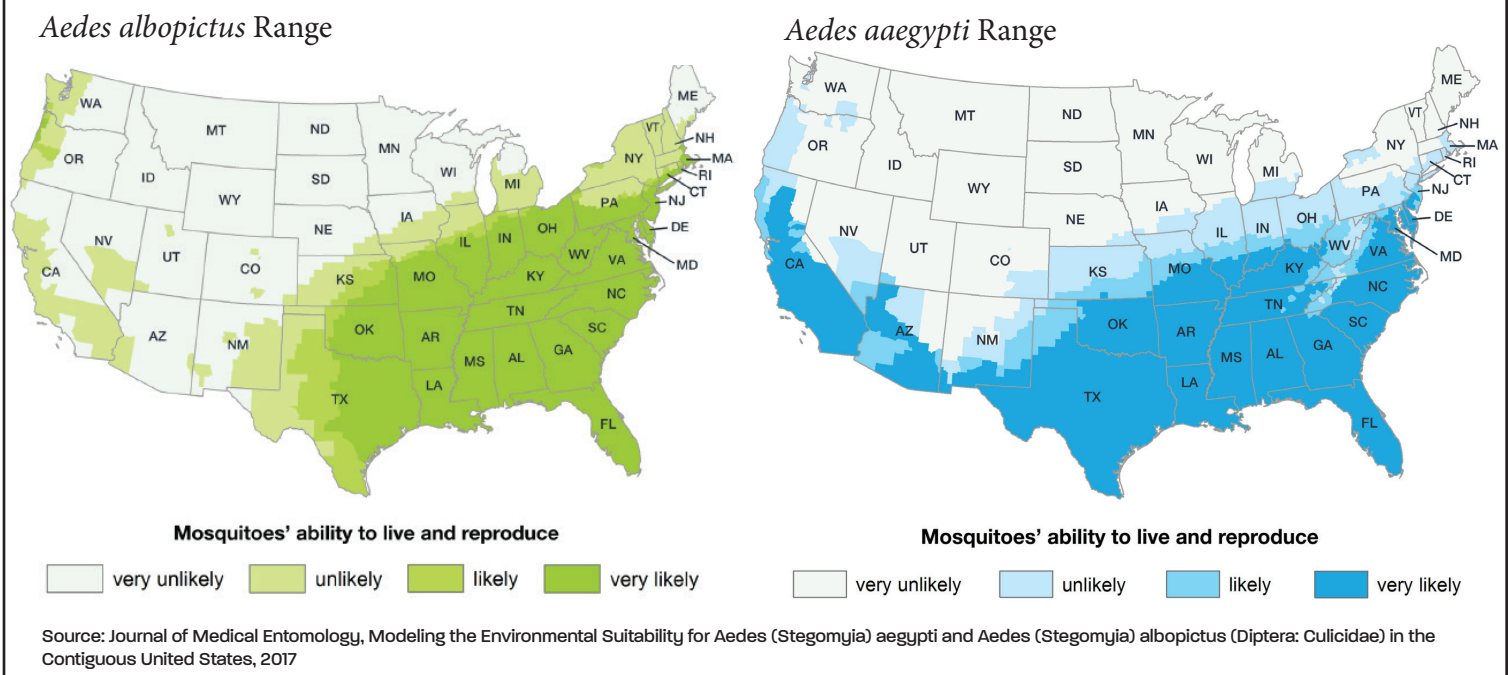
Aedes aegypti tend to inhabit towns or cities as human blood is their preferred meal. They are the primary carriers of the virus that causes yellow fever and Zika virus. Females feed in early mornings and late afternoons - or evenings when artificial light is present.^{14,15}



Aedes albopictus Mosquito

Aedes albopictus, or Asian Tiger mosquito, came to Missouri from Japan through the used tire industry during the mid-1980s.^{12,16} Unlike other types of mosquito that feed during dawn or dusk, the Asian Tiger mosquito feeds throughout the day.¹²

FIGURE 7. Estimated Ranges of *Aedes aegypti* and *Aedes albopictus*, United States, 2017



These ranges depicted in Figure 7, as well as the length of season, could expand with increasing temperatures and greater precipitation in the northern United States.

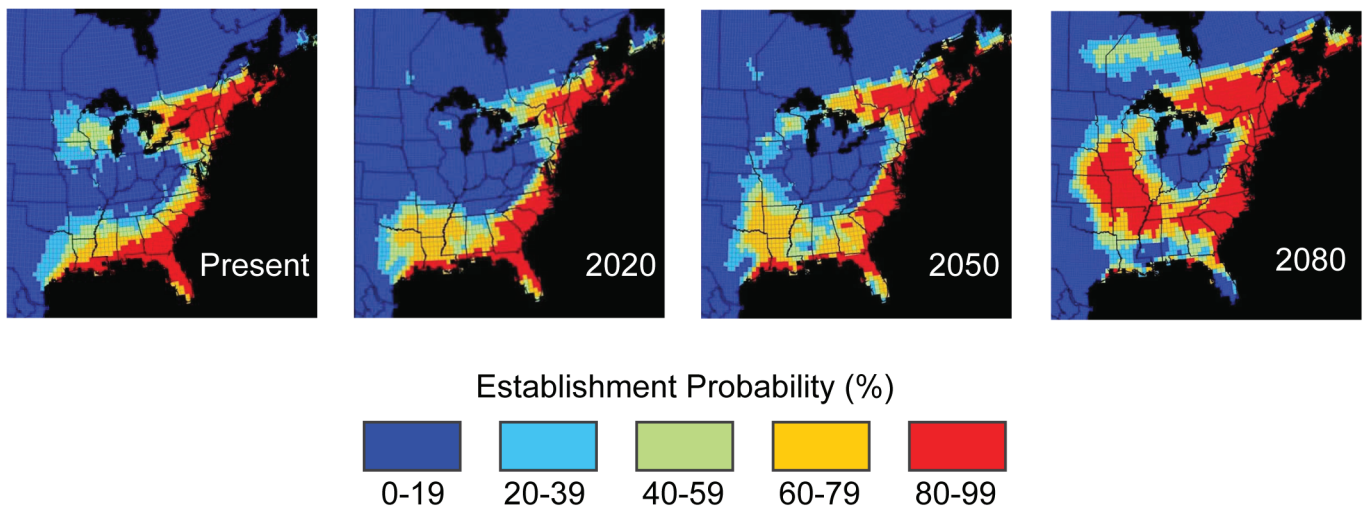
TICK-BORNE DISEASES

Lyme disease is the most common vector-borne illness in the United States. Certain species of tick carry the disease, which causes more than 300,000 human illnesses per year.¹⁰ Over time, cases of Lyme disease have increased in both frequency and distribution.

Most cases of Lyme disease occur outside of the Kansas City metro; however, several tick-borne illnesses have been reported in JACOHD's jurisdiction. These include 44 cases of Ehrlichiosis and 29 cases of Rocky Mountain spotted fever from 2012-2016.

