2020 Climate Action Plan Draft

Lincoln, Nebraska | October 2020

CITY OF LINCOLN NEBRASKA

verdis GROUP

Contents

Introduction

The achievement of any great undertaking begins with a vision. Sometimes overlooked as unnecessary dreaming, a vision is, on the contrary, a depiction of a world we could inhabit if we could create it.

By envisioning this world, we begin to create a narrative in which we ourselves are the actors, and the city around us is our creation. The more we become invested in the vision, the more we plant the seeds of longing for the vision to become reality. And the more we long for its realization, the greater the chance that we step up to create the future we want.

"This Climate Action Plan has come about from an understanding of the need to significantly reduce greenhouse gas (GHG) emissions in order to slow the pace of climate change and protect Lincoln residents' way of life."

This Climate Action Plan paints a vision for what the city of Lincoln could become over the next 30 years. It is a vision of a city that is thriving with local businesses and verdant greenways; a city that uses both ordinary and innovative measures to reduce greenhouse gas emissions in transportation, electricity and buildings; a city that is inclusive, welcoming and fair.

The extent of the seriousness of the climate crisis we face demands an equal if not greater degree of creativity and commitment if we are to meet it and thrive. In January 2020, 11,000 scientists declared that planet Earth is facing a climate emergency. Across a wide range of indicators, evidence of planetary emergency is clear: as populations of humans and ruminant livestock have grown, as global GDP and air travel have increased, greenhouse gas emissions have increased, global tree cover has decreased, Arctic sea ice has diminished significantly, the rate of ocean acidification has grown, the number of wildfires and extreme weather events have increased.[1] Biodiversity is on a tragic and precipitous decline: a 2018 study found that populations of mammals, birds, fish and reptiles have declined 60% since 1970.[2] A 2019 UN report found that around one million animal and plant species are now threatened with extinction, many within decades, which is more than ever before in human history.[3]

The 2018 Fourth National Climate Assessment stated, "More frequent and intense extreme weather and climate-related events, as well as changes in average climate conditions, are expected to continue to damage infrastructure, ecosystems, and social systems that provide essential benefits to communities. Future climate change is expected to further disrupt many areas of life, exacerbating existing challenges to prosperity posed by aging and deteriorating infrastructure, stressed ecosystems, and economic inequality."[4]

In December 2015, nations from around the world came together in Paris for the 21st United Nations Climate Change Conference. Nearly every nation—197 in all— signed a historic agreement, known as the Paris Climate Accord, to voluntarily reduce greenhouse gas emissions with the goal of limiting global temperature increase to 2°C above pre-industrial levels by the end of the century, while pursuing means to limit the increase to 1.5°C.[5] The United States was a signatory to the agreement at the time, however, in November of 2019 , the U.S.

announced its intention to withdraw. It remains to be seen what positions the U.S. will take on a federal level regarding climate change policy. Regardless, the Paris Agreement has spurred actions on climate change in the public and private sectors across the globe and given a framework within which to work to reduce greenhouse gas emissions.

A 2018 report from the Intergovernmental Panel on Climate Change (IPCC) investigated the projected impacts of a world that had warmed 1.5°C compared to one that had warmed 2.0°C. The IPCC found that going to 2.0°C would expose several hundred million people to climate-related risks by 2050. The study found that global emissions of greenhouse gases would need to drop by 45% from 2010 levels by 2030 to stay on a 1.5°C path. As the World Resources Institute puts it, "behavior and technologies will need to shift across the board in order to achieve these emissions reductions. For example, by 2050, renewables are projected to supply 70-85% of electricity in 1.5˚C pathways. Energy efficiency and fuel-switching measures will be critical for the transportation sector. Reducing energy demand and improving the efficiency of food production, changing dietary choices and reducing food loss and waste also have significant potential to reduce emissions."[6]

The changes in climate will result in several impacts, each of which may have many implications for life in Lincoln. Nebraska will see warmer, drier summers, wetter springs, more extreme rain events, more frequent drought, more frequent and more intense floods, potential economic instability from impacts to the state's agricultural sector, and a range of climate-related health impacts, including heat-related illnesses, respiratory illnesses and increased insect-borne diseases.

The changes societies need to make to protect a livable Earth are daunting, and the stakes couldn't be higher. But the climate crisis is also an unprecedented opportunity to innovate. It is a chance to re-think norms, patterns and habits—many of which were not serving the ideal mental, physical, social, ecological and economic health of communities to begin with—in order to create thriving cities of the future. As Rob Hopkins, who writes about transitions in society, has stated, "one response to... the need for rapid, far-reaching, and unprecedented change in all aspects of society [to deal with the impacts of climate change] is to kick against that, deny it, and say that it's impossible. Another response is to look at it as a historic, once-off invitation to our brilliance."[7] This plan aims to invite Lincoln to manifest its brilliance.

Lessons from the Coronavirus Pandemic

As of this writing, the U.S. remains in the throes of a historic and destabilizing pandemic. Many observers have noted that the COVID-19 crisis is a harbinger of the kinds of mass, system-wide disruptions that climate change will bring. There are a few notable issues that the current crisis may teach us about a climate-altered future:

- **Sudden shocks to the system can happen and can have enormous consequences.** More than 36 million Americans lost their jobs in a mere two months in the spring of 2020.[8]
- **Disasters can have cascading effects.** In the case of the pandemic, what started as a public health emergency quickly became an economic and social crisis. Climate impacts may start with natural disasters, but have cascading economic, public health and social impacts, which themselves can create ongoing feedback loops. Climate change threatens to produce shocks of even greater magnitude that play out over longer timeframes, including multiple breadbasket failures, climate-induced conflicts and refugee crises.
- **Interruptions to cities' food supplies are a real threat** when there is massive strain on supply chains and transportation networks. Before COVID-19, this was discussed as a theoretical projection. Now people have witnessed it firsthand with shortages of specific items in grocery stores.

Photo courtesy of the Lincoln Journal Star

- **Vulnerable populations will be hardest hit.** While this is not a novel realization, the COVID-19 crisis has exposed anew the deep structural inequalities and injustices of our society. Those who bear the burdens of systemic racism, income inequality and disparities in access to healthcare have been much more likely to die of COVID-19 . In the same way, if unaddressed, these inequalities will put millions of people at risk during future climate crises.

- **It is possible to reduce emissions.** Carbon emissions are estimated to drop 8% by the end of 2020, the largest decline ever recorded.[9] Though no one advocates for an economic crisis as a strategy for reducing emissions, two of the world's largest oil companies reduced the value of their assets by nearly $40 billion, signaling that the coronavirus pandemic may accelerate a global transition away from fossil fuels.[10]

- **Crises bring unexpected consequences.** An historic movement for racial justice galvanized Americans during the pandemic. Racism and xenophobia toward Asian Americans soared. Domestic violence increased. Farmers had to destroy millions of pounds of fresh goods they could no longer sell. Americans encountered unexpected shortages of certain items at grocery stores, and price increases on others.

- **Crises bring unexpected benefits.** Much of the country adopted technology for virtual gatherings, meetings and classes practically overnight, and some discovered in the process that it was a fine replacement for the traveling that used to cost time, money and emissions. Telemedicine was finally cleared of regulatory roadblocks and put into robust practice. Thousands of people planted backyard gardens and started baking bread. Some families experienced renewed bonding.

- **Social capital matters.** The COVID-19 crisis has shown that neighbors can help neighbors with simple tasks to stay safe and increase resilience. Several communities have set up formal or informal networks to help deliver groceries and medication, walk dogs, do yard work and provide friendly phone calls for companionship.

A Global Transition

The transition to a climate-smart, low-carbon way of life is well underway. Today, solar and wind provide the least expensive sources of new electricity in two-thirds of the world. Natural gas and coal generating plants are being replaced with less expensive electricity from wind and solar farms, which are connected to ever-more affordable and reliable battery storage. The fastest growing occupation in the United States is solar installers. The second fastest growing job is wind turbine service technicians.[11]

Changes are happening with companies, cities and consumers all over the world. Over 200 of the world's largest companies have announced commitments to use 100% renewable energy in their operations, and several have already reached that goal.[12] Many of them are influencing their suppliers to switch to renewables as well, creating a strong market force for change. According to the Sierra Club, over 160 cities, more than ten counties, and eight states across the U.S. have goals to power their communities with 100% clean, renewable energy.[13] The global market share for electric vehicles has grown at about 60% per year, reaching 2.1 million in 2018.[14] By 2040, it is estimated that over half of all passenger vehicles sold will be electric.[15]

Natural climate solutions cannot be overlooked. Through photosynthesis, plants naturally remove carbon dioxide from the atmosphere, and there is growing attention to the impact that practices like planting trees, cover cropping, managing forests and timber production, reconnecting tidal marshes and restoring seagrasses could have. A recent study found that managing most land in the U.S. for carbon reduction—both limiting new emissions and removing carbon dioxide from the atmosphere—could achieve the equivalent of cutting the country's emissions by 21%.[16]

Significantly, public opinion is shifting. In Lancaster County, 69% of people believe global warming is happening, 53% say it is caused mostly by human activities, and 59% say they are worried about it. [17]A national poll in June 2020 found that voters want climate action as part of the COVID-19 economic recovery plan. Seven in 10 (70%) voters say federal stimulus funding should prioritize the clean energy industry over the fossil fuel industry. [18]

It is clear that historic change is afoot, and that the time is ripe for Lincoln to take great strides toward a climate-smart future.

Lincoln's Sustainability Successes

Between the City government and the Lincoln Electric System (LES), Lincoln has a solid foundation of sustainability efforts on which to build a more resilient city. Recent accomplishments from both the City and LES are presented here for context.

City of Lincoln Achievements and Commitments

Going back to the 1970s, Lincoln has a long history of boards, committees and advisory groups dedicated to collaboration and advancement of environmental health in the city. The Mayor's Environmental Task Force (METF), as well as its precursors known by other names, is a citizen group that has advised the Mayor on local environmental stewardship and sustainability policies and programs for many years. In 2017, the City released its first environmental plan, the Lincoln Environmental Action Plan (LEAP). The plan called for energy efficiency improvements, more support of electric vehicles, transit and bikes, and increased rates of landfill diversion. The city consistently ranks well above national averages and peer cities when it comes to percentage of parks and green space. Lincoln's trail systems and bikeways are also recognized as some of the nation's best, as demonstrated by the city's 2016 National Bike Challenge award. More examples of the city's recent, high-level progress are outlined to the right.

A. **Reduction in GHG emissions:** From 2011 to 2017, the City reduced per capita annual GHG emissions by 23%.

B. **Landfill Gas Recovery:** In 2013, a landfill gas recovery project was established at the municipal Bluff Road Solid Waste Facility. Natural gas is captured and used to power a 1,600 kilowatt engine/generator set operated by LES.

C. **Wastewater Biogas Project:** Since 1991, Lincoln has captured natural gas from the wastewater treatment plant and used it to generate electricity. In 2020, the City upgraded the system to begin selling the gas to an outside provider, generating substantial income for the City.

D. **Facilitating Solar Installations:** In 2019, the City completed an initiative to the process to install a solar energy system. The City established a streamlined online permitting application, and was awarded the SolSmart Gold designation by the Solar Foundation and the International City/County Management Association (ICMA).

E. **LED Streetlight Replacement Project:** In 2018-2019, the City replaced over 25,000 older, less efficient streetlights to longer-lasting and more efficient LED streetlights. In addition to emissions reductions, this project was a resounding success in terms of waste management and cost-savings: Over 355,000 pounds of steel, glass, bulbs, cardboard and plastic were recycled during this project, achieving a 90% diversion rate. Annual cost-savings were valued at $1.2 million, including both energy and maintenance savings. This project is estimated to have avoided nearly 9,149 annual tons of GHG emissions, equivalent to 933,935 gallons of gasoline use avoided.

F. **Energy Efficiency Improvements:** The City program "ReEnergize" helped weatherize private and public buildings across the community to increase their efficient use of energy and save costs.

G. **Prairie Corridor:** A public-private partnership has formed to establish the Prairie Corridor on Haines Branch, a tallgrass prairie passage and trail that will preserve and enhance unique prairie remnants.

H. Green Light Lincoln: The City implemented the Green Light Lincoln (GL2) program that employs "smart" technologies to move traffic safely and efficiently, saving energy and reducing vehicle emissions.

I. The N Street Bikeway project was completed, which encourages more environmentally friendly transportation and has far exceeded initial usage goals.

J. EV Chargers: The City has installed 22 electric vehicle (EV) charging stations in public parking garages.

K. A Hazardous Materials Collection Center was built at the N 48th Solid Waste Facility.

L. Cardboard Recycling: In 2018, an ordinance banning cardboard from the landfill went into effect, which significantly improved waste diversion rates across the City.

M. We Are Still In: In early 2020, the City of Lincoln joined over 3,600 U.S. communities in signing the "We Are Still In" Declaration to signal their commitment to support the goals of the 2015 Paris Agreement, despite the notification to withdraw from the current presidential administration.

N. Flood management: Lincoln has earned a FEMA Community Rating System of 5, which provides a 25% reduction in federal flood insurance premiums for Lincoln property owners. This is the highest rating in Nebraska and in the top 5% nationwide.

LES Achievements and Commitments

For more than a decade, the Lincoln Electric System (LES) has demonstrated its commitment to protecting the environment and its commitment to continuous improvement by reducing its fossil fuel usage, helping customers improve energy efficiency, and offering a range of sustainable programs.

- **The Sustainable Energy Program** offers customers and contractors financial incentives for energy-efficient installations and upgrades. The program helps lower the cost of energy-smart investments in a home or business while helping lower community-wide demand for electricity. Through 2019, LES has invested over $25 million resulting in approximately a net 31 MW reduction in peak demand, which is equivalent to the energy usage of over 10,000 average Lincoln homes.
- **EV charging stations:** LES assisted with the installation of 15 new EV charging stations throughout the city, to ensure it is ready for a future with more EV drivers.
- **Current sustainability goal:** Adopted in 2011, the Sustainability Target calls for LES to meet the area's future peak load growth through sustainable power resources and energy-efficiency programs that reduce demand on the system. The goal is perpetually ongoing, as every year LES looks to offset demand growth forecasts out another 5 years in the future. LES has met and surpassed this target since its adoption.
- **Increase of renewable energy sources:** LES' renewable resources produced energy equivalent to 46% of LES' total retail sales in 2019. For reference, LES' renewables produced the equivalent of 10% of total retail sales in 2010. Production of renewable energy comes from LES' commitment over the years to increase renewables, including the following milestones:
  - Addition of three large-scale wind contracts, totaling 273 MW, in 2015.
  - Installation of the first utility-scale solar project in Nebraska in 2016. Supported in part by the LES SunShares Program, this 5-MWDC/4-MWAC community solar project is still one of the largest projects in the region and allows customers to support the project with their monthly bills.
- **Reduction of carbon intensity:** The the rate at which LES' aggregate generating fleet produces CO2 (tons/net MWh) has dropped 38% from 2010 to 2019. Over this same period, the actual CO2 production (tons) of LES' aggregate generating fleet has been reduced by 42%.
- **Availability of net-metering:** LES updated its long-standing net metering program in 2014, providing enhanced incentives to customers who produce up to 25 kW of their own renewable energy, including a one-time payment for the capacity value the installation brings to the system. LES introduced its new Renewable Generation Rate at the same time, allowing customers to partner with their neighbors to sell up to 100 kW of renewable energy to LES at the same incentive levels.

Process

In the summer of 2019, the City of Lincoln engaged with Verdis Group to facilitate the City's climate resilience planning process. This process involved three main steps, summarized below.

Step 1: Prepared Information, Systems and Processes

Main outcomes from this first task included a summary of previous sustainability and resilience work, description of Lincoln's climate-related risks, summary of peer city sustainability and resilience work, community characteristics survey results, and formation of the Sustainability Working Group and the Climate Resilience Task Force. Verdis Group achieved these outcomes through an in-depth information-gathering initiative, which included the following research and review activities:

1. Reviewed the City's past and current work related to sustainability and resilience, such as the Solid Waste Plan, the Comprehensive Plan, the Lincoln Environmental Action Plan (LEAP), the Water Management Plan, and the Local Emergency Operations Plan.
2. Gathered past and projected climate data for Lincoln and determined projected energy and water demand based on climate and population growth projections. Consulted with local, regional climatologists.
3. Collected information on past environmental disasters in Lincoln and the region, including the response process, people affected and lessons learned.
4. Gathered demographic and hazard information on Lincoln, including population age/ability level/ethnicity/income level/marriage and family status data, public health data, transportation data, evacuation plans, flood plain maps, and other hazard maps.
5. Assisted the Mayor's Office in appointing two planning groups: An internal, cross-departmental Sustainability Working Group, and the Climate Resilience Task Force, composed of individuals representing a cross-section of the Lincoln community. Some of the communities represented included: business, government, non-profit, faith, educational, public health, emergency management, immigrant and refugee, those with disabilities, and low-income residents. The pre-existing Mayor's Environmental Task Force, which holds monthly meetings open to the public, was the third main planning group.

Step 2: Facilitated a Climate Action Planning Process

Main objectives for this phase of the project were to honor and include past work, elicit new knowledge, build relationships, identify knowledge gaps, take a holistic view of the Lincoln community's strengths and vulnerabilities, and create a sense of community ownership for ongoing climate resilience development. Verdis Group facilitated multiple workshops, full group meetings and one-on-one meetings with the Climate Resilience Task Force, Sustainability Working Group and Mayor's Environmental Task Force. In between workshops, Verdis Group analyzed data, conferred with subject matter experts and prepared for the next step of the process. The planning process asked participants to do the following:

1. Envision a future, resilient Lincoln.
2. Assess Lincoln's strengths and vulnerabilities in relation to climate hazards.
3. Identify priority focus areas for the Climate Action Plan.
4. Explore goals and strategies to reduce emissions across sectors.
5. Articulate, vet and refine strategies.

Step 3: Wrote and Designed Draft Plan

In the final step, Verdis Group finalized research, wrote the narrative of the draft plan, and requested the review of key sections of the plan by subject matter experts on the Sustainability Working Group and Climate Resilience Task Force.

Next Steps: Engagement

This draft plan is being released to the public for their feedback and suggestions in order to make it a more robust plan for Lincoln. Engagement opportunities will be conducted throughout 2020-2021. Special focus will be given to listening to communities expected to be most impacted by climate change, including those who live in floodplains, those who are low-income, people of color, those for whom English is a second language, and those with poor health status.

Feedback from these sessions will be integrated into the final plan, which is expected to go before the City Council in 2021. If adopted, the recommendations of the plan will be integrated into the Comprehensive Plan update. While much remains to be determined about the many groups who will have accountability for ensuring the strategies are implemented, every Lincoln resident has a role to play at making the vision of this plan a reality.

Executive Summary

Resilience: The capacity of social, economic, and environmental systems to cope with a hazardous event, trend, or disturbance, responding or reorganizing in ways that maintain systems' essential function, identity, and structure while also maintaining the capacity for adaptation, learning, and transformation.

Resilience is commonly thought of as the ability to bounce back from a shock or disturbance. While recovery is a necessary component of resilience, climate resilience also includes capacity-building that allows continued adaptation in the midst of an ever-changing environment. Climate resilience can thus be understood as the ability to recover from shocks and the capacity to thrive in the midst of a continually changing environment.

Resilience is a bridge between climate change adaptation and disaster risk reduction. While disaster risk reduction focuses on identifying specific hazards and assessing risk relative to those hazards, climate resilience focuses on ensuring the proper functioning of a whole system in the face of multiple hazards and ongoing disruptions.[19]

This plan attempts to take an intersectional approach to climate resilience, looking at the ways in which climate risks will intersect with Lincoln's socio-economic, health and systemic vulnerabilities, and also at the ways in which solutions can have co-benefits across sectors.

Lincoln's Future Climate

The ways in which Nebraska's climate is expected to change are significant.

2-5 degrees

warmer than now

By 2050, average temperatures in Nebraska are expected to be 2 to 5 degrees warmer than they are now.

10-20 days

annually with a high temperature greater than 95°F

Nebraska experiences, on average, 10-20 days annually with a high temperature greater than 95°F. By mid-century, this number will likely double, impacting plant growth and development. Conversely, the number of extreme cold days will be cut by 50%-66%, on average.

15-20%

winter and spring precipitation totals will be up

Winter and spring precipitation totals will be 15% to 25% higher than current conditions. Fall will be slightly wetter (5% increase in precipitation) and summer will be 5% to 15% drier than the present climate, impacting summer irrigation demand.

15% to 30%

increase in heavy precipitation days

Heavy precipitation days are projected to increase 15% to 35% by 2050. Furthermore, multi-day extreme precipitation events will increase in severity.[20]

Projected Climate Impacts

The changes in climate will result in several impacts, each of which may have many implications for life in Lincoln.

Nebraska's Projected Climate Impacts

- Warmer, drier summers
- More extreme hot days
- Wetter springs
- Snowier winters
- More extreme rain events
- Higher cooling degree days
- Lower heating degree days
- More demand for water
- More frequent droughts
- More frequent and more intense floods
- Increased insect-borne diseases
- Crop, livestock stress
- Increased damage potential
- More frequent large hail
- Longer growing season
- Economic instability
- Climate-related health impacts

Seven Qualities of Resilient Cities

- **Flexible**
- **Redundant**
- **Robust**
- **Resourceful**
- **Reflective**
- **Inclusive**
- **Integrated**

Source: City Resilience Index

Climate Risks

The planning process identified eleven main areas where the city is exposed to risk in the ways that climate impacts may intersect with existing social and infrastructure vulnerabilities.

1. **Flooding and Drought.** Lincoln's susceptibility to flooding, particularly along the leveed portion of Salt Creek, is one of the most significant climate risks for the city. Flood conditions are expected to alternate with drought conditions, which create another high risk for the city.

2. **Single Water Source.** The fact that Lincoln is reliant on one source for all of its water needs—a source that, as seen in 2019, is vulnerable to extreme weather—is a critical climate risk that must be addressed.

3. **Public Health Risks.** Extreme heat, extreme storms, wildfire, floods, fewer freezing temperatures and psychological stress are some of the impacts from climate change that can lead to serious health issues.

4. **Disproportionate Impacts on Vulnerable Populations.** Those who are vulnerable economically, socially or physically will be more at risk from the cascading impacts of climate change. Lincoln has several populations who are at risk.

5. **Financial and Workforce Resources Not Aligned with Climate Risks and Opportunities.** Currently, Lincoln's economic and workforce development efforts have not taken climate change into account, nor are current efforts aligned with the climate risks and opportunities of the future.

6. **City Policies Not Aligned with Climate Risks and Opportunities**. Like all cities, Lincoln has conventionally based its policies and ordinances on the notion that the climate operates within historical and stable limits. As we are now living in the era of anthropogenic climate change, policymakers will need to consider updated models and data. There is therefore a great need to update the City's policies and planning efforts to reflect projected climate hazards.

7. **Auto-Reliant Transportation System.** The auto-reliant infrastructure in Lincoln, combined with the fact that most cars are combustion engine vehicles, means that greenhouse gas emissions from the transportation sector will be a challenge to reduce.

8. **Reliance on Fossil Fuels.** The lives of Lincoln residents are intertwined with fossil fuels-- through the gas in their cars, the way the electricity they use is generated, the natural gas they use to heat their homes, and more. To make significant progress in reaching the goal of reducing community-wide net emissions by 80%, the way that everyday life is powered in Lincoln will need to shift.

9. **External Control Over Food Supplies.** Nearly all edible food for residents must be shipped in from far away and stocked in the city's grocery stores, which generally carry a three-day supply.

10. **Vulnerable Natural Resources.** Climate change can have a range of negative effects on the natural resources on which we depend for clean air, water and soil.

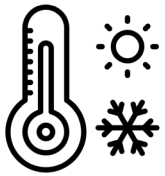
11. **Degree of Public Awareness.** In general, climate change is not being discussed enough in homes, workplaces and civic organizations in Lincoln, and most residents are likely unaware of the dangers that climate change poses to them and what they could do to reduce greenhouse gas emissions.

Strategic Visions

Three overarching directions form the vision for Lincoln's Climate Action Plan.

Lincoln will reduce net greenhouse gas emissions 80% by 2050 (relative to 2011 levels).

This ambitious goal will serve as a guiding target for municipal operations, the Lincoln Electric System, local businesses and institutions, and our entire community in the years to come. Lincoln joins scores of cities across the country who have set a similar "80x50" goal to reduce emissions. A myriad of strategies in the plan speak to achieving this target, from increasing energy efficiency, generating more electricity from renewable energy, switching to electric vehicles and active commuting modes, and employing natural climate solutions.
The goal is a *net* reduction in emissions because it will allow for an accounting of carbon sequestration activities—where plants or systems naturally absorb greenhouse gases—against the amount of greenhouse gases that are emitted into the atmosphere.



Lincoln will be resilient to the climate hazards it will face.

Increasing resilience to the impacts of climate change is a key outcome of this plan. While it is impossible to set a single, measurable goal that would encompass the wide range of resilience capacity the City should build across economic, demographic and infrastructure sectors, this strategic vision, like the first, will help to align actions across Lincoln to increase resilience.

Strategic climate directions and climate resilience will be integrated throughout City actions and ordinances.

Many of the strategies in this plan will be adapted into the next Comprehensive Plan. Beyond that important effort, climate resilience strategies will need to be adopted throughout municipal government in order to be truly effective.

Strategies to Build Resilience

The plan includes over 600 strategies to reduce emissions and increase resilience. Many strategies look to reduce emissions by reducing energy use, switching to renewable forms of energy, and reducing transportation emissions by employing active commuting and electric vehicles. Others seek to remove greenhouse gas emissions from the atmosphere through natural solutions such as planting trees, expanding greenways and composting. Also included are strategies that seek to protect Lincoln residents from the worst effects of climate change in Lincoln.

Many of the strategies use the term “climate-smart” to describe a way forward that is zero emissions, sustainable, equitable, risk-informed and forward-looking. In total, the strategies create a path for Lincoln to adapt to a changing reality and do so while not just surviving, but thriving.

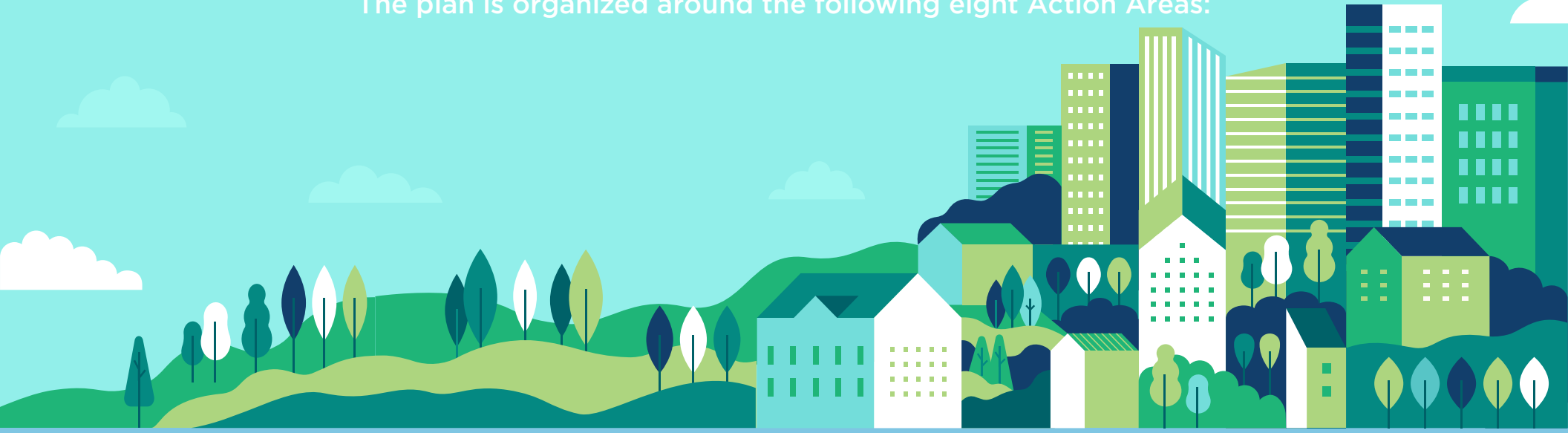
The strategies in this plan are to be read as recommendations, not existing policy. Much work lies ahead to determine the details of how these recommendations will be adopted, if and how they will be revised, who will be accountable for meeting the objectives, and how progress will be tracked and shared. This plan aims to provide a roadmap that can be used by the public and private sector for years to come to guide the city’s progress toward its climate-smart future.

Photo courtesy of Lincoln Parks and Recreation

Many of the strategies use the term “climate-smart” to describe a way forward that is zero emissions, sustainable, equitable, risk-informed and forward-looking.

Action Areas

The plan is organized around the following eight Action Areas:



- Transition to Low-Carbon Energy
- Build a Decarbonized and Efficient Transportation System
- Align Economic Development Goals with Climate Realities to Ensure a Thriving Economy
- Improve Protections for and with Lincoln Residents
- Build a Resilient Local Food System
- Maximize Natural Climate Solutions
- Reduce Waste
- Engage Residents in Co-Creating A Climate Smart Future

2050 Vision

Imagine... it is August, 2050 in Lincoln, Nebraska:

It has been a hot summer, but everyone is excited about the arts and music festival that will start on Friday night. Many of Lincoln's nearly 400,000 residents[21] will bike, bus, or hop on an autonomous electric shuttle to make it downtown for music, food and celebration. Some will even come from Omaha on the electric bus that shuttles commuters regularly between the two cities. The annual festival has become a cultural hot spot, featuring all kinds of ethnic food, local artists and artisans, a local food market, and bands with musical influences from Sudan to Tibet. After all, one in three Lincoln residents is a person of color,[22] including many Latinx people who have migrated northward from the Southwestern United States and Mexico due to the changing climate. They have been wholeheartedly welcomed as valued additions to Lincoln's community, workforce and brain trust. New residents have been assisted in getting connected to local resources by the new Onboard Center and by the "Everyone Belongs" community project, which seeks to ensure equitable access to jobs, greenspaces and health care to every member of the community.

The previous month was hot: 31 days in a row of temperatures over 90° kept everyone indoors. Despite the increased demand for electricity for air conditioning, LES is nearly completely decarbonized, now providing the majority of its energy through renewable sources. The Lincoln-Lancaster County Health Department had to issue several heat index warnings, and since everyone has the MyLNK app on their devices, construction managers and other outdoor workers were able to shift their work hours to stay safe. Prompted by the 2020 coronavirus pandemic and the climate-related rise of insect-borne diseases, the local health department has proactively responded to many climate-related health risks, including novel disease vectors, like those originating from mosquitos and ticks. With successful partnerships, strategic interventions and improved health care services, the City of Lincoln has eliminated a 20-year life expectancy differential that used to exist between different residential areas of the city.

The solar manufacturing plant is one of the main sponsors of the festival. The company was started back in 2022 and has now grown into one of Lincoln's major employers. By partnering with a job training program at the University of Nebraska-Lincoln and Southeast Community College, the solar company is able to employ graduates in its growing, worldwide business. Other local businesses are thriving too, thanks to the proactive vision of the Chamber of Commerce and City leaders who incentivized small business growth toward climate-smart goals. One successful business provides technicians to assist businesses in meeting their energy efficiency goals and to assess rooftop solar potential. Since many low-wage jobs have been replaced by automation over the years, having a strong local economy has been key to maintaining Lincoln's low unemployment level and cutting its poverty rate in half.

The city is dealing with the ramifications of a severe drought that has gripped the state for two months. Many homeowners have replaced their lawns with drought-resistant landscaping, and some are incorporating pollinator habitat and vegetable gardens. Fortunately, Lincoln's water supply is not a concern since the addition of a second water source to provide additional clean drinking and service water to Lincoln. Thanks to rain sensors being installed on all commercial and residential irrigation systems, water conservation has increased. Pity the person who wastes water by letting their sprinkler system hit pavement—the middle-aged Gen Z population has made wasting anything socially

unacceptable. Hardly anyone remembers plastic water bottles or plastic bags anymore— the whole notion of “single-use plastics” has gone the way of the dinosaur. Nowadays, all packaging is made from materials that are compostable, reusable or recyclable, and schoolkids can’t imagine it any other way.

The weather seems to swing between extremes. Just five months previous, in late winter, a major flood event occurred. The combination of melting snow and an extremely heavy precipitation event combined to create dangerous flash flood conditions across town. The height of Salt Creek rose to historic levels and the levees were overtopped by about one inch. While there was flooding in the North Bottoms neighborhood, the levees did not breach, thanks to reinforcement efforts undertaken in recent decades. Residents were notified of the danger ahead of time and had time to prepare, which lessened the damage. The low-income residents who had water damage in their homes were assisted in recovering by the Lincoln Community Relief Fund, a public-private philanthropic effort now in its 25th year which has made a demonstrable difference in increasing Lincoln’s resilience to natural disasters. The NeighborLNK program is another key element in Lincoln’s climate resilience toolbox: it connects neighbors in need with volunteers who provide grocery and medication delivery, emergency assistance, transportation, dog-walking and friendly conversation.

The year-round indoor public market will double as a cooling center for festival-goers. Lincoln’s local food network has won awards nationwide for its innovative approach that includes employing seniors in living wage jobs, training new farmers in regenerative agriculture techniques, providing food for all of Southeastern Nebraska’s large institutions, eliminating food

Photo courtesy of Lincoln Calling; Photograher Odochi Akwani

deserts in the community and selling a refined compost product that is made from the food production waste combined with the organic waste from the city-wide curbside compost collection system. As Nebraska's climate has changed, so have its cropping patterns, introducing a much wider variety of crops, which are enjoyed by the enthusiastic patrons of the public market. The public market includes over a dozen food booths and cafes, with vendors selling everything from crafts to condiments, and local musicians who give lunchtime concerts. The building itself was built with green concrete and features a green roof and pervious pavement- all of which are now requirements for construction of municipal buildings in City contracts.

Opening night of the festival arrives. Against a backdrop of the city's newest green, transit-connected affordable housing complex, the Mayor steps to the microphone to give a warm welcome to the festival attendees. She announces the celebration of an important milestone: the Salt Valley Greenway is now 90% complete. This interconnected loop of greenways surrounding Lincoln provides recreational trails, riparian conservation that inhibits flooding, habitat conservation for dozens of wildlife species, bike commuter trails and educational sites. A public-private partnership has helped to acquire land to make this dream a reality, while also providing funding and volunteers for tree-planting, native prairie preservation, habitat conservation and other natural carbon sequestration activities across town that have helped Lincoln reduce emissions.