Though many factors influence tick populations, not just climate change, studies suggest that Lyme disease carriers - namely *Ixodes scapularis* and *Ixodes pacificus* - will show earlier seasonal activity and expand northward as temperatures continue to go up.¹⁰ The region has yet to see more ticks, but predicted climate changes over the next 50 years could broaden their habitats, possibly increasing the number of cases of tick-borne illness in Jackson County.

FIGURE 8. Projected Changes in Tick Habitat, United States, 2016-2080



Source: USGCRP, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, 2016

These maps demonstrate the current and projected probability of establishment of tick populations (*Ixodes scapularis*) that transmit Lyme Disease.¹⁷ The projected expansion of tick habitat includes much of the eastern half of the country by 2080.

FOOD AND WATER-BORNE DISEASES

Risks to food and water safety are further exacerbated by climate change as several kinds of pathogens are more common in warmer temperatures. Moreover, rapid snow melt and extreme rainfall may sporadically increase stream flow rates and disturb water treatment systems thus spreading water-borne pathogens.¹⁸ Infections can occur through drinking, inhaling, or other direct forms of contact with contaminated drinking or recreational water and through the consumption of contaminated animal products or produce.¹⁸

Jackson County residents should take the necessary precautions to avoid exposure to these pathogens. For example, residents should be aware of any recreational water illness (RWI) outbreaks and heed orders to boil their drinking water.¹⁹

Symptoms of food-borne illnesses include diarrhea, vomiting, abdominal cramps, nausea, fever, and fatigue.²⁰ Water-borne illnesses also cause gastrointestinal problems as well as skin, ear, respiratory, and eye irritations.²¹

Table 3: Water and Food-borne Disease: Climate-Susceptible Pathogens

	Rising Temperatures	Increasing Rainfall	Shifts in Reservoir Ranges	Sea Level Changes
Salmonella	X	X	X	
Campylobacter	X	X	X	
Vibrio	X	X		X
Leptospira	X	X		
Enteroviruses	X	X		
Naergieria fowleri	X			
Cryptosporidium	X	X		
Giardia	X	X		

"X" indicates environmental conditions that could increase the above pathogens

Source: Climate-Trap, Training for Health Professionals: Module – Food & Waterborne Diseases, n.d.

ALLERGENS

Changes in climate are intensifying the pollen allergy season as well. Warmer spring and fall temperatures have lengthened the growing season for allergenic plants such as ragweed. More carbon dioxide in the air also enables these plants to produce larger quantities of pollen. Consequently, many localities have suffered longer and more heavily concentrated pollen allergy seasons compared to the past.²²

The Jackson County region saw an increase of 25 days to the ragweed season from 1995 to 2015. This increase is the highest seen in the Midwest region.²² Due to increases in the frost-free season, Jackson County will experience longer and more severe allergy seasons for years to come.

RAGWEED FACTS:

- Symptoms include: congestion, runny nose, itchy eyes
- Allergies to ragweed are also known as Hay Fever
- Ragweed can trigger asthma attacks

AIR POLLUTION

Changing weather patterns can influence levels and locations of air pollutants like ground-level ozone and particulate matter. An example of changing weather patterns is the decrease of global wind speeds over the past 30 years.²³ This change in climate may be hazardous for residents as Jackson County contains multiple energy producing facilities that release millions of tons of air pollution each year.²⁴

Air pollutants are linked to health conditions such as cancer, asthma, allergies, respiratory problems, and impaired lung development in children. Air pollution is also associated with increases in premature death.²⁵

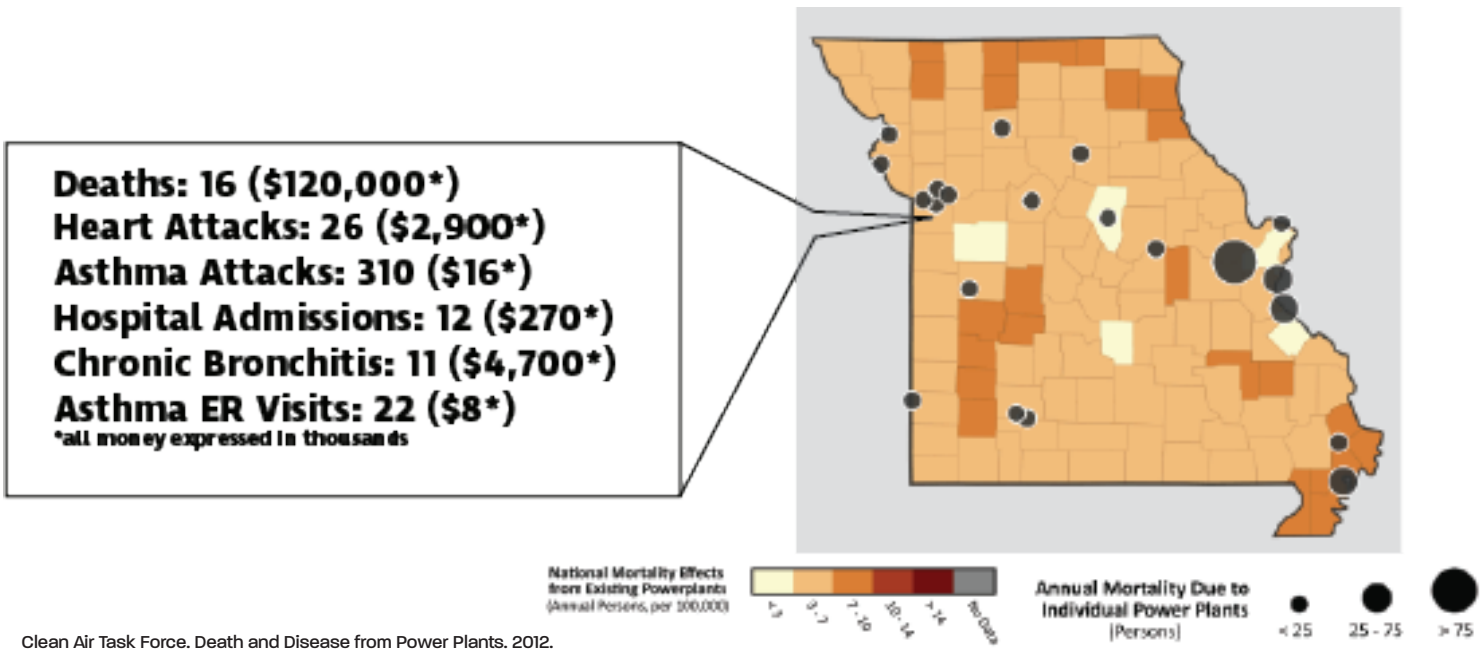
INCREASING RISK OF OZONE

Climate change may elicit longer and more frequent episodes of warm, stagnant air in places where there are polluting emissions. As a result, more ground level ozone could form in the air we breathe. Ground-level ozone is the product of chemical reactions between nitrogen oxides (NOx) and volatile organic compounds (VOCs) under sunlight. It is also the main component of smog.²⁶ Higher levels of ground-level ozone can affect people's health by causing headaches, heart and respiratory problems, and by aggravating preexisting conditions such as lung cancer.²⁷

PARTICULATE MATTER

Particulate matter (PM) consists of small solid and liquid particles suspended in the atmosphere. Main components of PM include: sulfate, nitrate, ammonium, organic carbon, elemental carbon, sea salt, and dust.²⁷ PM can occur naturally or be the result of human activities such as burning fossil fuels. Inhalation of such particles - whether natural or man-made - can lead to a variety of negative health outcomes including lung cancer, chronic obstructive pulmonary disease (COPD), and cardiovascular disease.²⁷

FIGURE 9. Human and Financial Impacts from Air Pollution, Jackson County, 2012



Clean Air Task Force. Death and Disease from Power Plants. 2012.