Festival attendees roar their appreciation, and a few minutes later, as the beats of the first band resonate into jubilant and healthy bodies, the crowd begins to dance. There's a sense of anticipation in the air: the Huskers finished in the top ten last season, and kickoff day is around the corner. Tonight, the good life feels pretty great.

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Characteristics of Lincoln

Often described as a “big, small town,” Lincoln residents prize the quality of life in the capital city. High quality public schools, verdant parks, bike trails, low crime, a relatively low cost of living, and a strong sense of community are some of the strengths that can be built upon to create a more resilient city.

For centuries the territory of Otoe, Pawnee and other Plains Indians tribes, the land around what is now Lincoln was attractive to White settlers because of its natural salt resources. “Salt was a precious commodity on the prairie, especially for preserving meat, and the Lancaster settlers envisioned a lucrative industry.

In sunny weather a crust of salt would form on the ground, and even greater quantities could be obtained by pumping the brine into vats and boiling away the water.”[23] Though the early settlers’ hopes for commercial salt mining success were never realized, the village of Lancaster—later renamed Lincoln—was there to stay.

Today Lincoln is home to over 287,000 people, the Nebraska State Capitol, five institutions of higher education including the University of Nebraska’s flagship campus, over two dozen art galleries and theaters, 16 arboretums, a children’s zoo, 131 miles of trails, and much more.

Members of Lincoln’s Climate Resilience Task Force (CRTF) took a survey in Fall 2019. In this survey, they were asked to share their thoughts on Lincoln’s strengths, struggles, changes over time, and what their ideal Lincoln would look like in 40 years.

Strengths

Society and culture, higher education, size, and economy were the top four strengths CRTF members identified for the city. Respondents shared that they feel Lincoln's culture is "friendly," "thriving," "vibrant." They also described the city as "an easy place to live" with a high quality of life. Sample descriptions of Lincoln's strengths include:

- "I believe its greatest strength is that the citizens of Lincoln OWN Lincoln - they care for it, cherish, and continually want to improve it. It is not just a place to stay for a little while. It is home."
- "Lincoln is a charming college/capital town that is large enough to have what you are looking for and small enough for you to experience those things conveniently."
- "Good community, lots of inexpensive music and arts events, friendly, good schools, good trails and parks, clean, intentional development, strong non profit community, progressive leadership, improving efforts to engage and collaborate among businesses, government, education, arts and nonprofits."

Struggles

CRTF members described Lincoln's struggles in four main topic areas: economy, growth, infrastructure and diversity. While the local economy was noted as a strength, respondents pointed out issues related to the rising costs of living, increasing taxes, decreasing housing affordability, and a perceived lack of diversity in the types of industry available in Lincoln. Struggles with recruiting and retaining young professionals were also mentioned. Sample descriptions of Lincoln's struggles include:

- "Struggles with disparities in who enjoys the good life."
- "One thing that I think we struggle with is retention. We need more young professionals in the city, so that we can continue to grow and thrive."
- "Challenges: Ensuring critical infrastructure keeps pace with growth and development."

Changes Over the Past 5 to 10 Years

A majority of CRTF members named growth and development as the defining characteristic of Lincoln's recent changes. Over the past five to ten years, the city has seen an increase in development, particularly in the downtown area. Lincoln has also grown in size, as well as in the diversity of its demographics. Respondents described Lincoln's recent growth and development as:

- "Lincoln continues to grow but does so in a smart way. Revitalizing downtown has been good for the city."
- "Lincoln has really matured as a community during this time. This has included the growth in the Haymarket and West Haymarket stimulated by the arena, the completion of the Antelope Valley project and the redevelopment occurring as a result, the tech startups and other business growth within the community, the increased cultural and entertainment opportunities, and the increased diversity brought by our community's welcoming of immigrants and refugees."

Future Lincoln

A plurality of CRTF members described their ideal Lincoln in 30 years as a city where sustainable living is the default way of life. Respondents hope to see sustainable features such as the reduction or elimination of greenhouse gas emissions, an energy portfolio comprised mostly of renewable energy rather than coal and natural gas, an increased landscape of urban farming and local food initiatives, expanded bike lanes and healthy transportation infrastructure, more electric vehicle charging stations and walkable neighborhoods. Narratives of an ideal future Lincoln included the following descriptions:

- "I would love to see Lincoln become a community that takes pride in a small carbon footprint. This would be exemplified in ubiquitous use of solar panels for businesses and residences, electric car charging stations throughout the city, ubiquitous bike lanes, widespread investment and use of public transit, a light rail between Lincoln and Omaha, and a foodie culture that prizes local and family owned agriculture."
- "Community gardens are prevalent, people are growing their own food and buying locally produced products (strong support for local businesses). There is an emphasis on public transport and electric vehicles are affordable and convenient to own. Development is planned mindfully, focusing on integrating new neighborhoods, businesses, and other organizations into the existing infrastructure rather than tacking on another isolated suburb. Neighborhoods are zoned so that people can live work and eat within a walking radius. Social support structures are visible and accessible. Public spaces are attractive and functional. Bicycling to work is seen as normal, cyclists are not nuisances on the road. People feel connected to the environment."

To summarize the words of its residents, Lincoln is:

Welcoming. Pragmatic. Transparent.
An evolving, vibrant, diverse city.
Big city opportunities with a small town feel.

Descriptions above from Lincoln residents depict a thriving and friendly city with a high quality of life. These descriptions are affirmed by the latest Lincoln Vital Signs Report (2019), a collaborative effort led by Prosper Lincoln and the University of Nebraska's Public Policy Center, which describes Lincoln as "prospering and growing stronger."[24] Community characteristics of Lincoln are summarized below from Lincoln Vital Signs 2019 with citations from supplemental resources.

Growing

Nebraska's capital city sits in the heart of Lancaster County in the southeastern part of the state. With a population of over 287,000, Lincoln is the second largest city in the state of Nebraska and is located approximately 60 miles southwest of Omaha, the state's largest city. Lincoln's population has been steadily increasing by 1-2% since 2009, with a total of 33,391 (13%) more people in 2019 than in 2009. Retirement-age residents (65+) are the fastest-growing population in Lincoln, growing 42% over the past decade compared to 10% of working age and younger populations.

Lincoln's population lives within the city's 93.5 square miles of land. To accommodate future population growth, the City projects 1,500 housing units will be added each year through the year 2040.[25] Multi-family units are anticipated to make up 40% of total new dwelling units added in Lincoln through 2040.

A majority (78%) of dwelling units are anticipated to be added in Lincoln's "new growth areas," which are located on the city's North, East, South, and West perimeters. Lincoln's southern new growth area has seen a plurality of new units from 2016-2018.

Prospering

Before the coronavirus pandemic, unemployment in Lincoln was the lowest it had been in 15 years. The city's unemployment rate is consistently below the national average and job force participation rate in Lincoln has been at least 7% higher than the national rate over the past decade. Education and employment are tightly linked. Lincoln is home to a highly educated population with over half (53%) of the city's adults holding an associate's, bachelor's, or graduate/professional degree. Nearly 94% of adults in Lincoln have a high school diploma or higher, compared to 88% of the U.S. general population.

It should be noted that Lincoln is experiencing increases in income disparity similar to what is occurring across the nation. Although job force participation rates are high and unemployment rates are low, household median income in 2018 was $55,388 which is an amount that has not recovered from the Great Recession of 2008 despite adjustment for inflation. Lincoln's cost of living is, on average, lower than other parts of the U.S., however this lower cost of living does not make up for the fact that Lincoln's average per capita income is lower than national averages and in 2018 Lincoln's per capita income was $3,682 below the national average.

Most recent data (2018) shows that a majority (76%) of workers in Lincoln are employed in the private sector. The top three industries in Lincoln by number of people employed are health care and social assistance, educational services, and retail.[26]

Diversifying

Lincoln's non-White population is increasing at much faster rates than the city's White-alone population. From 2009 to 2018, Lincoln's non-White population grew 56% while the city's White-alone population grew only 5% over the same timeframe. Lincoln's White non-Hispanic/Latinx population previously comprised 85% of the city's population in 2009. Ten years later, Lincoln's White non-Hispanic/Latinx population is now 79%.

Since the 1980s, Lincoln has been welcoming refugees from all over the world. The U.S. State Department designated Lincoln as a "Refugee Friendly" city in the 1990s.[27] Lincoln, Nebraska is now home to over 30,000 immigrants and refugees from approximately 150 different countries. Nebraska has a long history of resettling refugees and, in 2016, Nebraska resettled more refugees per capita than any other state in the United States. The city's New American Task Force is a collaborative group of various agencies, departments, and individual advocates who help guide new residents. Many of Lincoln's refugee population have arrived in Lincoln from Vietnam, the Middle East, Eastern Europe, Africa, Iraq, Afghanistan, and Burma (Myanmar).

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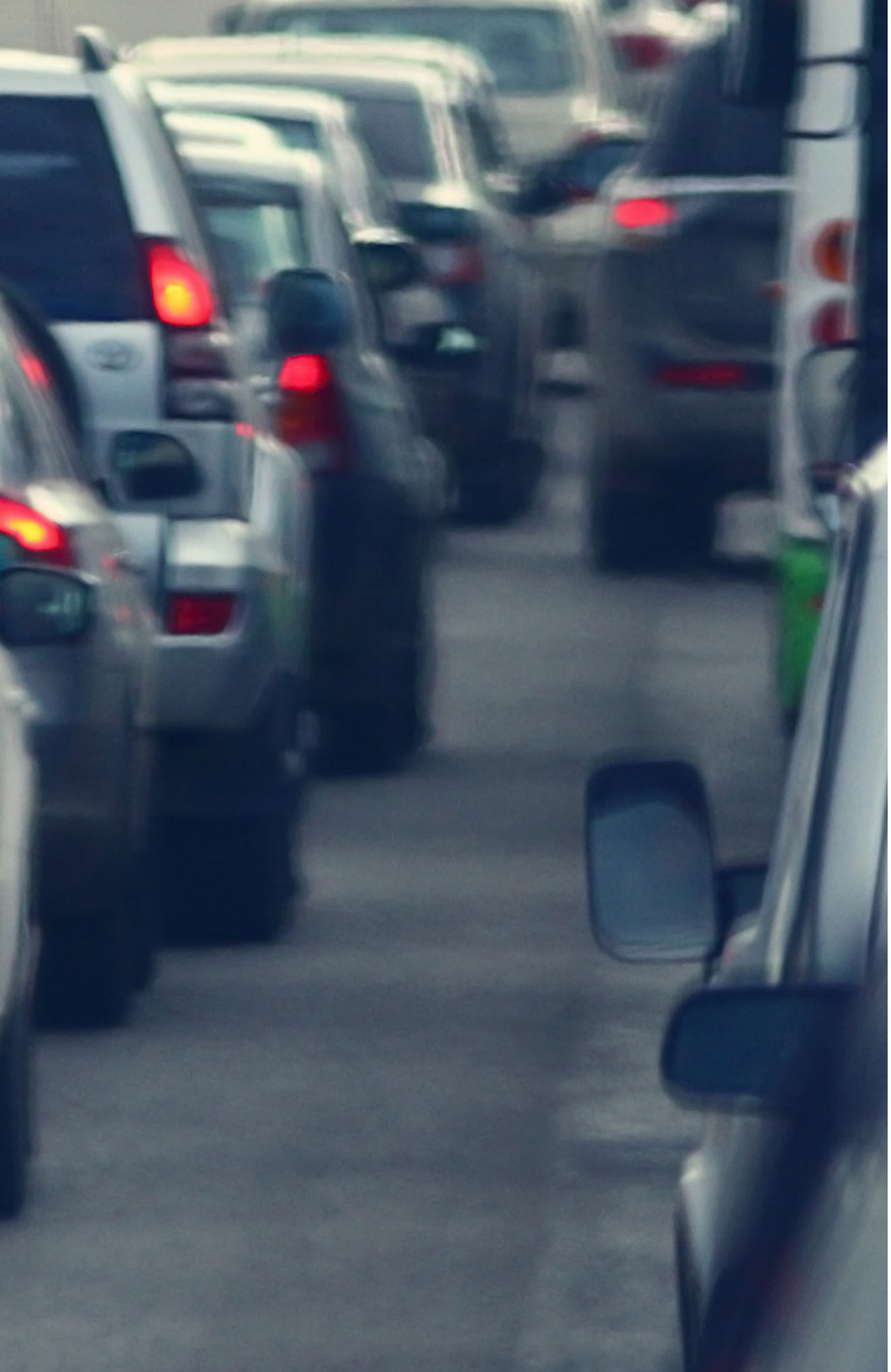
Photo courtesy of Lincoln Parks and Recreation

Greenhouse Gas Emissions Reduction Target

This Climate Action Plan has come about from an understanding of the need to significantly reduce greenhouse gas (GHG) emissions in order to slow the pace of climate change and protect Lincoln residents' way of life.



Most greenhouse gases—including carbon dioxide, methane and nitrous oxide—are associated with the production and burning of fossil fuels, which create energy for electricity generation, transportation, heating and manufacturing. Setting an emissions reduction target was thus a key outcome of the climate action planning process. After much deliberation, the target was set: reducing the city's overall net greenhouse gas emissions 80% by 2050, relative to 2011 levels. Most of the strategies in this plan are intended to contribute toward meeting this goal.

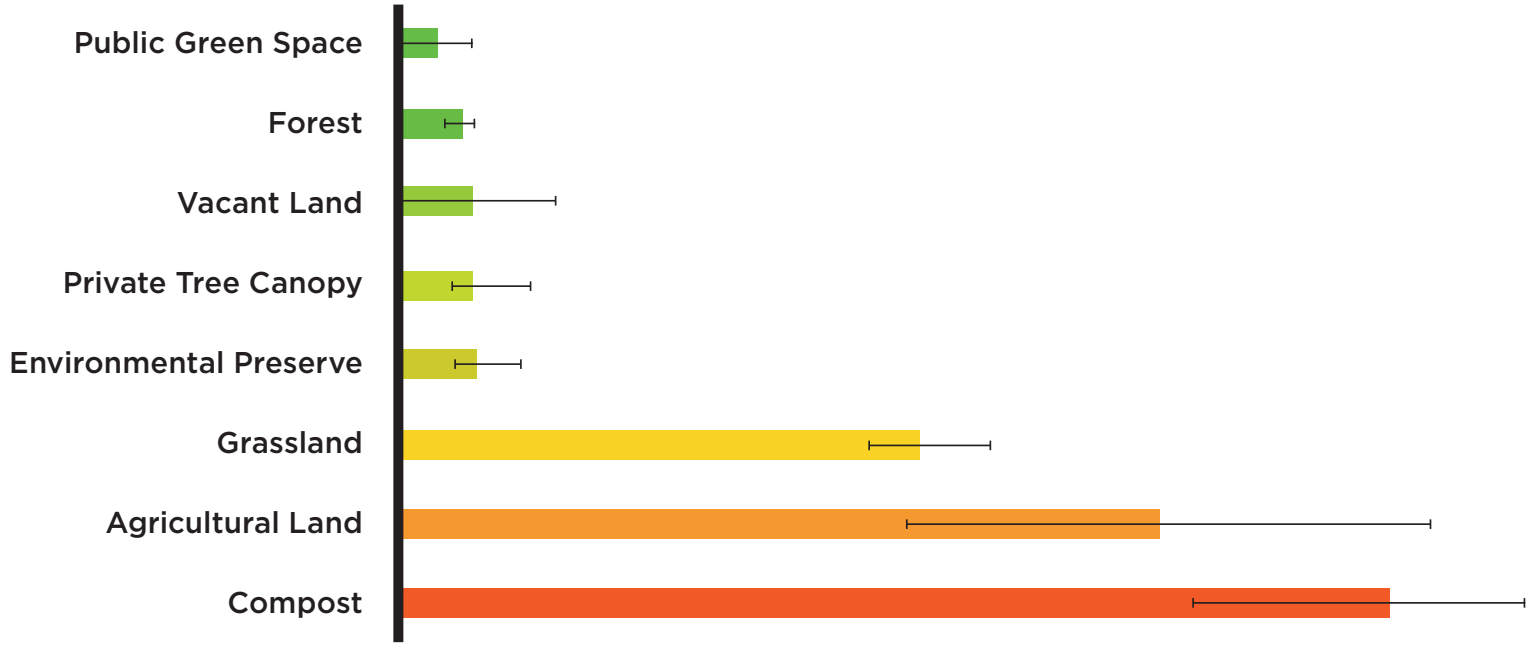
The goal is based on emissions rather than on sources of electricity for a few reasons. While many cities have set goals for 100% renewable energy, this kind of direction targets only the electricity sector and leaves out the important sectors of energy efficiency and transportation. It also puts the entire onus of change on the electric utility, while in fact, every Lincoln resident has an important role to play in shifting to low-carbon behaviors. This "80x50" (eighty by fifty) goal, as it is known by many cities around the world that have adopted a similar target, is intended to be an all-encompassing, visionary goal that will invite all sectors of Lincoln to play a part in transitioning to a low-carbon future.