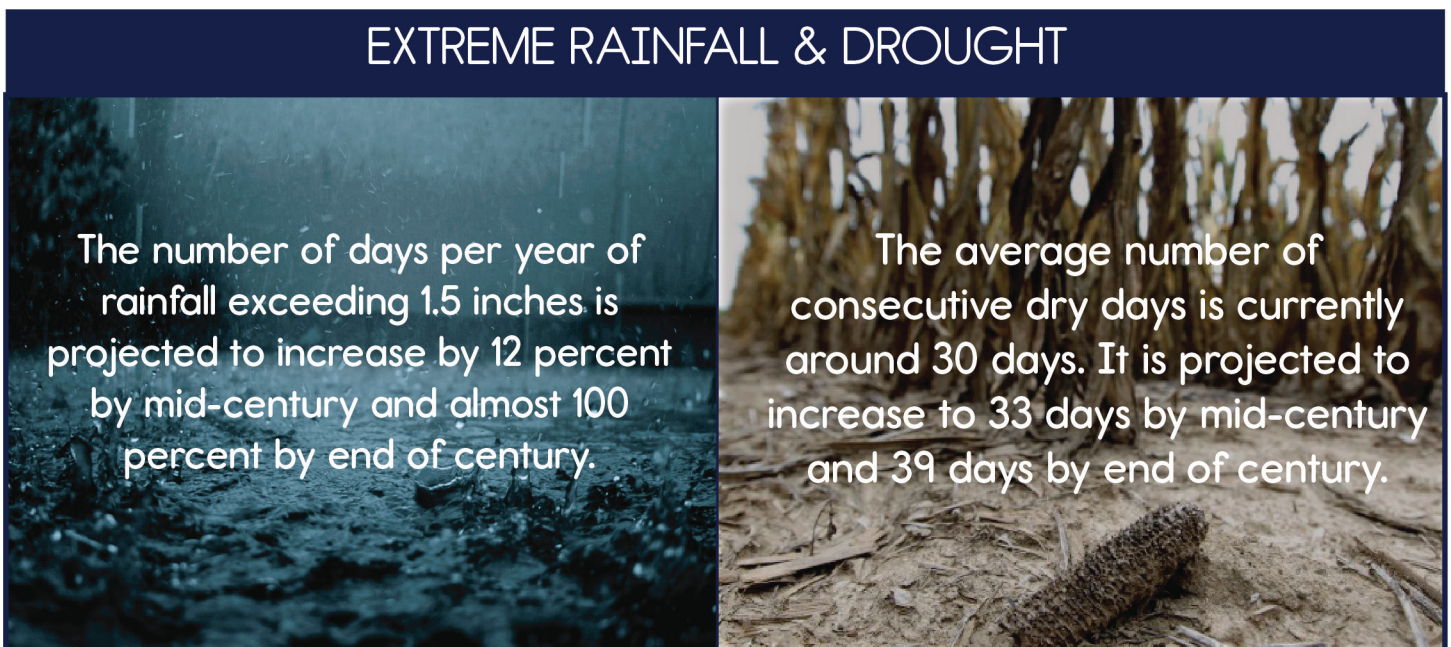
The graphic above shows the estimated human and financial cost of fine particulate air pollution from power plants within Jackson County for 2012.

SEVERE WEATHER: EXTREME RAINFALL, FLOODS, AND DROUGHT

In 2017, the U.S. faced weather conditions which led to wildfires, hurricanes, and severe flooding. Jackson County could encounter the same type of precipitation extremes which, paradoxically, bring both flooding and drought. These kinds of weather events produce many hazards in which health impacts can be felt immediately and as time goes on.

In Jackson County, average precipitation and spring rainfalls are expected to increase for both high and moderate emissions trends.^{1,28,29} More intense storms are also expected. Each of these factors increases the risk of flooding in Jackson County, which is already susceptible to flooding from the Missouri River.²⁹

FIGURE 10. Extreme Rainfall & Drought



Source: KC Water Services & Climate Look, Understanding Long-Term Climate changes for Kansas City, Missouri, 2016

DEATH AND INJURY

Extreme precipitation events can impact people's health by causing death, injury, population displacement, mental health problems, and water issues.^{30,31} Nearly all flood deaths in the U.S. occur during flash floods. Drownings can happen when individuals become stranded and/or swept away while trying to drive or walk through flooded areas.³⁰

Rural areas are more susceptible to flash floods as they tend to have basins that collect water more rapidly, low water crossings that are without bridges, limited transportation options, and fewer emergency response units. Though flash floods occur more often in rural settings, urban flood events can result in higher numbers of death and injury.³⁰ Fatal and non-fatal injuries can occur before, during, and after a flooding event. Flood-related injuries consist of: blunt trauma from falling or floating objects, electrocution, falls, and injuries from car accidents because of wet, damaged, or blocked roads.³⁰

POPULATION DISPLACEMENT

An extreme weather event such as flooding has the capacity to destroy large-scale infrastructure and devastate whole environments. Some families may have no choice but to abandon their homes or neighborhoods as these spaces could become uninhabitable. For instance, flooded buildings become ideal for the growth of mold and fungi which can aggravate allergy and asthma symptoms.³⁰

On a larger scale, extreme flooding can also damage and wash away entire roads and bridges making it difficult to travel to safe areas. Additional health risks emerge from loss of access to electricity, sanitation, food, water, health care, and communications.

MENTAL HEALTH

During and after an event, mental health problems escalate. Conditions can range from acute symptoms of distress to long-term clinical disorders such as anxiety, depression, post-traumatic stress disorder, and suicidal thoughts.³²

REDUCED WATER QUALITY

Extreme precipitation threatens water quality by overwhelming storm and wastewater treatment systems. Heavy rainfall increases storm water runoff, which spreads pollutants like agricultural waste and chemicals, and could also cause sewers to overflow into rivers.³⁰ As toxic chemicals and pathogens spread, public health becomes endangered. Health problems associated with poor water quality include: gastrointestinal illness, wound infection, skin irritation, and eye, ear, nose, and throat infections.³⁰ Like flash flooding, drought can also reduce the supply and quality of drinkable water. During drought conditions, the decreased flow of water increases concentrations of pollutants and contaminants in water resources.²⁵

CHANGES TO AGRICULTURAL PRODUCTION AND DISTRIBUTION

The combined effects of climate change will influence agriculture throughout the Midwest and Missouri.^{28,29}

Initially, longer growing seasons, along with fertilizing levels of CO₂ in the atmosphere, may increase crop production; however, subsequent changes in weather could threaten overall production. The effects of these changes may include:³³

- Flooding and droughts which will degrade soil quality and expose plants to harmful chemicals/pathogens.
- Heat stress on crops and livestock.
- More crop pests and greater competition from weeds.