The target specifies a net reduction in emissions. This specification will allow the City to inventory, track and account for the carbon sequestration activities that occur within the city limits over time. There are several ways that greenhouse gases are removed from the atmosphere: through the process of photosynthesis, through the breakdown of organic waste through composting, and through the capture of methane in landfills and wastewater treatment plants. These are known as "carbon sinks," and these activities can be expanded where possible to increase the amount of greenhouse gases being sequestered into the ground.

Carbon-sink technology remains in its infancy and is currently not economically viable at scale, but may become viable during the course of this plan. Natural carbon sinks, where carbon is captured and stored via trees, soil, and microbes, can be managed to have a significant reduction in net carbon and are important tools towards reaching a net carbon goal. To date, Lincoln has not fully surveyed carbon sinks within the city limit. An internal analysis of several carbon sinks indicates there is a significant amount of carbon stored in Lincoln that is not included in the City's inventory because current protocols and methodology to measure carbon sinks are limited.

The following figure is for illustrative purposes to display the relative ability of different activities to store carbon today given current levels of activity. It is important to note that many of these activities, such as composting, have associated emissions that are larger than the carbon sinks, leading to net positive emissions. It is recommended that Lincoln develop a carbon sequestration plan, which would entail a full analysis of current and potential greenhouse gas emissions and sinks in the city, and provide recommendations for increasing carbon sequestration capacity.

Relative Carbon Sequestration by Source



Consumption-Based Emissions

With one notable exception, Lincoln's GHG inventory covers activities that occur within the geographic scope of the city, such as vehicles driving on city roads or homes burning natural gas for heating. Electricity is primarily produced outside of city limits, but consumption within the city is accounted for in the current inventory. However, there are numerous other sources of emissions for which Lincoln is responsible for that occur outside city limits. For example, when residents purchase items such as food, beverages, appliances, and clothes, associated emissions from the production of these and many other goods are not accounted for in the current inventory. The emissions associated with manufacturing and transportation of goods is a key area for Lincoln to include for a more holistic view of GHG emissions. The emissions captured from a consumption-based inventory can be similar in magnitude to the geographic scope,[28] which means that the emissions produced by the activities of Lincoln residents are significantly larger than what is captured in the geographic inventory. Consumption-based emissions can be difficult for a municipality to reduce directly, but can be impacted by personal behavior, local laws and programs. Consumption-based emissions can also be an opportunity to engage the public because these emissions are directly connected to consumer choices.

Lincoln's Electricity

Lincoln's electricity is delivered by the Lincoln Electric System (LES). LES has part or full ownership in (or contracts with) three natural gas plants, three coal plants, eight wind farms, one landfill-gas-to-energy facility, one hydropower marketing administration, and one community solar facility.[29]

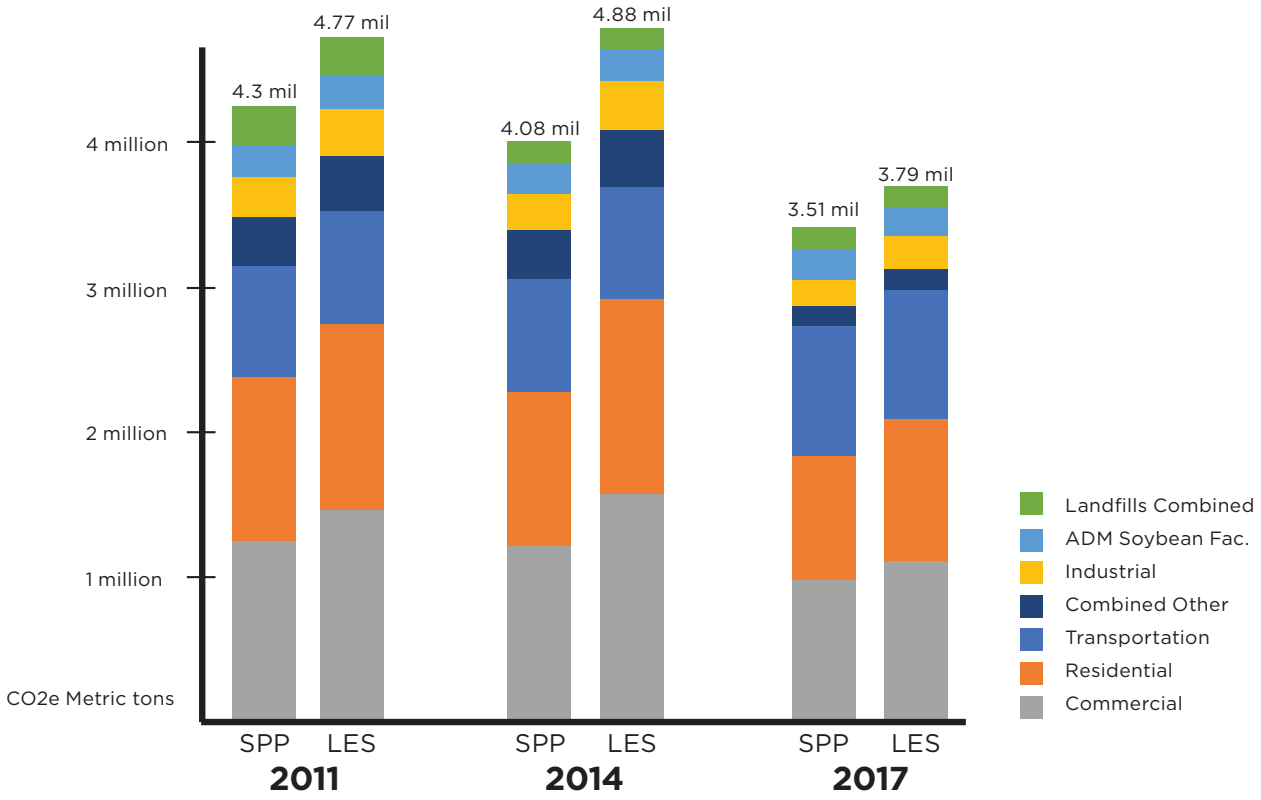
In addition to operating these electricity generating resources, LES is a part of the Southwest Power Pool (SPP). SPP is a regional power authority that oversees the electric grid and the wholesale power market in the central U.S. on behalf of a diverse group of utilities and transmission companies in 14 states. It is one of nine Independent System Operators (ISO)/Regional Transmission Organizations (RTOs) in the country. These regional associations operate their electricity grid to provide reliable sources of power and adequate transmission infrastructure.

SPP operates the Integrated Marketplace, which is the mechanism through which LES buys and sells electricity. LES sells its energy resources into the market, and then purchases electricity from the market (supplied from various sources like coal, wind, hydroelectricity or natural gas), which is delivered to LES customers. Although electrons cannot be traced to their origin, just like a drop of water in a swimming pool cannot be traced to its origin, the energy that LES customers use actually comes from the SPP market and not directly from the electricity that LES generates. For this reason, the City of Lincoln's greenhouse gas inventory is calculated using two sets of figures, as explained on the next page.

Lincoln's Greenhouse Gas (GHG) Inventory

The Lincoln-Lancaster County Health Department has been conducting GHG inventories of Lincoln since 2005. The inventory is calculated using one set of numbers based on the electricity purchased from the Southwest Power Pool (SPP), and another set based on the electricity that was generated by LES. The figures from SPP reflect the emissions associated with the electricity that Lincoln residents actually used. The figures from LES reflect the assets that it controls. Despite the different approaches, there has so far not been a large difference in outcomes between the two.

The figures below show the GHG inventories for Lincoln for three different years in the last decade. SPP-based figures are included in the left column, and LES-based figures are included on the right.



Total emissions dropped 16% from 2011 to 2017. Net transportation emissions increased 7% since 2011, while both Residential and Commercial decreased 24%. As a percentage of the whole, Transportation emissions have increased 6% while Residential and Commercial have decreased 3% respectively. When population figures are taken into account, the data show a per capita emissions reduction of 23% from 2011 to 2017 (using LES figures; 21% using SPP).

It is clear that Lincoln has been moving in the right direction over the past decade. Going forward, it will be essential to continue to track and report both emissions and carbon sinks, to assess progress relative to the goal, and to adjust course as necessary as new information becomes available. Much remains unknown about the future. Some of the variables that will make significant impacts on the progress Lincoln will make toward meeting its goal are the following:

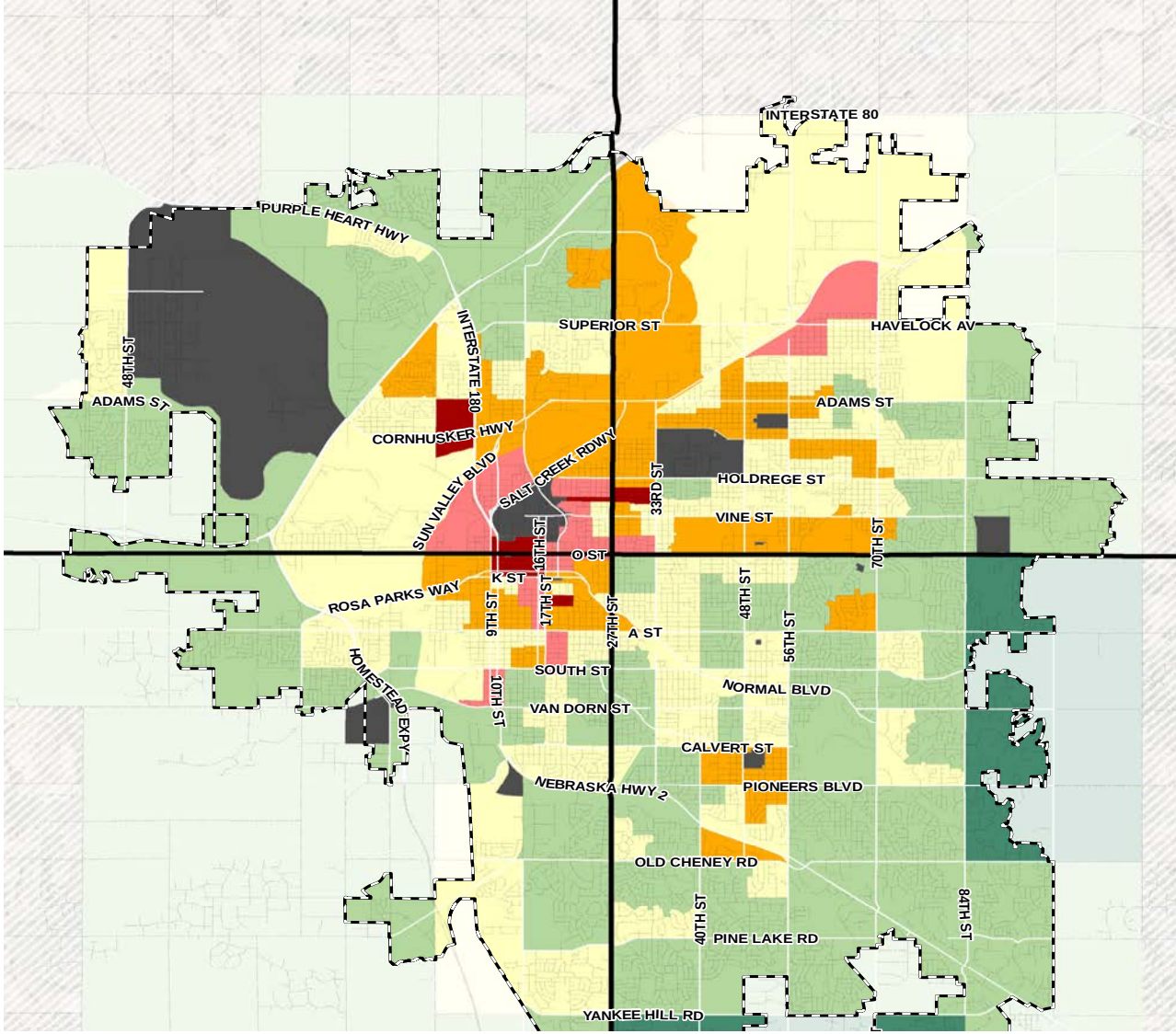
- The speed at which the electricity consumed decreases in carbon intensity;
- Whether heating of new and renovated spaces continues to be supplied by natural gas or other fossil fuels instead of electricity;
- The rate of adoption of alternative modes of transportation and the reduction of single-occupancy vehicles;
- The industrial and manufacturing outputs produced by local industry;
- The pace of the transition to electric vehicles;
- The pace at which a city-wide composting program could be implemented;
- How quickly deep energy retrofits could occur in Lincoln's buildings;
- Whether carbon sequestration could become a revenue-generating activity in the region, and thus spur innovation and progress;
- Whether new battery storage technologies become available that would expand renewable energy potential;
- Whether carbon capture technologies that could remove GHG emissions from the atmosphere become economically feasible at scale;
- The degree to which City officials, local professionals and residents are dedicated to the implementation of this plan and to the vision of co-creating a more resilient city for all.

What is essential is to move forward implementing strategies that reduce emissions and sequester carbon, whether or not technological "fixes" arrive. As the strategies in this plan show, moving in this direction will create a more efficient, healthy and equitable City that will also be more resilient to climate change.

Photo courtesy of Lincoln Parks and Recreation

Energy Burden

This energy burden map shows summer electricity cost as a percentage of median income by census tract. The analysis shows the neighborhoods where residents may be paying a higher share of their income on electricity than others. As the climate continues to warm, summer energy use is expected to increase.



LES Energy Use / Cost Burden: Summer Average

Process:
Urban Development selected parcels that have a primary residential use. They divided the median energy cost (via LES) use by the median income (via ACS). Where ACS data wasn't advailable due to supression the mean of the surrounding blockgroups were used to fill four of 201 block groups.
- The data is symbolized via standard deviations to she which areas are higher or lower than the mean.
- These percentages do not include service fees, or other charges

Median for the service area is 1.7%
Data model average between -0.5- and 0.50 is between 1.5 and 2.1%

<-1.5 Std Dev breaks at 0.8%
-1.5 to -0.5 Std Dev breaks at 1.5%
-0.5 to 0.5 Std Dev breaks at 2.1% (this is the average area)
0.50 to 1.50 Std Dev breaks at 2.8%
1.50 to 2.50 Std Dev breaks at 3.5%
> 2.5 Std Dev ends at 4.8%

< -1.5 Std. Dev.
-1.5 - -0.50 Std. Dev.
-0.50 - 0.50 Std. Dev.
0.50 - 1.5 Std. Dev.
1.5 - 2.5 Std. Dev.
> 2.5 Std. Dev.
Excluded_Areas
27th & O St

Areas with 0% are hatched
(Didnt have LES service)
(Wasn't include in analysis)

City of Lincoln: Urban Development - Kurt Elder - 402-441-7874

Endnotes

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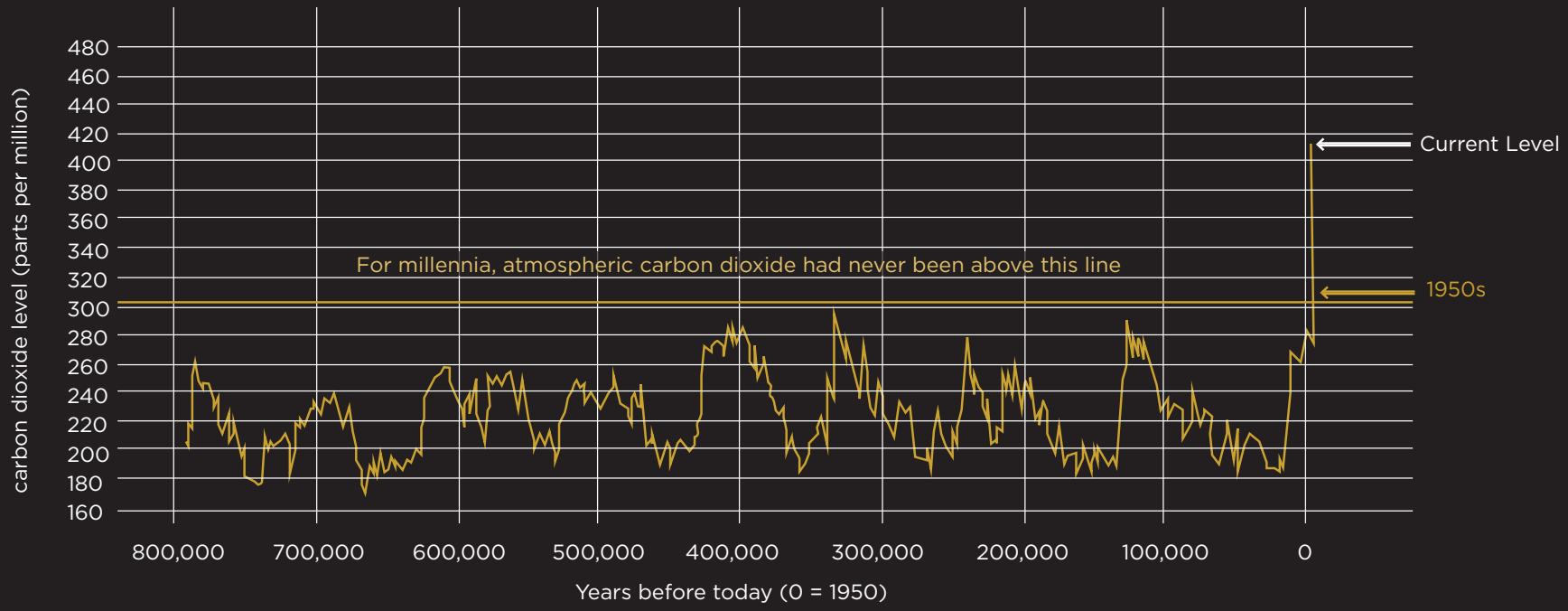
Climate Projections

Earth's climate is now changing faster than at any point in modern civilization.[30] The effects of Earth's changing climate are being felt across the country and across the globe, and Nebraska is no exception.