The quality of food will also be affected as too much CO₂ can decrease the nutrient and protein value of certain crops.³³ In addition, to maintain production and combat pests and weeds, farmers may be forced to use more agricultural chemicals including fertilizers, pesticides, and herbicides. This could increase exposure to residues of toxic chemicals for farmers, farmworkers, and consumers.³⁴

Exposure to agricultural chemicals can cause a range of health impacts:³⁵

- Memory loss
- Loss of coordination
- Reduced reaction time
- Reduced vision
- Changed or uncontrollable mood
- Reduced motor skills
- Asthma
- Allergies
- Hypersensitivity
- Cancer
- Hormone disruption
- Problems with reproduction and fetal development

Declining food production will cause food to become more expensive and lead to further food insecurity in the United States.³⁴ Furthermore, people tend to purchase cheaper, more processed food when faced with higher prices. These foods usually contain more calories and less nutrients resulting in conditions such as obesity and malnourishment.³⁴





VULNERABLE POPULATIONS

A variety of physiological and social factors can influence an individual’s vulnerability to climate change. Extreme weather events such as heat waves or flooding can limit access to medical and social services, aggravate some chronic health conditions, and even cause death. For these reasons, it is important to identify those at greater risk to better prepare for and assist with potential health impacts.

One way of identifying these groups is by using the Social Vulnerability Index (SVI). The SVI assesses a community’s preparedness and ability to respond to a hazardous event such as an extreme weather event, a disease outbreak, chemical spill, etc.³⁶ It ranks each Census tract in the U.S. based on four themes including: socioeconomic status, household composition and disability, minority status and language, and housing and transportation.

Public health officials and local planners use the SVI to obtain spatial data which help them locate specific parts of communities that will need services (e.g. food, water, medicine, emergency personnel, shelters, transportation, etc.) during an emergency response.³⁶

KEY FINDINGS:

In Jackson County:

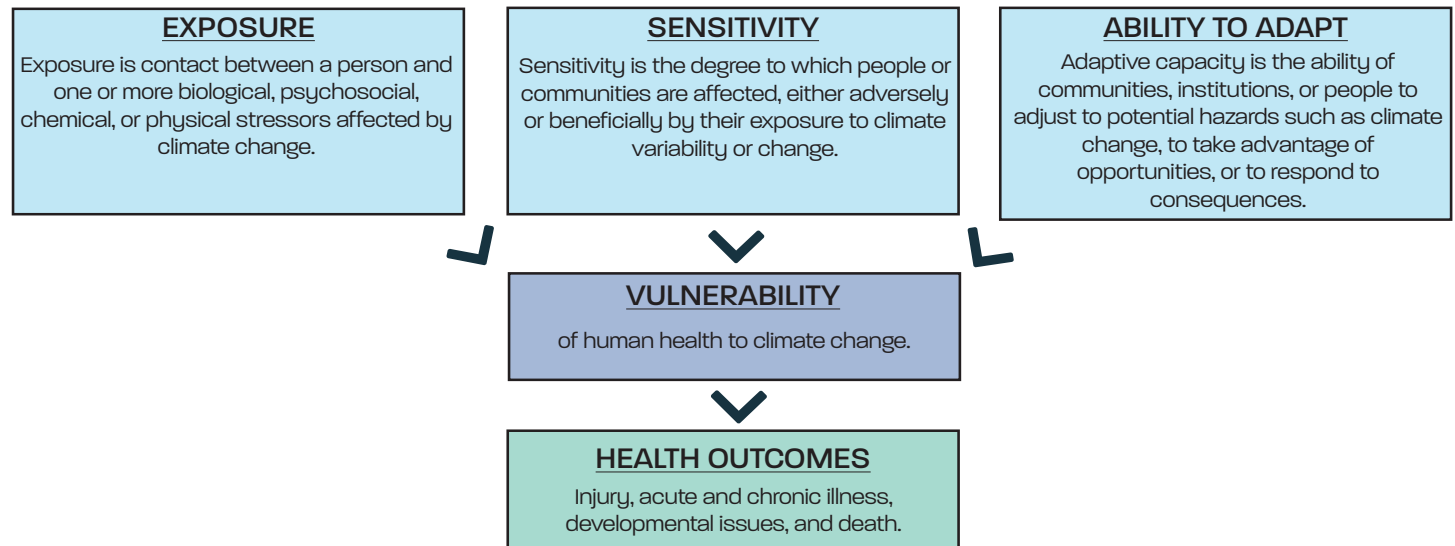
- Vulnerable populations exist that will require additional services before, during, and after an event.
- We rank in the middle (in the 57th percentile) for overall SVI which indicates that we have more vulnerability than over half of the other counties in Missouri.
- Census tracts vary in regard to SVI rankings with areas in Kansas City, Raytown, and Grandview having the highest vulnerability.



POPULATIONS AT RISK

All individuals face health risks due to climate change; however, some people are more vulnerable to these risks than others. Factors like age, physical and mental conditions, socioeconomic status, race/ethnicity, and location all influence vulnerability. These factors create differences in people’s exposure, sensitivity, and ability to adapt to climate change.

FIGURE 11. Determinants of Vulnerability



Source: U.S. Global Change Research Program. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, 2016

In this section, populations who are most vulnerable to the effects of climate change are outlined with reasons why. The SVI is discussed to explore vulnerable populations in Jackson County.

OLDER ADULTS (AGED 65 AND OLDER)

Multiple factors can make older adults more vulnerable to climate-related health risks. For instance, older adults are more likely to have chronic conditions and/or physical impairments that make them more susceptible to heat related illnesses or infectious diseases including vector-borne, food-borne, and water-borne illnesses. Poor air quality can also aggravate asthma and COPD symptoms in older adults as well as increase the risk of heart attack - particularly for those who are diabetic or obese.³⁸ Lastly, older adults with cognitive and/or physical impairments are more likely to suffer negative health impacts because of difficulties responding to, evacuating, and/or recovering from extreme weather events.³⁸

CHILDREN

Children are considered a vulnerable population due to the unique ways in which they are exposed to the environment, their underdeveloped immune systems, and their limited capacity to respond to climate-driven weather events.³⁸ Children usually spend more time being active outside compared to adults. As a result, they can experience greater exposure to extreme heat, vector-borne diseases, water-borne pathogens, allergens, and air pollution.³⁸ In addition, exposure to extreme weather events can be emotionally traumatizing and affect children’s cognitive development. Children are also less able to evacuate during an extreme weather event without the help of an adult.³⁸

PEOPLE WITH CHRONIC CONDITIONS

The risk of illness and/or death related to climate change is greater for people with chronic conditions. With extreme heat, for example, some people may take medications that impair their ability to manage heat stress. Those with chronic respiratory diseases like asthma or lung cancer are particularly vulnerable to air pollution and overall poor air quality.²⁶ Loss of access to medical services and treatment may also result in illness or death.³⁸

PEOPLE WITH DISABILITIES

Social risk factors, such as poverty and low educational attainment, commonly affect people with disabilities.³⁸ Such factors increase a disabled person's vulnerability as they can be more exposed to the effects of climate change, but less able to respond or adapt. Cognitive and/or physical impairments can also impede a disabled person's ability to take appropriate action during and after an extreme weather event.³⁸ In addition, some disabled people may depend on medical equipment that need uninterrupted electricity.³⁸

PREGNANT WOMEN AND NEWBORNS

Climate-driven exposures can cause negative health outcomes for both pregnant women and their babies. These outcomes can include miscarriage, low birth weight, preterm birth, and neonatal death. Extreme heat has been linked to low birth weight, preterm birth, infant mortality, and congenital cataracts.³⁸ Sensitive immune systems also cause pregnant women, fetuses, and young children to be more at risk of getting, or having complications from, infectious diseases.