Photo courtesy of the Lincoln Journal Star

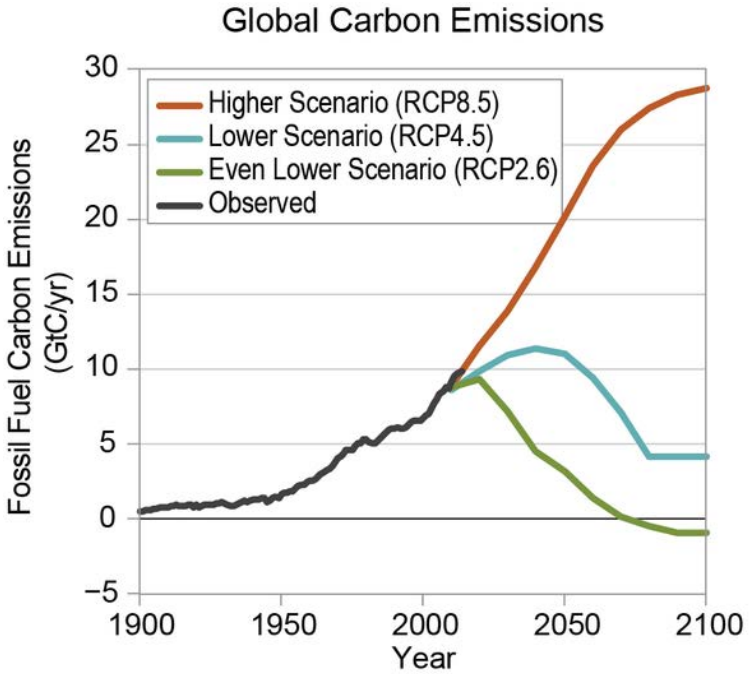
The Relentless Rise of Carbon Dioxide

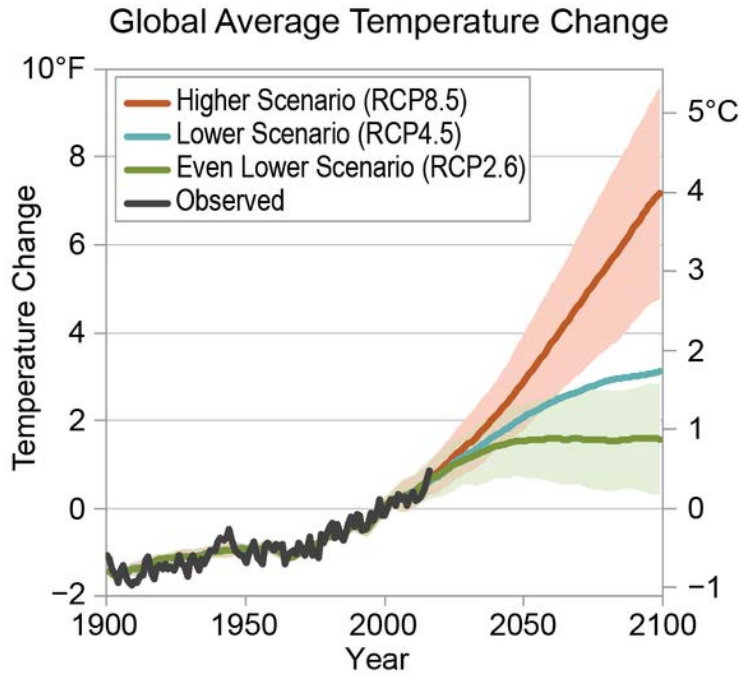


Source: NASA [35]

There are a multitude of anthropogenic (originating from human activity) causes contributing to global climate change. However, the primary cause is the burning of fossil fuels that emit excessive amounts of carbon dioxide and other greenhouse gases into the atmosphere. Greenhouse gases are the 'heat regulators' for the Earth's climate and this fact has been known for more than 150 years. Other causes of climate change include deforestation and land use changes. The level of atmospheric carbon dioxide is currently higher than it has been in 3 million years.[31] Scientists agree that 350 parts per million of CO2 in the atmosphere is the level which should not be surpassed to ensure a stable climate. However, that level was exceeded decades ago. The May 2020 observation was 417.1 parts per million. [32]

The global average temperature has already increased an average of 1°C (1.8°F) over the last thirty years, relative to pre-industrial levels.[33] The temperature changes that we will experience in the future are dependent on the amount of greenhouse gases we will continue to emit. Under a "business as usual" scenario, global average temperatures are expected to rise as much as 8°F by the end of the century.[34] It is important to remember that this amount of increase is not like the difference between a 70° day and a 78° day; rather, it is like the difference between having a fever of 101° versus 109°. A vast network of interconnected ecological systems will be affected, with potentially disastrous consequences.





Source: Fourth National Climate Assessment

Thus, there is urgency for cutting greenhouse gas emissions dramatically. If cities, states and countries can succeed at making the transition to a low-carbon future, we will be able to keep global warming within limits recommended by the scientific community. The 2015 Paris Climate Accord called for all nations to keep warming below 2°C (3.6°F). In 2018, a special report from the Intergovernmental Panel on Climate Change (IPCC) took it even further: researchers predicted that the planet will reach the crucial threshold of a 1.5°C increase by as early as 2030, leading to dramatically increased risk of wildfires, extreme drought, floods and food shortages for hundreds of millions of people. The report calls for keeping warming to no more than 1.5°C (2.7°F).[36] The study found that in order to achieve a 1.5°C limit to warming, "global net human-caused emissions of carbon dioxide (CO2) would need to fall by about 45% from 2010 levels by 2030, reaching 'net zero' around 2050." Reducing emissions to this degree requires widespread changes to the ways we produce energy, transport ourselves, heat our buildings, manufacture products and consume food and goods.

Even with immediate sharp reductions in greenhouse gas emissions, warming will continue for decades before it starts to decline. This is due to the persistence of carbon dioxide that has already been released into the atmosphere and will remain there for many decades. Carbon removal technologies that would directly capture CO2 from the atmosphere are in development, but many questions remain about if and how they could scale up, who would benefit and who would not, and what collateral effects might emerge. It is important to remember that one of the most effective carbon removal "technologies" we have are trees. Forests and prairies are important carbon sequestration vehicles, and they will likely become even more important in the future. Substantial benefits can be gained by improving soil health for carbon sequestration. Given Nebraska's agriculturally-based

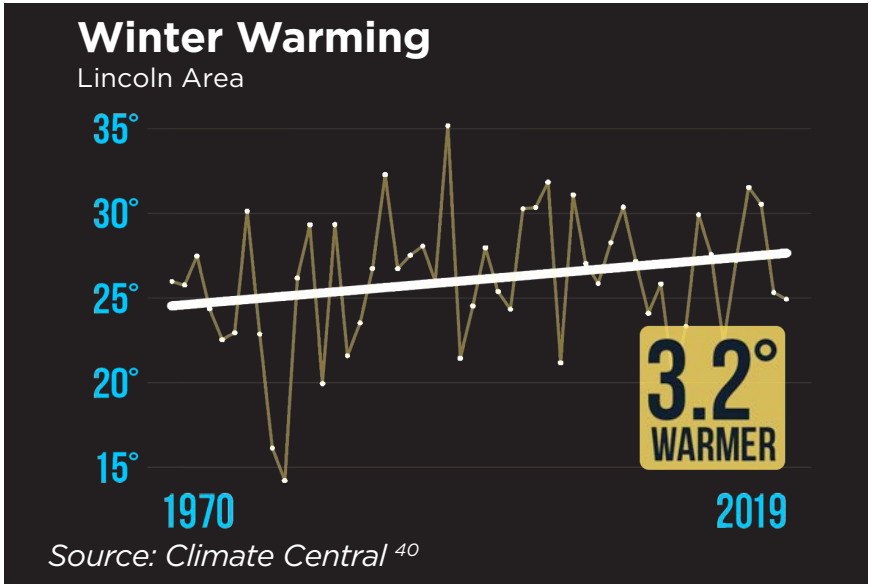
economy, farmers can contribute in a significant way to capturing carbon while also improving soil health and productivity.

Nebraska's average temperature has increased about 1.6°F since 1895, most notably in summer and fall.[37] State Climatologist Martha Shulski describes some of the changes Nebraskans will see in the future:

> Overall, the rise of minimum temperatures is outpacing the rise in maximum temperatures by a factor of two. Lows have warmed 2.2 degrees while highs have warmed 1.1 degrees.... Climate models project the overall warming trend will continue throughout this century. The rate of warming will accelerate in the coming decades. By mid-century average temperatures in Nebraska are expected to be 2 to 5 degrees warmer than they are now, increasing at a rate of 0.5-1.25 degrees per decade.

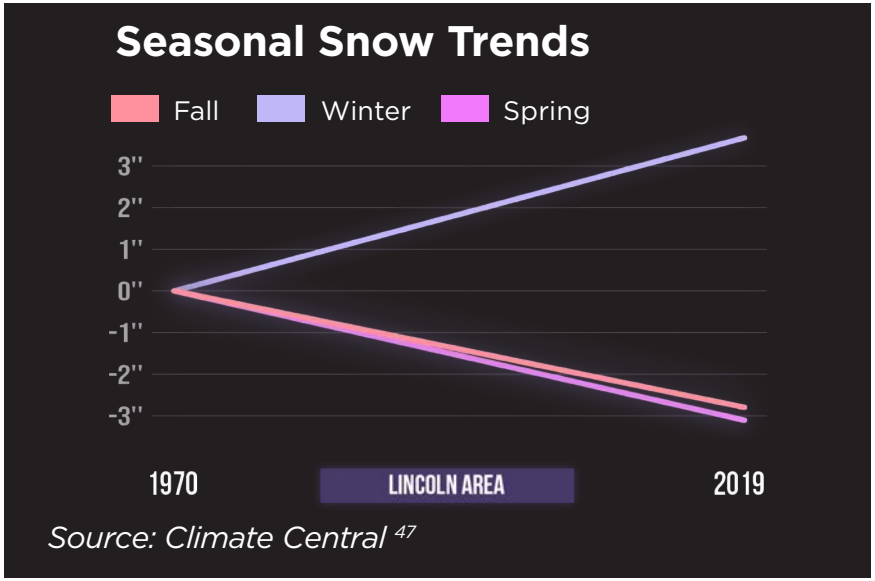
Lincoln's summer maximum temperatures will be similar to Oklahoma City by mid-century.[38] Extreme heat is among the deadliest weather hazards society faces, and it disproportionately impacts communities of color and low-income communities.[39] Increases in the number of days with a high heat index (temperature plus humidity) is critically important to consider. More days with a heat index above 95 has serious implications for human and livestock health. Dr. Shulski describes the likelihood of increased extreme heat days and decreased extreme cold days:

> Nebraska experiences, on average, 10-20 days annually with a high temperature greater than 95°F. By mid-century, this number will likely double, impacting plant growth and development. Conversely, the number of extreme cold days will be cut by 50%-66%, on average.
> The length of the growing season (number of days between last spring and first fall freeze) can be quite variable in Nebraska from year to year. On average, it is about 150 days. By mid-century, the length of the growing season is expected to increase by several weeks.



Precipitation is another critical component of climate change, which has already profoundly affected the state. Precipitation has increased an average of 2 inches over the last thirty years in Nebraska, with most of that increase occurring in the eastern half of the state. This trend of increasing precipitation is expected to continue. There will be changes, however, in the type and timing of precipitation. Dr. Shulski summarizes those changes:

> Winter and spring [precipitation] totals will be 15% to 25% higher than current conditions. Fall will be slightly wetter (5%) and summer will be 5% to 15% drier than the present climate, impacting summer irrigation demand.



Source: Climate Central [47]

Snowfall trends in Lincoln are already changing. Overall, snowfall totals have decreased by 16% over the past 44 years. Spring and Fall snowfall is decreasing considerably, while Winter snowfall totals have increased 25%.[41] In fact, four of the five snowiest winters in Lincoln occurred since 2000.[42] These shifts can be explained by the fact that precipitation is increasing while at the same time temperatures are increasing, which leads to precipitation in Spring and Fall more often falling in the form of rain than snow. The implications of increased snowfall in winter on snow removal services, budgets and road maintenance could be serious.

Lincoln has experienced two damaging heavy precipitation events in recent years (September 2014 and May 2015). In each of these events, approximately eight inches of rain fell in a 24-hour period, causing dangerous conditions, widespread flooding of basements and streets, and property damage to local businesses.[43],[44] Lincoln city proper was largely spared during the March 2019 "bomb cyclone" and subsequent flooding, which was the state's largest natural disaster in history and caused $3.4 billion in flood damages statewide.[45]

Nevertheless, these extreme events are a warning sign to Lincoln: not only will they continue, they will increase over the next several decades. Dr. Shulski reports on the increase of extreme rainfall events:

> Daily rainfall greater than one inch is generally not very common (less than five days a year) currently. However, we can expect a 15% to 35% increase in heavy precipitation days by mid-century. Furthermore, multi-day extreme precipitation events will increase in severity. Soil cover and structure will be critical to reduce runoff and increase the infiltration of excess precipitation.

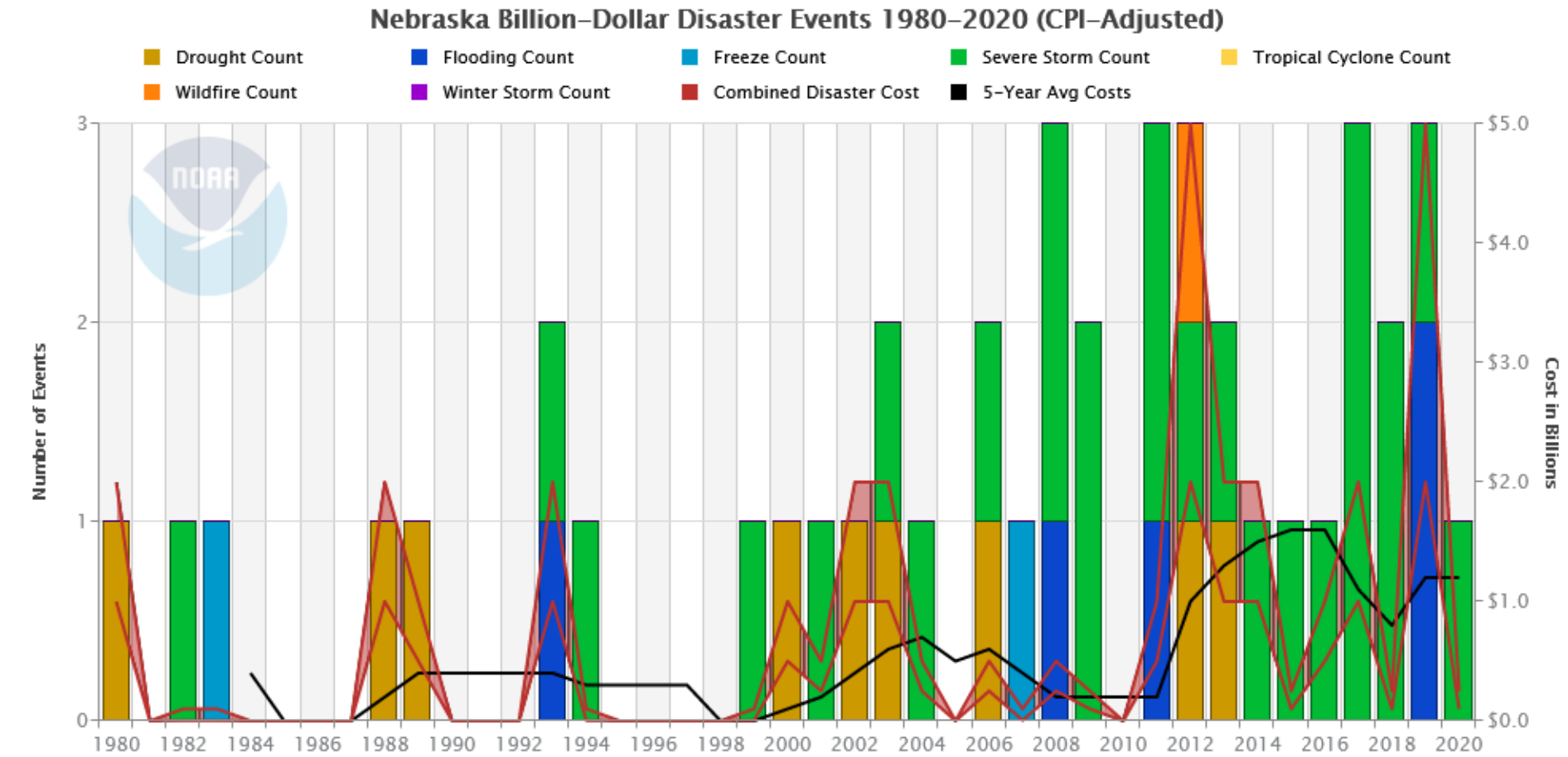
Regional effects of climate change will impact important resources outside the state's boundaries as well. Dr. Shulski narrates the regional and local watershed impacts related to our changing climate:

> Related to Nebraska's water resources, Rocky Mountain snowpack has seen an overall decline in the last several decades. This trend is expected to continue with less snow water equivalence in addition to an earlier snowmelt altering the timing of peak streamflows in many Nebraska rivers.