PEOPLE WITH MENTAL HEALTH DISORDERS

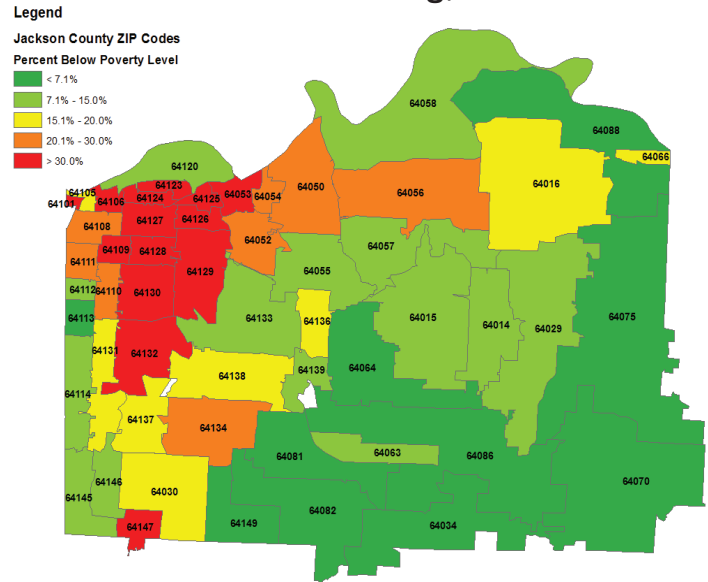
Some individuals with mental health disorders are more vulnerable to extreme heat. During periods of high temperatures, suicide rates increase signifying a possible relationship between weather events and mental health disorders.³⁸ Medications taken to treat severe mental health disorders may also inhibit temperature regulation or cause hypothermia.³⁹ For those with debilitating conditions, they may be at greater risk during an extreme weather event due to impaired judgment and behavioral responses to crises.³⁹



LOW SOCIOECONOMIC STATUS

Limited financial resources negatively affect people’s ability to prepare for and adapt to extreme weather. People of low socioeconomic status (SES) are at an increased risk of climate-driven exposures since they are more likely to live in areas that could be hazardous, such as urban heat islands, remote rural areas, or areas that are flood-prone.³⁸ They may also live in neighborhoods with inadequate housing (i.e. homes without proper air conditioning and heating) as well as infrastructure. In addition, low SES individuals tend to have higher rates of chronic diseases, such as cardiovascular and kidney disease, diabetes, asthma, and COPD, which can all be made worse by climate change.³⁸ Low SES individuals may also have difficulty paying for replacement housing or insurance that will cover damages from extreme weather. Lastly, this group is more likely to be affected by reduced food quality as they spend a large amount of their income on food. These groups already disproportionately suffer from low-nutrient diets and limited access to health foods.³⁸

FIGURE 12. Percent of Residents in Poverty, Jackson County, 2015

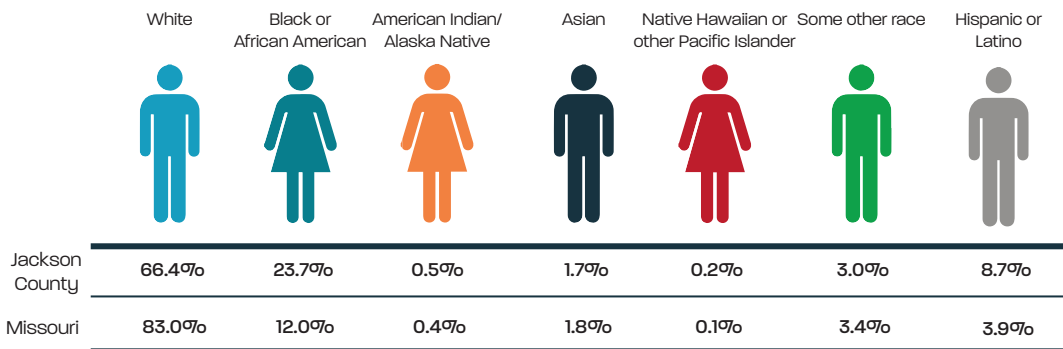


Source: U.S. Census Bureau, ACS, 2015

COMMUNITIES OF COLOR

Communities of color are more vulnerable to climate change due to disparities in housing, environment, access to health care, and disease burden. Heatwaves may be more intense for people of color since they often live in cities where temperatures are significantly warmer than in rural areas.³⁸ In addition, some communities of color are more likely to live near polluting facilities that contaminate the air with ozone and particulate matter.²⁶ Higher prevalence of chronic diseases, such as asthma and COPD, also cause these groups to be more susceptible to air pollution.³⁸ Lastly, language and cultural barriers, as well as citizenship status, may limit some people’s access to health care and social services during and after an extreme weather event.³⁸

FIGURE 13. Race/Ethnic Distribution, Jackson County, 2015

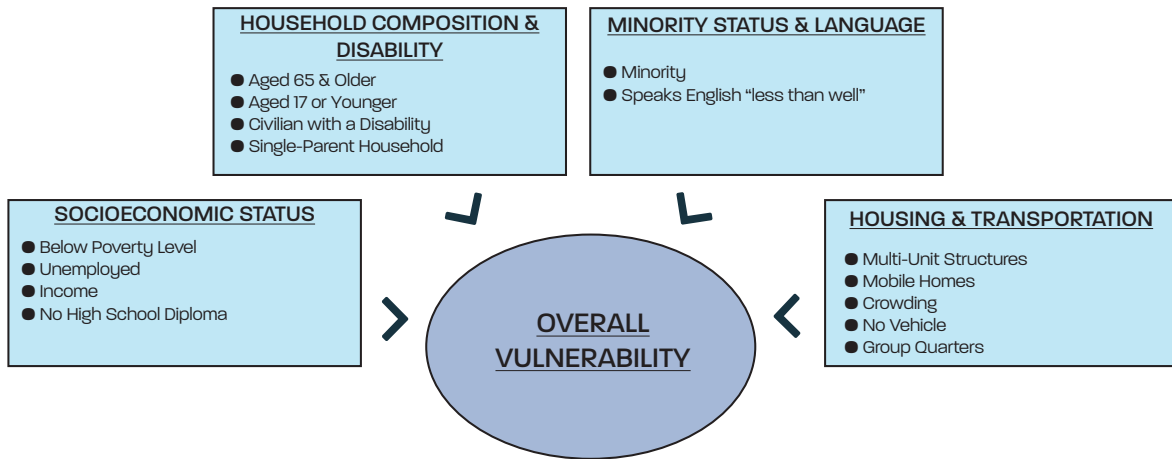


Source: U.S. Census Bureau, ACS, 2015

SOCIAL VULNERABILITY INDEX (SVI)

The SVI is an indicator used to determine the resilience of a community when faced with natural and human-made disasters. It can identify what vulnerable populations exist within Jackson County and where they are located. The index uses four separate themes, containing 15 variables, to rank communities as shown in Figure 14.