Declining snowpack threatens to reduce streamflows Nebraska's rivers, impacting surface irrigation areas, groundwater recharge, availability of water to Lincoln's well fields and potentially creating competition between urban and agricultural users for a decreasing quantity of water in rivers.

> There is inherent variability in Nebraska's climate and the potential for back-to-back flood-to-drought years. As such, reservoir and groundwater storage are expected to become even more important to mitigate enhanced risk to future precipitation variability that lies outside of the range of past experience. Sustainable water management is therefore paramount.[46]

In summary, the projected changes in climate for Nebraska, and Lincoln, include more extreme downpours, more extreme hot days, snowier winters, more frequent large hail, and a longer growing season. The impacts of these changes will be increased flooding, heat-related public health risks, more demand for water, more frequent droughts, more electricity demand for summer air conditioning and irrigation, more insect-borne diseases and the potential for economic instability due to unknowns in how the state's agricultural economy will be affected. Projected effects and impacts of Nebraska's changing climate are summarized in the table below. As projected climate impacts lead to future climate hazards and as these hazards intersect with existing vulnerabilities from demographic and infrastructure realities, climate risks are created. Climate risks will be discussed in the next chapter.



Source: NOAA [48]

Elements of Nebraska's Changing Climate

- Warmer summers
- More extreme hot days
- Wetter springs
- Snowier winters
- More extreme rain events
- Higher cooling degree days
- Lower heating degree days
- More frequent large hail
- Longer growing season
- More demand for water and energy
- More frequent droughts
- More frequent and more intense floods
- Increased insect-borne diseases
- Crop, livestock stress
- Increased damage potential
- Economic instability
- Climate-related health impacts

Photo courtesy of Lincoln Parks and Recreation

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Climate-Related Risks

Warming temperatures, extreme heat, more precipitation and extreme storms, drought, and a longer growing season are the major climate change impacts Lincoln will face in the coming years. When impacts from climate change intersect with the socio-economic, racial, geographic, and infrastructural characteristics of Lincoln, the residents of Lincoln will be affected by climate hazards in dramatic and disproportionate ways.

Risk:

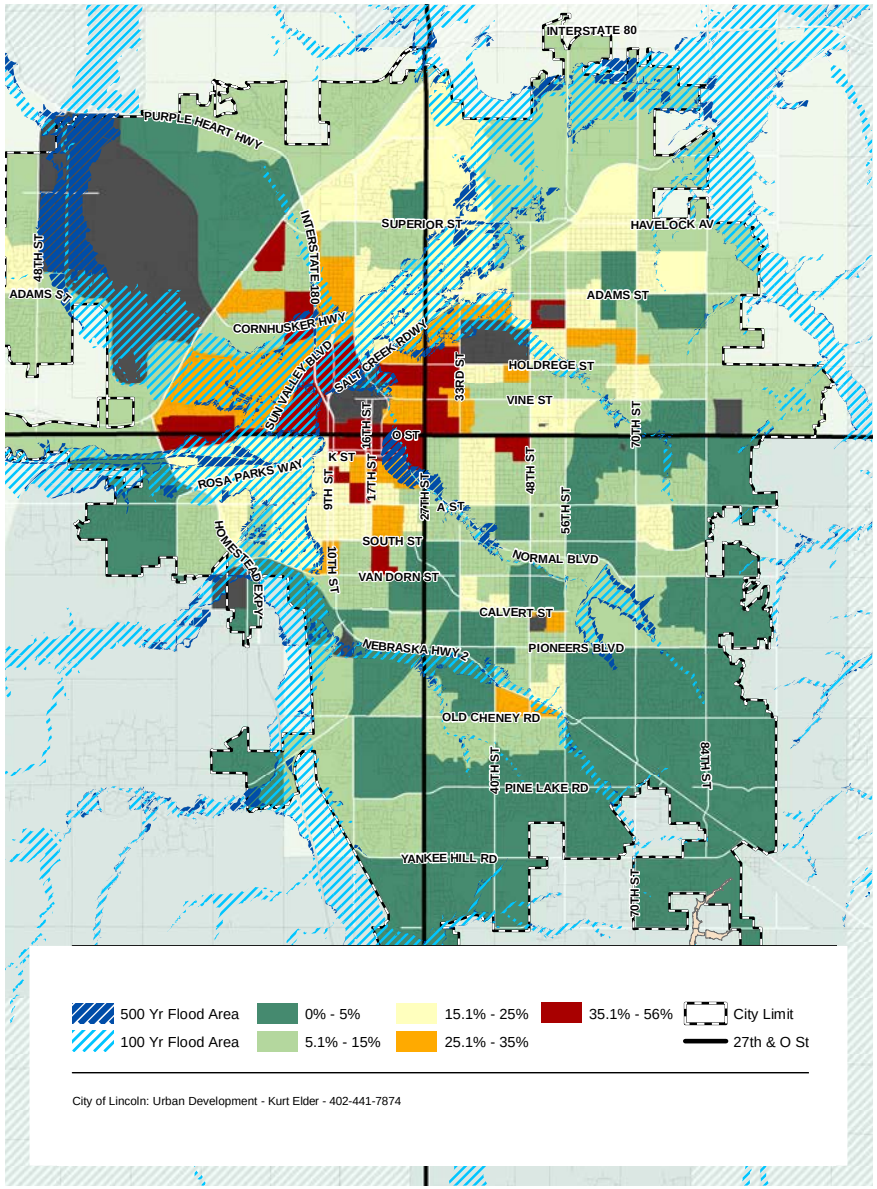
The potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain. In the context of the assessment of climate impacts, the term risk is often used to refer to the potential for adverse consequences of a climate-related hazard, or of adaptation or mitigation responses to such a hazard, on lives, livelihoods, health and wellbeing, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure. Risk results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence. *Source: IPCC*

Intersections with Socio-Economic Trends

Several demographic factors are important to take into account when assessing Lincoln's climate risk. Socio-economic factors can create stressors that exacerbate climate hazards. One of these stressors is poverty. According to the 2019 Lincoln Vital Signs report, approximately 30% of households in Lincoln are in or near poverty.[49] Seven census tracts are categorized as being in extreme poverty. The neighborhood with the highest poverty rate (59%), North Bottoms, is also at the highest risk of flooding from Salt Creek (see right).

Structural racism is another stressor. Poverty rates are not evenly distributed across racial categories. The Black population has a poverty rate more than twice as high as Whites, followed by Hispanics and Asians, despite the fact that Whites make up the vast majority of Lincoln's population. Six of the seven neighborhoods in extreme poverty have a higher percentage of racial/ethnic minorities than Lincoln overall.[50]

Socio-economic factors can create stressors that exacerbate climate hazards.



When Lincoln's floodplain map is overlain with poverty data by census tract, it becomes clear which neighborhoods may have multiple vulnerabilities to flooding and its after-effects. The North Bottoms and West A neighborhoods are two neighborhoods where the confluence is clear. *Source: City of Lincoln Urban Development Department*

The large cohort of Baby Boomers is aging, shifting Lincoln's population to have a higher percentage of older residents. By 2050, the number of Nebraskans aged 65+ will more than double. In 2050, they will make up 15% of the population in Lancaster County.[51]

Lincoln residents come from all over the world. A recent survey showed the top countries of origin are Iraq, Vietnam, Mexico, Burma and Sudan.[52] The most common languages spoken among new Americans include Spanish, Arabic, Kurdish, Vietnamese, English and Karen. Some residents for whom English is not their primary language might not be reached by City communications unless they are translated.

Larger technological and economic shifts can also create stressors. The projected increase in automated jobs will likely have an impact on Lincoln's economy, particularly on low-wage workers. It is projected that by the mid-2030s, as many as 50% of jobs in transportation, 45% in manufacturing, and nearly 40% in construction could be replaced by automation in the U.S., with an average replacement rate of nearly 30% across all employment sectors. The impacts will not be distributed equally: those with low educational attainment levels will be the hardest hit.[53]

Climate migration is an issue that will have increasing importance across the United States in coming decades as people will be forced to move due to sea level rise, extreme heat and drought. It is possible that Lincoln may receive new arrivals from other parts of the country and the world who will be drawn to the city for its good quality of life.

Lincoln's food supply is another area of concern. Already, 13% of residents in Lancaster County experience food insecurity, according to Lincoln Vital Signs. The COVID-19 crisis showed how easily food shortages can occur when supply chains are interrupted. Global crop yields are expected to decline in a climate-altered future,[54] which may create instability in the availability and pricing of groceries locally.

Lincoln's Climate Risks

An analysis of the ways in which climate impacts may intersect with existing socio-economic characteristics in Lincoln yielded 11 specific climate-related risks that stakeholders prioritized in the climate action planning process. Two vulnerabilities are more urgent than the rest: flooding, and Lincoln's reliance on a single source for all its water needs.

1. Flooding and Drought
2. Single Water Source
3. Public Health Risks
4. Disproportionate Impacts on Vulnerable Populations
5. Financial and Workforce Resources Not Aligned with Climate Risks and Opportunities
6. City Policies Not Aligned with Climate Risks and Opportunities
7. Auto-Reliant Transportation System
8. Reliance on Fossil Fuels
9. External Control Over Food Supplies
10. Vulnerable Natural Resources
11. Degree of Public Awareness

1. Flooding and Drought

Lincoln's susceptibility to flooding, particularly along the leveed portion of Salt Creek, is one of, if not the most, important climate risks for the city. It is a risk that deserves the close attention of community leaders, residents, water resource managers and emergency management professionals. This is not a new risk to Lincoln. Flood events have been documented since the city's founding in 1867. In fact, there have been more than 100 flood events recorded on Salt Creek over the past 120 years, including 17 major events and two events that were considered catastrophic.[55]

Previous flood events offer some instructive lessons. In 2014 and 2015, two massive rain events occurred. Over September 30th to October 1st, 2014, Lincoln was deluged with heavy precipitation. The official count at the Lincoln Airport was 4.6 inches, though unofficial reports ranged between 5.4 to 8.9 inches in various parts of town.[56] In May of 2015, an even more severe event occurred when 6.73 inches fell over an eight- to ten-hour stretch overnight. Not only did the rain fall fast and heavily, but the ground was already saturated from previous rainfall, causing widespread flooding. Towns near Lincoln were even more inundated: several locations reported rainfall totals over 9 inches. That much rain over about an eight-hour period translates into approximately a 1 in 1,000-year event.[57]

According to a June 2015 article from the Department of Natural Resources,

> *The early May storm system poured rain almost directly over the Salt Creek watershed and sent staggering amounts of water rushing through the city. Five of the nine stream gages in Lincoln, on Salt Creek or its tributaries, saw record high crests on May 7th. As the water came flowing into Lincoln*

High water along Salt Creek in Lincoln nears the surface of a pedestrian bridge on May 7, 2015.

Photo courtesy of Eileen L. Williamson, Army Corps of Engineers

from the south, Wilderness Park provided the first flood reduction buffer. The park acted like a huge sponge, slowing the flow and letting the creek overflow its banks out into the riparian area. The levees that start at Calvert Street and run through town provided flood protection, but just barely. In some areas, the water was less than a foot from the top of the levee.

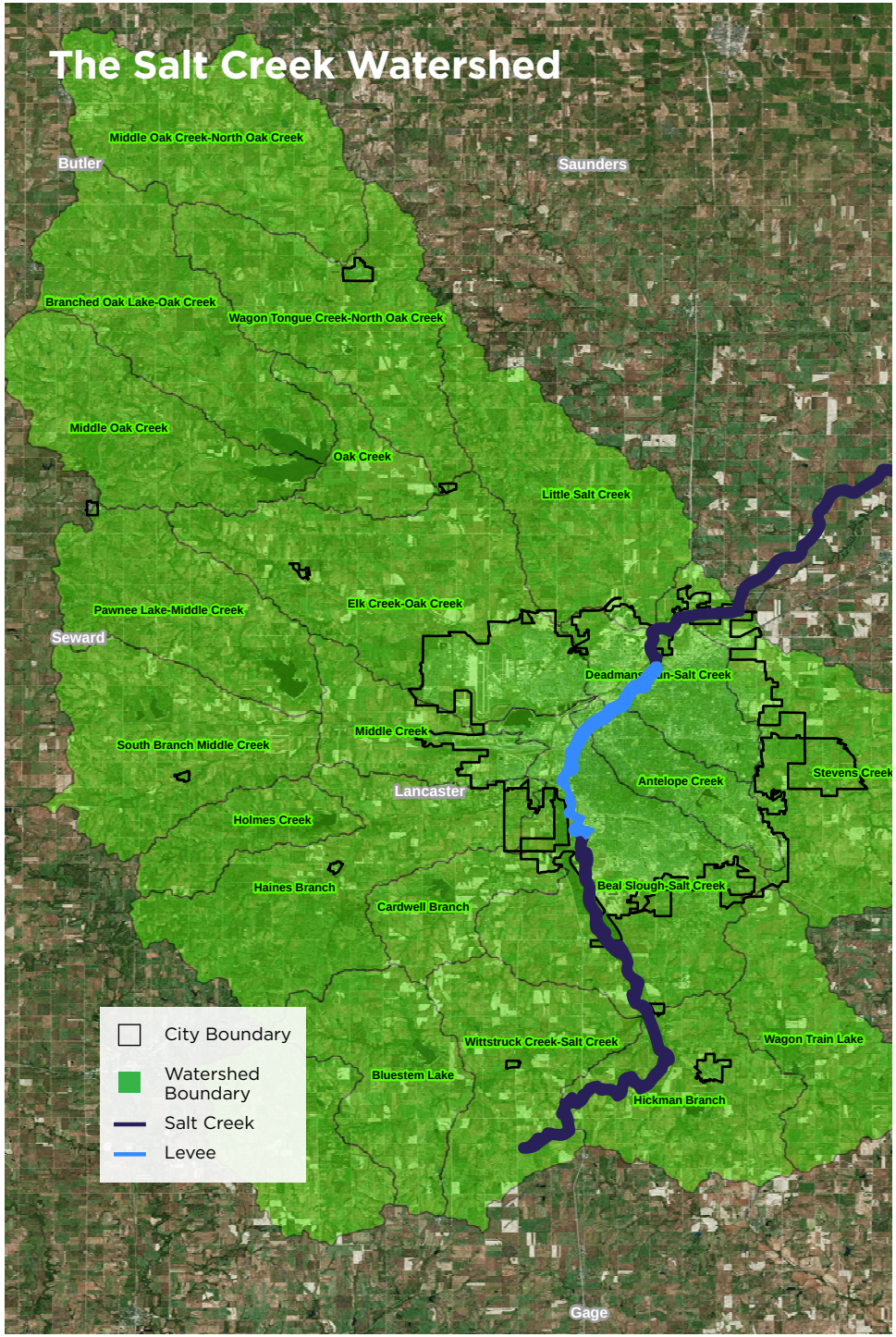
South Bottoms neighborhood, which lies behind the levees, also saw significant water in the streets and basements because drainage was blocked up by the high water in Salt Creek. For the first time in at least 50 years, the Lancaster Emergency Management called for voluntary evacuation of South Bottoms and North Bottoms neighborhoods for fear that the levees may be overtopped.[58]

These flood events caused street and house flooding, sanitary sewer backups, car accidents, and flows over four times higher than normal to Lincoln water resource recovery facilities. According to the Lincoln-Lancaster County Emergency Management Office, the 2015 event caused more than $3.9 million in damages to public property and infrastructure in Lincoln and Lancaster County.