FIGURE 14. Social Vulnerability Index (SVI) Themes



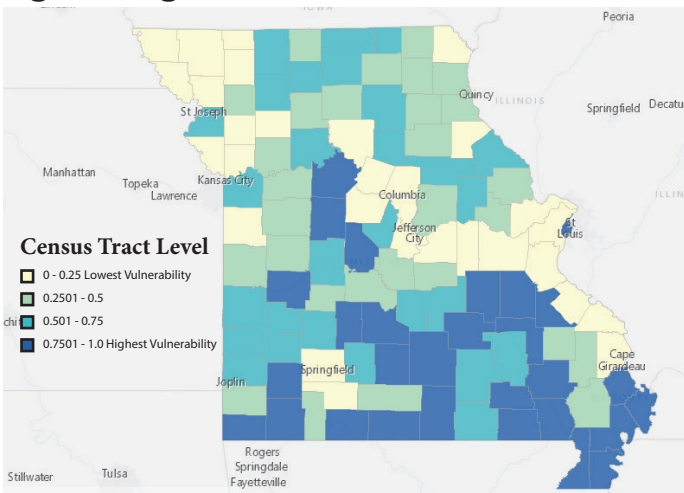
Source: U.S. Global Change Research Program. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, 2016

The SVI ranks both census tracts and counties within a state to determine areas with higher vulnerability to better identify how resources should be allocated and where additional personnel, evacuation assistance, and shelters may be needed. Jackson County ranks in the 57th percentile when compared to all other counties in Missouri for overall SVI. Jackson County had a high percentile for minority status, English speaking, multi-unit structures, and transportation indicating possible areas for additional investment of resources during times of crisis.

Table 4: Social Vulnerability Index (SVI) Percentiles, Jackson County, 2016

	Percentile
Overall SVI	57.9
Socioeconomic	21.9
Below Poverty	43.0
Unemployed	56.1
Income	5.3
No HS Diploma	18.4
Household Composition & Disability	38.6
Aged 65 & Older	7.9
Aged 17 or Younger	71.9
Civilian with a Disability	12.3
Single-Parent Household	93.0
Minority Status & Language	98.2
Minority	99.1
Speak English "less than well"	94.7
Housing & Transportation	57.9
Multi-Unit Structures	96.5
Mobile Homes	2.6
Crowding	36.8
No Vehicle	92.1
Group Quarters	39.5

FIGURE 15. Social Vulnerability Index (SVI) by County, Missouri, 2016



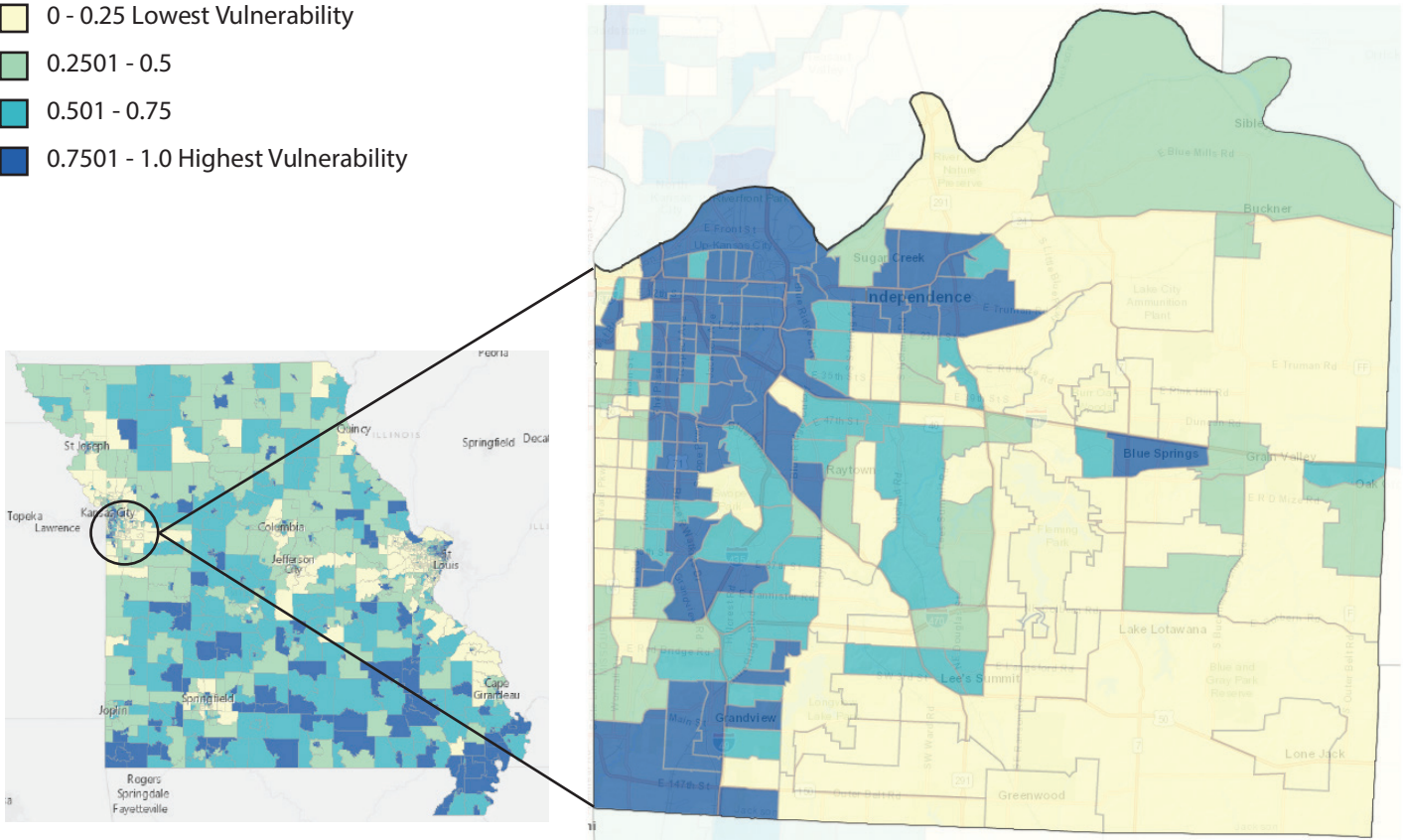
Source: Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. Social Vulnerability Index 2016 Database Missouri, 2016

Looking at the census tracts in Jackson County can assist local responders and personnel to better identify areas with the highest vulnerability. The SVI helps communities to identify needs and to prepare for responding to emergency events including flooding, disease outbreaks, and severe weather. In Jackson County, census tracts in Kansas City, Grandview, Raytown, and Blue Springs have areas with the highest vulnerability. To better determine specific resources needed, the Centers for Disease Control has created a tool that maps percentiles for each of the 15 variables used to create the overall SVI. Resources like translators, public transportation, and emergency shelters can be better allocated to directly reach those in need of services.

FIGURE 16. Social Vulnerability Index (SVI) by Census Tract, Jackson County, 2016

Census Tract Level

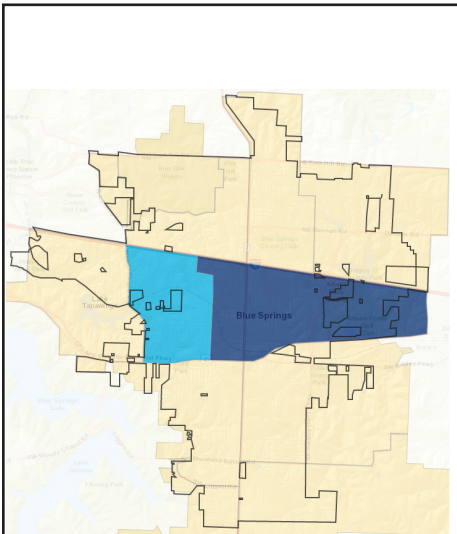
- 0 - 0.25 Lowest Vulnerability
- 0.2501 - 0.5
- 0.501 - 0.75
- 0.7501 - 1.0 Highest Vulnerability



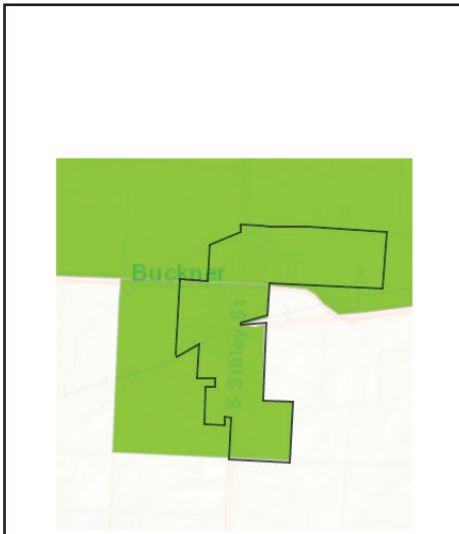
Source: Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. Social Vulnerability Index 2016 Database Missouri, 2016

Vulnerability in Your Community

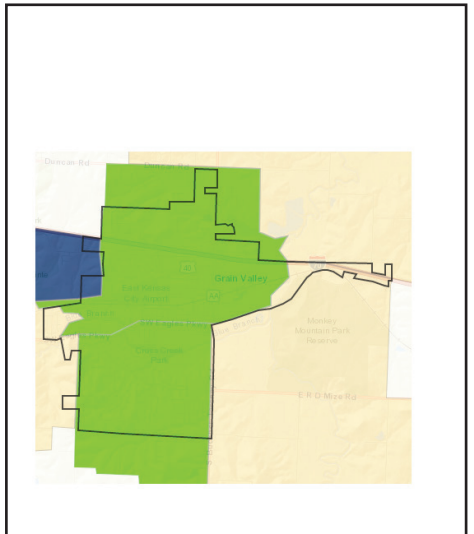
These maps display Census tracts within JACOHD's jurisdiction and the levels of vulnerability compared to others in the state. City officials can also identify their jurisdiction's most vulnerable areas.



Blue Springs
 Total Population: **53,364**
 Highest Vulnerability Population: **13,504***
 *Count of population in most vulnerable rankings



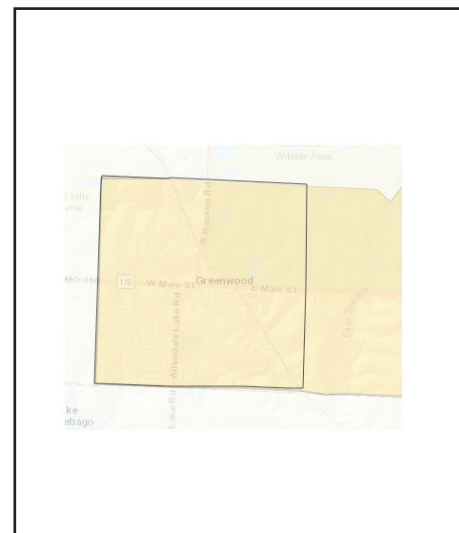
Buckner
 Total Population: **3,077**
 Highest Vulnerability Population: **0***
 *All of population considered "low" vulnerability.



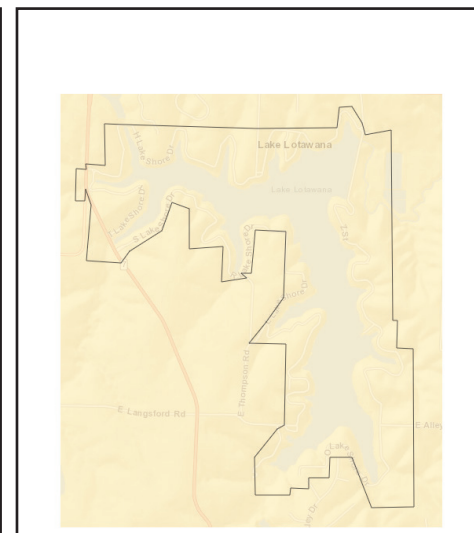
Grain Valley
 Total Population: **13,134**
 Highest Vulnerability Population: **6,753***
 *Count of population in most vulnerable rankings



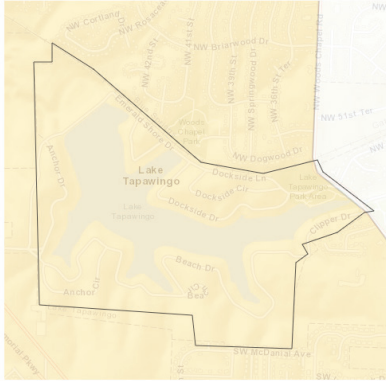
Grandview
 Total Population: **24,997**
 Highest Vulnerability Population: **22,742***
 *Count of population in most vulnerable rankings



Greenwood
 Total Population: **5,400**
 Highest Vulnerability Population: **0***
 *All of population considered "low" vulnerability.

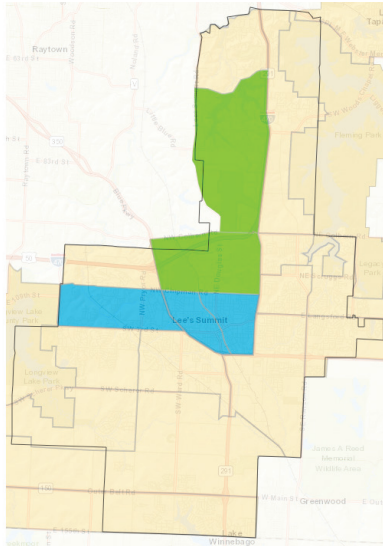


Lake Lotawana
 Total Population: **2,100**
 Highest Vulnerability Population: **0***
 *All of population considered "low" vulnerability.