In 2020, local engineering firm Olsson completed an analysis of the resilience capacity of Salt Creek to severe flooding. The focus of the study was to illuminate how existing non-structural and structural floodplain management measures can be strengthened to further reduce flooding impacts to existing infrastructure, local businesses, residences, and future developments and enhance the floodplain resiliency in Salt Creek. The study contained a comprehensive analysis of current and future precipitation amounts, projected discharge rates, land use changes that influence flood hazards, water elevation rates, and levee capacity. Detailed climate modeling, including

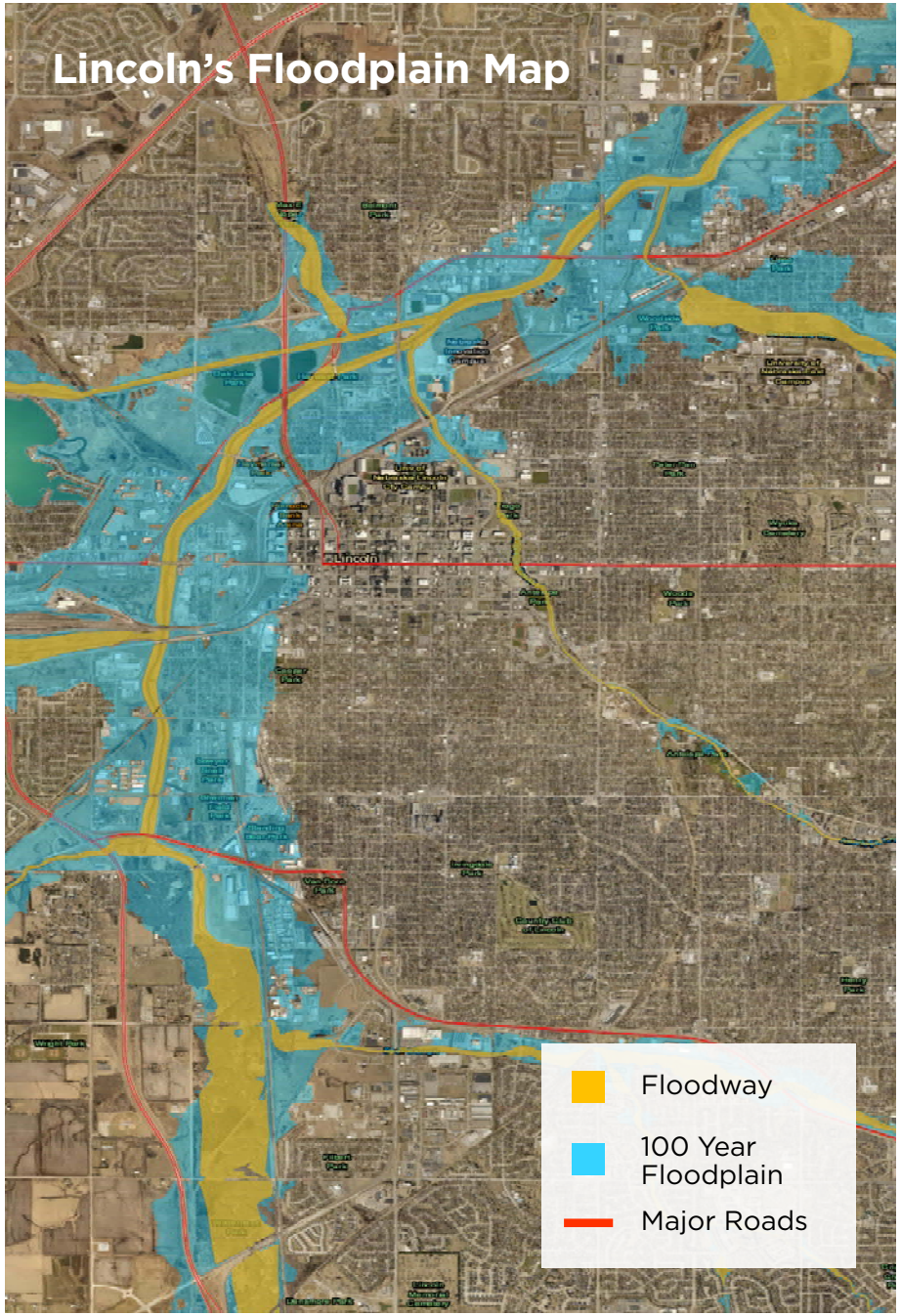
climate change projections, was undertaken to determine potential future precipitation values for the year 2100. The study evaluated best practices from other communities, analyzed structural and non-structural flood risk reduction measures, and made recommendations to reduce flood risk.

The Salt Creek watershed comprises 827 square miles of drainage area, including tributaries for Oak Creek, Stevens Creek, South Salt Creek, Haines Branch and others. The majority of the water from this vast area drains into the leveed portion of Salt Creek running through downtown Lincoln. The creek is leveed intermittently on both sides for 7 miles as it travels through the city, from Calvert Street on the upstream southwest side, to Superior Street on the downstream northeast side. The Salt Creek levee system was built in the 1960s and designed to contain the 1% annual chance flood with two feet of freeboard, the amount of space between base flood elevation levels and the top of the levee. However, a later study found that the levees did not meet that minimum requirement even in the past.



The Olsson study found that Lincoln should expect flood water surface elevations higher than existing mapped flood hazard data account for. Currently, in a 1% annual chance rainfall event (commonly called a 100-year rain event), the creek could rise 9.6 inches over the current levee height. A 1% annual chance flood event in Lincoln equates to 7.3 inches of rain falling in a 24-hour period. As seen above, the rainfall amounts in October 2014 and May 2015 came dangerously close to that level.

Moreover, climate projections of extreme rain events showed that water levels could rise more than 2.2 feet (26.4 inches) above the current levee height, causing even more serious flooding in nearby neighborhoods. The report states, "the 1% annual flood... will overtop the levees and cause widespread flooding to properties on the landward side."[59]



Note the 7-mile leveed portion of Salt Creek running through downtown and represented by the narrow yellow line.

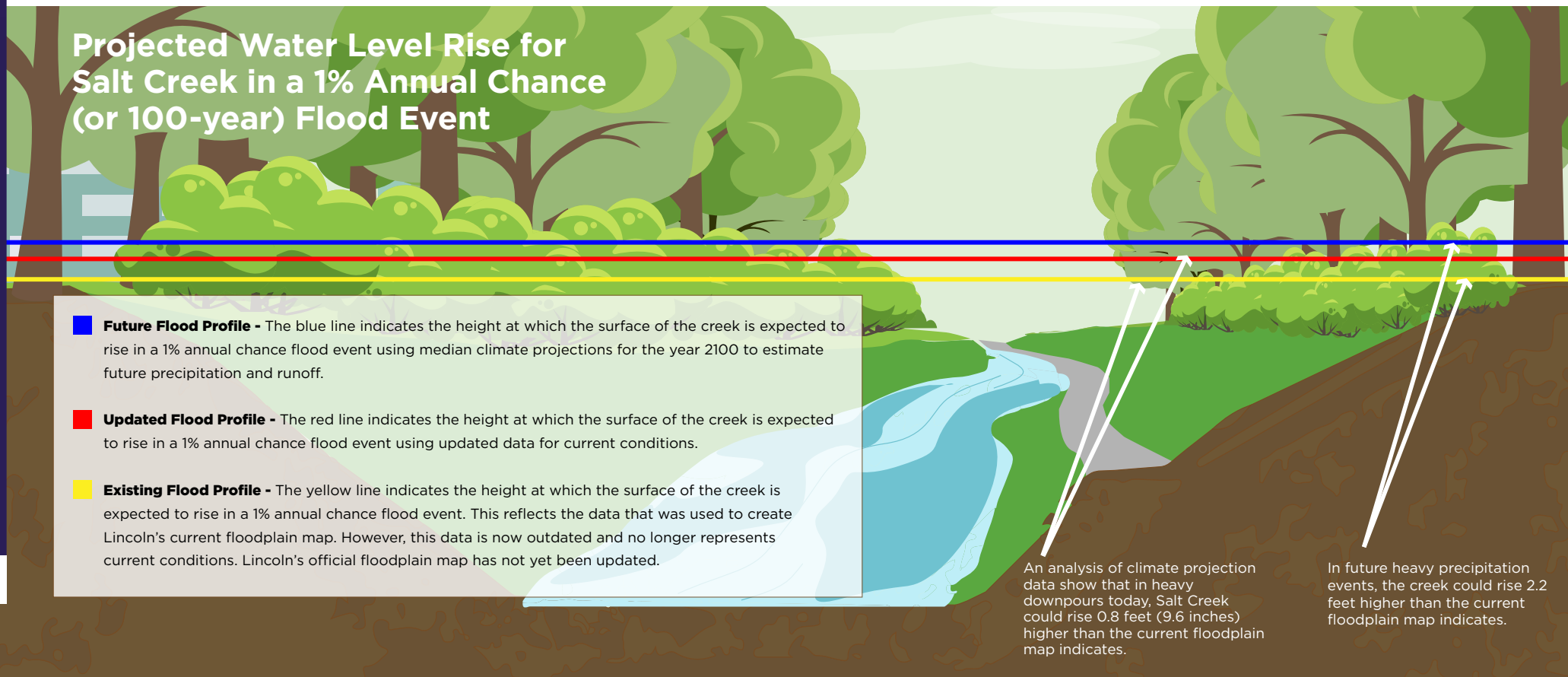
The impacts of future rainfall events will become more severe with more extreme downpours. The study found that currently, in a 0.2% annual chance rainfall event (commonly called a 500-year rain event), water levels could rise 2.2 feet (26.4 inches) over the current levee height. And in the future, the creek could rise a staggering 4.5 feet (54 inches) above the current levee height. (Based on preliminary modeling within a confined floodplain)

According to the National Levee Database, the following are at risk within the current Salt Creek levee systems:[60]

- 5,912 people
- 1,229 structures
- $847 million in property value

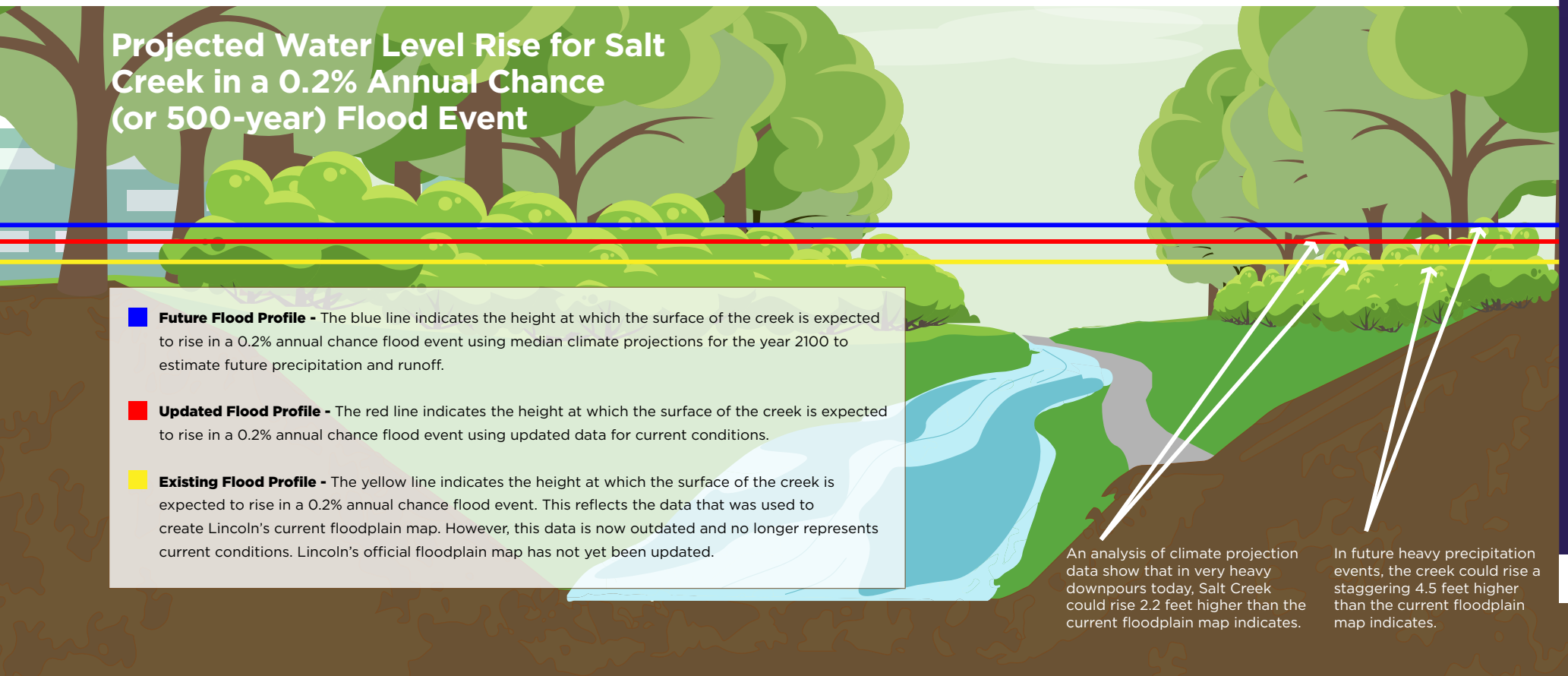
If emissions continue to rise on their current trajectory, flood risk for Lincoln will increase.

The report makes the link between increasing levels of greenhouse gas emissions and increasing risk. If emissions continue to rise on their current trajectory, flood risk for Lincoln will increase. The Olsson report states, "In the 'business as usual' global greenhouse gas emissions scenario, precipitation events causing flooding are forecast to increase by nearly 10 percent



by the year 2100 in the Salt Creek watershed."[61] Furthermore, the report found that "flood hazards will increase significantly in magnitude in the Salt Creek watershed by the year 2100, compared to existing flood hazards."[62]

The study modeled structural flood risk reduction measures (e.g., dams) to see what types of infrastructure would be needed to reduce flood risk along Salt Creek. Analysis found that even if 16 dams were built within the Salt Creek tributary sub-basins, these dams would not be enough to prevent flooding based on current flood hazard data, let alone future climate projections. The existing Salt Creek levee systems are not accredited by the Federal Emergency Management Agency (FEMA) to provide protection during the 1% annual chance flood event, and an investment to bring levees to accreditation level would be immense. Additionally, this investment would not have a positive cost-benefit ratio, which would make these changes to the levees ineligible for federal funds.



The study recommends six non-structural flood resilience measures for further consideration by the City and the Lower Platte South Natural Resources District. The non-structural strategies include the following:

1. **Cluster subdivision regulations:** grouping or directing new development to relatively less-sensitive areas within a subdivision;
2. **Overlay zoning:** additional guidance or requirements for development within a zone located in a floodplain;
3. **Voluntary buyout program:** allowing property owners in floodplains could sell their property to the City or the Lower Platte South Natural Resources District;
4. **Setbacks and riparian preservation:** requiring properties to be built a certain distance from the streambed, and preserving vegetated ecosystems along the streambed;
5. **Low impact development regulations:** requiring developers to include measures that reduce flooding; and
6. **Higher floodplain management standards:** increasing regulatory standards for freeboard and restricting allowable uses within flood-prone areas.

It is important for Lincoln residents to know that even if levees were reconstructed to a higher height and the non-structural measures noted above were put in place to reduce risk during certain flood events, they would still not provide absolute protection from flooding.

As Lincoln's climate continues to change, it is more important than ever that Lincoln residents know their flood risk and how they can act accordingly. Purchasing flood insurance, flood-proofing homes, identifying neighbors with special needs who might need help in a disaster, and creating evacuation plans are all steps residents can take to protect themselves and their neighborhoods.

Since one effect of the changing climate is the increasing fluctuation between extremes, drought is another important climate risk for Lincoln. In 2012, the state of Nebraska experienced an historic drought. Irrigation restrictions were imposed across the state. Eighty-one municipal water systems in Nebraska had water supply problems due to the drought. High temperatures and dry conditions also lead to record wildfires in the state that burned in excess of 343,000 acres.[63] River flows in the Platte River near Ashland, where Lincoln gets its water, were at the lowest levels in modern history. Flows were below 300 cubic feet per second (cfs), while at least 2,000 cfs are necessary to have adequate recharge of the city well fields, according to a City engineer at the time.[64] As a result, the City imposed mandatory water restrictions and residents persevered through the event. The drought ended in 2013.

Drought can have many effects for Lincoln residents. Most important is the risk to the city's water supply. It can negatively affect agricultural production in the state, which can contribute to reduced tax revenue, which in turn may reduce budgets for programs and services residents rely on. Drought can also contribute to poor air quality, drying fields so that wind lifts particles and carries dust in the air that is especially risky for people with underlying health conditions. Other effects of drought are damage to plant species, soil erosion, land subsidence, reservoir and lake drawdown, groundwater depletion, diminished sewage flows, increased fire risk and psychological stress.[65]

Lincoln is fortunate to be part of the Lower Platte South Natural Resources District, which is one in Nebraska's statewide network of watershed-based environmental management entities. The Lower Platte South Natural Resources District carefully manages water resources in the Lincoln area and, along with the City of Lincoln, includes drought planning in its hazard mitigation efforts. Going forward, it will be important to continue to proactively manage and prepare for drought risk to protect Lincoln residents.

2. Single Water Source

Lincoln's drinking water is sourced from 44 wells along the Platte River in Ashland, approximately 20 miles away. The system includes 60 miles of large pipelines, 12 high service pumps, two treatment plants, eight plant reservoirs, 16 city reservoirs, and over 100 additional pumps that bring water throughout the city. The system's maximum capacity is 120 million gallons per day in non-drought conditions. Actual capacity is dependent on stream flow.[66] Lincoln's average daily usage is 41 million gallons per day.

In 2012, Lincoln experienced a flash (rapid onset) drought when it had 72 days over 90 degrees and only 0.6 inches of precipitation in July and August. River flow in the Platte reached historic lows, and both voluntary and mandatory water restrictions were imposed on Lincoln residents. Fortunately, the city got through the event without major incident. As a result of this drought, two new horizontal collector wells were installed along the Platte, which provide an additional 20 million gallons per day during drought conditions.