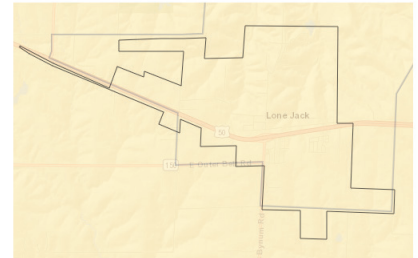
Lake Tapawingo

Total Population: **689**
 Highest Vulnerability Population: **0***
 *All of population considered "low" vulnerability.



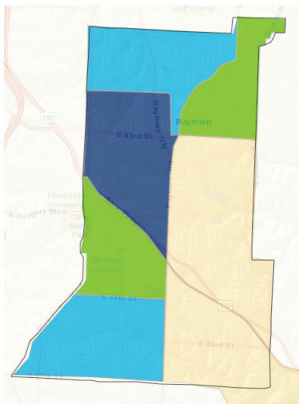
Lee's Summit

Total Population: **91,344**
 Highest Vulnerability Population: **14,202***
 *Count of population in most vulnerable rankings



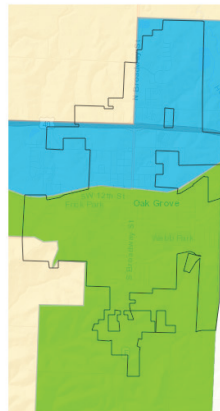
Lone Jack

Total Population: **1,076**
 Highest Vulnerability Population: **0***
 *All of population considered "low" vulnerability.



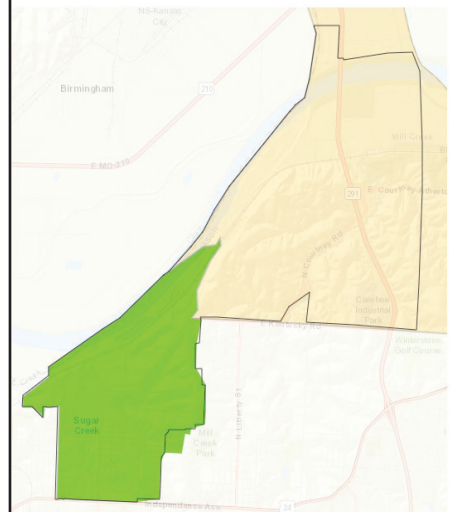
Raytown

Total Population: **29,486**
 Highest Vulnerability Population: **14,761***
 *Count of population in most vulnerable rankings



Oak Grove

Total Population: **7,794**
 Highest Vulnerability Population: **2,852***
 *Count of population in most vulnerable rankings



Sugar Creek

Total Population: **3,339**
 Highest Vulnerability Population: **0***
 *All of population considered "low" vulnerability.

Source: Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. Social Vulnerability Index 2016 Database Missouri, 2016



Just as climate change has many different environmental and health impacts, so are there many different ways to address these impacts that involve both mitigation (tackling long-term impacts by reducing greenhouse gas emissions) and adaptation (preparing for and managing impacts). Local action may seem insignificant relative to the rest of the country and world; however, it will make a real difference for our communities and the environment.

To build resilience in Jackson County, we must improve the capacity of all communities to prepare for, respond, and recover from climate-related health risks. We should also ensure that those who are most vulnerable have access to information and resources that will help them overcome present and future challenges.

This can be done while also gaining environmental, social, and economic benefits that will improve quality of life in Jackson County. Therefore, adaptation strategies can be seen as opportunities to pursue policies, actions, and infrastructure changes that will protect the health of the public while also creating health equity, resiliency, and sustainability.³¹

KEY FINDINGS:

Strategies for adaptation may include:^{31,40}

- Educating and engaging the community in regard to climate change.
- Building community resilience throughout Jackson County.
- Improving and sustaining public health preparedness and emergency response.
- Maintaining surveillance of weather, environmental conditions, and vulnerable populations.
- Improving infrastructure to withstand climate changes and improve energy efficiency.
- Fostering multi-sector collaboration to build collaborative capacity in addressing climate change and severe weather events.



Table 5: Adaptation Strategies to Increase Resilience to Climate Change

Strategies	Action Steps
Community Education & Engagement	<ul style="list-style-type: none"> • Carry out an educational outreach campaign related to existing efforts • Conduct outreach with specific vulnerable populations • Implement a proactive social media campaign
Community Resilience	<ul style="list-style-type: none"> • Promote healthy environments (such as decrease heat islands) • Improve food quality and security • Work toward more sustainable food systems • Encourage social and community engagement • Promote increased access to health care • Develop workforce focused on community resilience • Practice inclusive hiring and living wages for resilience projects
Public Health Preparedness and Emergency Response	<ul style="list-style-type: none"> • Establish a readiness campaign for extreme weather events in Jackson County • Develop emergency action plans • Conduct exercises
Surveillance	<ul style="list-style-type: none"> • Improve and maintain: <ul style="list-style-type: none"> - Climate and weather forecasting - Monitoring environmental conditions and hazards - Monitoring of climate-related illnesses - Monitoring of vulnerable populations <p>Local tools for individuals:</p> <ul style="list-style-type: none"> • Weather: http://www.noaa.gov/ • Air Quality: https://airnow.gov/ • Mosquito Activity: https://www.accuweather.com/en/us/kansas-city-mo/64106/mosquito-activity-weather/329441
Infrastructure Changes	<ul style="list-style-type: none"> • Update buildings for future climate changes (such as putting in heating and cooling systems in buildings that are energy efficient) • Retrofit existing buildings against weather hazards and flood damage • Pursue the development of green infrastructure that uses natural systems to manage storm-water and heat
Multi-Sector Collaboration	<ul style="list-style-type: none"> • Apply education and emergency training across agencies • Work to implement policy changes that address climate change at the local, regional, and national level

Other useful resources:

Climate Resilience Strategy for the Kansas City Region - <http://www.marc.org/Environment/pdf/climate-resiliency/Regional-Climate-Resilience-Strategy-Final.aspx> - This report gives insight into what actions are already being taken in the Kansas City/Jackson County region to mitigate and adapt to climate change while building community resilience.

Community Health Resilience Guide and Toolset - <https://toolkit.climate.gov/tool/community-health-resilience-guide-and-toolset> - Tools on this site can help communities maintain or improve their health resilience and enhance preparedness for human-made or environmental disasters, including climate change impacts.

Disaster Resources - <http://dnr.mo.gov/disaster.htm#wwfac> - The DNR's website offers information on cleaning up homes and communities that have been affected by severe weather, floods and other natural disasters.

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of MAYORS**

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Contact the Jackson County Health Department for more information on partnering to address the impacts of climate change in your community.

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