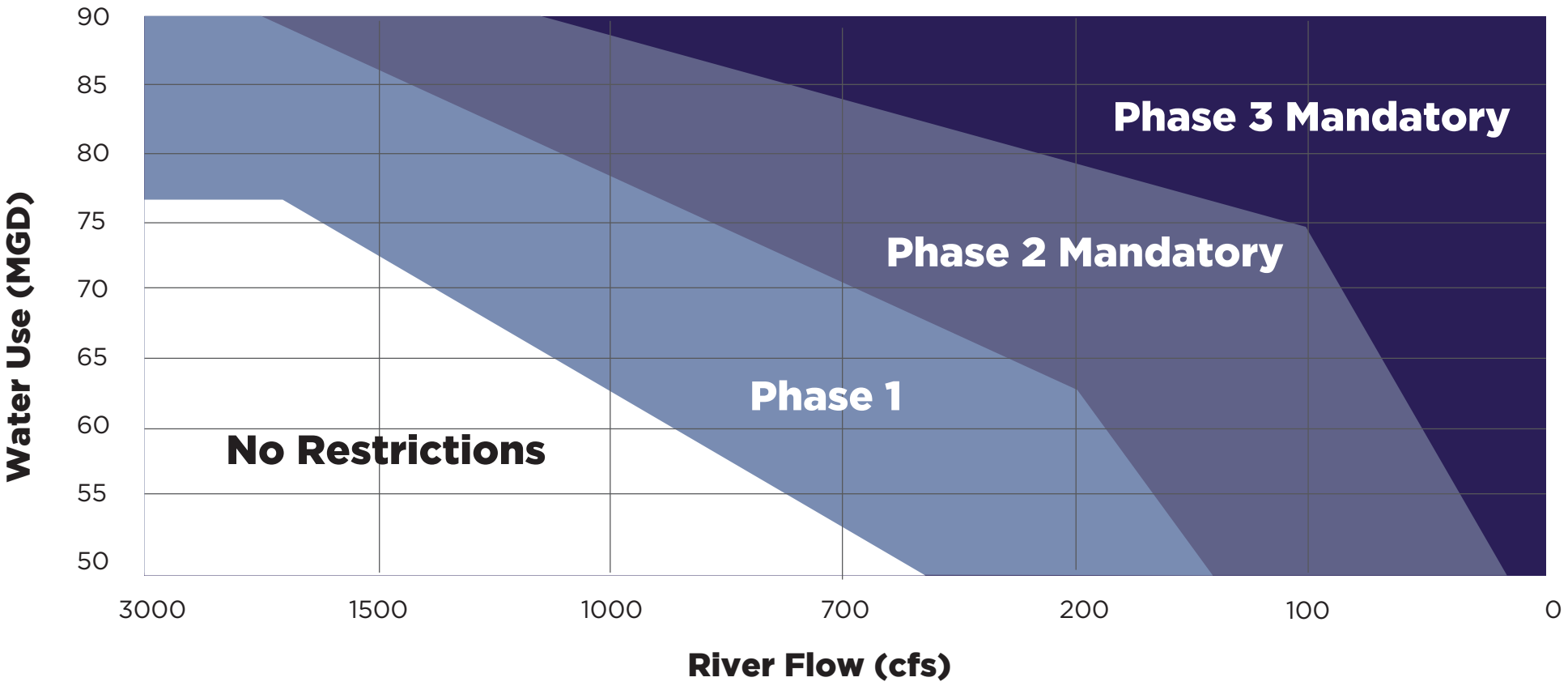
Lincoln's Water Management Plan Implementing Water Restrictions

Condition	No Restrictions	Phase 1	Phase 2	Phase 3
Remaining Operational Volume	>80%	60% - 80%	40% - 60%	< 40%
30 Day Precipitation Forecast (% Probability Below Normal)	Equal Chance or Above Normal	33% - 40% (below normal)	33%-40% (below normal)	> 40% (Below Normal)
30 Day Temperature Forecast (% Probability Below Normal)	Equal Chance or Below Normal	33% - 40% (above normal)	33%-40% (Above Normal)	> 40% (Above Normal)
US Seasonal Drought Rating	None Predicted - Improvement	On-going	Intensify	Intensify
US Drought Monitor Rating	No Rating - Moderate	Severe	Extreme	Exceptional
30 Day Precipitation (% of Normal Approcimated for Lower Platter River Basin)	>90%	70% - 90%	50% - 70%	< 50%

Two other outcomes of the 2012 drought were the formation of a new Water Management Manual which provides decision-making guidance on when the City will impose voluntary and then mandatory water restrictions. The decision-making rubric is based on remaining operational water volume, previous month's precipitation, following month's temperature and precipitation forecasts, drought monitor rating, and seasonal drought outlook.

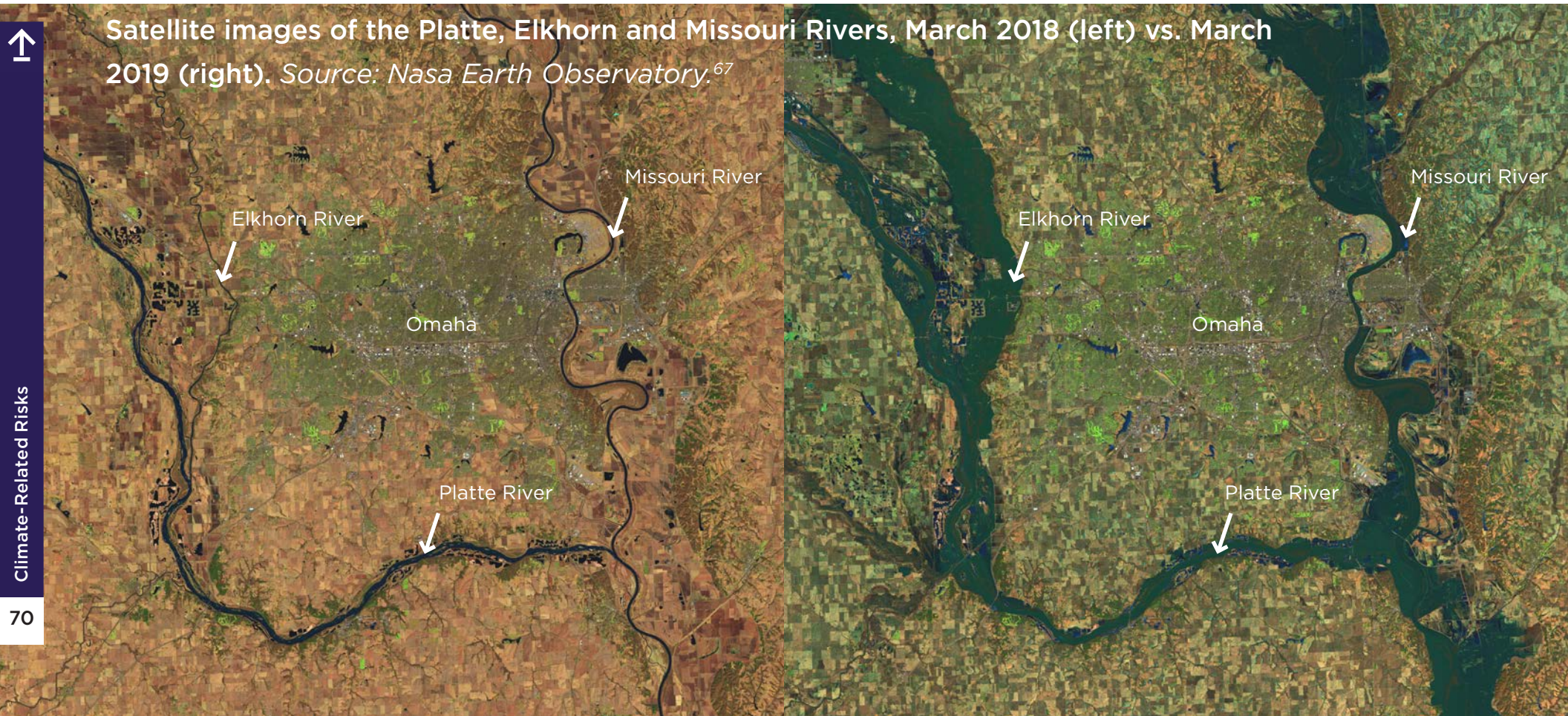
The decision-making rubric also takes into account daily water use in Lincoln, which varies considerably by season, compared with river flow.

Lincoln's Water Management Plan Implementing Water Restrictions



In March 2019, the city experienced another water crisis, this one on the opposite end of the weather spectrum but similarly putting Lincoln's water supply at risk. In a "bomb cyclone" weather event, cold weather, heavy rain, thick river ice, snowpack, and frozen ground combined to create catastrophic flooding along the Platte River which heavily impacted Lincoln's wellfields. One well was completely destroyed, rendering three additional wells unusable, while power was lost to two adjoining wellfields. At various times during the flood, Ashland had no operational wells due to power outages, at which point Lincoln began drafting the storage reservoirs. The City imposed mandatory water restrictions in an effort to ensure adequate water supply for residents. Fortunately, it was still winter - when water use in the city is lowest, but harder to cut. Thanks to the quick actions of City water managers and the water conservation from Lincoln residents, the city successfully kept the system operational, averting a crisis.

Fortunately, Lincoln itself was largely spared from flood damage. But at the wellfields, washouts occurred throughout, exposing raw water transmission mains and well structure. Large amounts of debris and sand were deposited, and roads in all wellfields were damaged.



Satellite images of the Platte, Elkhorn and Missouri Rivers, March 2018 (left) vs. March 2019 (right). *Source: Nasa Earth Observatory.*[67]

The 2019 flood event was the state's largest natural disaster in history, and brought about conditions that no one had ever seen, along with ramifications that no one had ever expected. Thirteen bridges were damaged and over 3,000 miles of highway were closed. The total cost was over $3.4 billion in Nebraska and $6.2 billion in the region.[68] It might be easy to conclude that it was a "once in a lifetime" event that won't happen again. But given the rapidly accelerating pace of climate change in the 21st century, we must expect such events to recur with greater frequency, and we must take appropriate precautions.

Fortunately, City water managers have known for a long time that they will need to secure a second water source sometime in the future as Lincoln's population grows. Current plans call for the Platte River wellfield to be fully developed by 2035 and for a second water source to be secured by 2045. After the events of 2012 and 2019, however, the understanding has grown that the second water source is needed for water security and redundancy to build resilience to climate impacts, in addition to serving a growing population.

The City is currently considering two options for securing a second water source: building pipelines to connect directly with the Missouri River 60 miles away; or collaborating with Omaha's Metropolitan Utilities District. Both options will require significant expense. Conversations are in the early stages, and much study still lies ahead.

Nevertheless, the fact that climate change will impact the city's water supply and that Lincoln is reliant on one source for all of its water needs—a source that, as we have seen, is vulnerable to extreme weather—compounds the challenge Lincoln faces and presents a critical climate risk that must be addressed.

3. Public Health Risks

Climate change influences health in numerous ways, putting Lincoln residents at risk of exacerbating existing health conditions as well as introducing new ones. Extreme heat, extreme storms, wildfire, floods, fewer freezing temperatures and psychological stress are some of the impacts from climate change that can lead to serious health issues.

Health Risks of Extreme Heat

Extreme heat, defined as summertime temperatures that are much hotter and/or humid than average,[69] is the leading climate-related cause of death. Over 600 Americans die each year from extreme heat. Heat exhaustion and heat stroke occur when the body is not able to properly cool itself. While the body normally cools itself by sweating, during extreme heat and humidity, the body's cooling process gets overloaded. When body temperature rises faster than the body can cool itself, there is risk of damage to the brain and other vital organs. Those at special risk include athletes, outdoor workers, individuals with chronic medical conditions, low-income households, infants and children, and adults over 65.

From 1971-2000, Lincoln experienced an average of 36 days per year with a heat index over 90 degrees. By mid-century, that number is expected to rise to 78, and by the end of the century, to 104 days per year. That means that over 28% of the year will consist of days with a heat index over 90 degrees.

Lincoln will also experience even more extreme heat. Historically, Lincoln had an average of only 3 days with a heat index over 105 degrees, but by mid-century that number will rise to 23, and by the end of the century, 48.[70]

These figures have serious implications for all those who work or practice outside, who travel by bike or on foot, whose business is dependent on outdoor activity, and who move about the city in their daily lives. The community of Lincoln will need to implement strategies to allow its residents to withstand these future heat waves.

Health Risks of Floods

Floods create numerous health risks for people. Flash floods on streets create hazardous driving conditions. Flooded basements can create mold, which can then lead to respiratory illness. Flooded garages can leach harmful chemicals into floodways. If people attempt to walk through floodwaters, their skin can come in contact with a whole host of toxic substances. Serious flooding can lead to inflow and infiltration problems, when the storm sewer system can backflow and mix with the sanitary sewer system, leading to sanitary sewer backups in homes. Electrification is another risk, if downed power lines or electrical cables come in contact with pooled water that individuals may try to walk through.

Health Risks of Extreme Storms

Storms that unleash more water, snow, wind and hail are becoming more common as the climate changes. As the Arctic warms, temperature differentials around the globe are changing and disrupting wind patterns. Increasingly, storms are behaving differently than in the past. These extreme storms may bring high-speed winds that pose hazards to trees and drivers, high levels of precipitation that can lead to flooding or large snowfalls, icing conditions that can pose great risk of car collisions and pedestrian falls.

Health Risks of Air Pollution

Air quality is a major factor in public health, and "bad air" days can have significant impacts on vulnerable populations, especially those with respiratory and cardiovascular health problems. Though wildfire is not generally seen as a large risk in Nebraska, the state lost 500,000 acres to it during the summer of 2012, the most in nearly 60 years of record-keeping.[71] Beyond the direct risk of wildfire, what is more of a health risk for Lincoln residents is the smoke from neighboring states' wildfires causing air pollution problems. Colorado has experienced historic wildfires in recent years, and there is consensus that their fires are burning longer and more intensely than ever before.[72] Smoke from controlled burns in the Flint Hills in Kansas is already an annual concern for Lincoln residents, particularly in the spring. Small particulate matter from fires across the western U.S. and even Canada can travel to Lincoln, which is a concern as the intensity of fires across the west increases. Though these events are usually short-term, they can have high peak levels which impact health. According to the Lincoln and Lancaster County Health Department, 15% of Lincoln's population suffers from asthma, which is exacerbated by poor air quality. As non-White Nebraskans are more likely to experience asthma, they are at particular risk from poor air quality.[73]

Lincoln has historically had very good air quality apart from days affected by smoke. As temperatures warm, however, ozone levels are expected to increase, leading to lower air quality and increased health risk.

Health Risks of Fewer Freezing Temperatures

Lincoln is expected to have fewer freezing temperatures in the future and, while this may be a welcome change for some, it will bring challenges with pests. Because warmer seasons will be longer and winters will be milder, conditions will become more hospitable for insects that carry disease. Ticks carry a range of bacteria that can be harmful to humans, and their numbers and range are increasing. The number of reported cases of Lyme disease in the United States has tripled since the late 1990s. In addition, the number of counties in the northeastern and upper midwestern United States that are considered high-risk for Lyme disease increased by more than 300% between 1993 and 2012.[74] The number of counties in the U.S. with the blacklegged tick, responsible for most cases of Lyme disease, also has more than doubled over the past twenty years, and now extends into the Lincoln area.[75]

West Nile Virus, spread by infected mosquitoes and ticks, is another insect-borne disease that may become more frequent with the changing climate. It has been found that drought dramatically increases the severity of West Nile virus epidemics in the United States.[76] In a small percentage of cases, the virus causes brain inflammation that can take weeks or months to recover from and sometimes causes permanent effects, according to the Centers for Disease Control and Prevention. In 2018, 18 cases of West Nile Virus were reported in Lancaster County.[77]

Health Risks of Psychological Stress

Recognition is growing that climate change poses a threat to mental health. According to the American Psychiatric Association,

> *Climate change and related disasters cause anxiety-related responses as well as chronic and severe mental health disorders. Flooding and prolonged droughts have been associated with elevated levels of anxiety, depression and post-traumatic stress disorders. The trauma and losses from a disaster, such as losing a home or job and being disconnected from neighborhood and community, can contribute to depression and anxiety. Extreme weather events have also been associated with increases in aggressive behavior and domestic violence. Exposure to extreme heat may lead to increased use of alcohol to cope with stress, increases in hospital and emergency room admissions for people with mental health or psychiatric conditions, and an increase in suicide.*[78]

As Lincoln takes steps to improve its climate resilience, it will be important to include strategies to proactively care for the mental health of residents.

Photo courtesy of Lincoln Parks and Recreation

4. Disproportionate Impacts on Vulnerable Populations

According to a 2017 climate resilience research report conducted by the Environmental Protection Agency (EPA), a community's demographic profile contributes to the community's capacity for resilience.[79] While there are many strengths, assets and much to celebrate and enjoy in Lincoln, there is also a recognition that not everyone is prospering. The number of people living in extreme poverty and experiencing poor health is increasing. People of color disproportionately struggle to achieve income equality and have, on average, lower levels of educational attainment and employment. Below is a list of vulnerable populations identified by the EPA, followed by data for the city of Lincoln from the U.S. Census Bureau and Lincoln Vital Signs 2019:

- Proportion of households with one or more adults 65 years or older: 23%
- Proportion of households with an adult 65 years or older living alone: 10%
- Proportion of the population who speak English "less than very well:" 5%
- Number of individuals experiencing homelessness: 451
- Proportion of the population under the age of 5 years: 7%
- Proportion of households living below the poverty threshold: 14%

The climate resilience planning process noted that those who live in the Salt Creek floodplain, especially low-income renters, are particularly at risk. Those individuals who are also elderly, do not speak English as a primary language, have a disability, and/or live alone are even more vulnerable. It is important to note that vulnerable people in Lincoln face risks not only during a single flood event, but throughout the longer economic and physical recovery afterwards.

Poverty is a threat multiplier, and is often correlated with poor health. According to the 2019 Lincoln Vital Signs report, over the last decade, the number of people living in poverty in Lincoln decreased 11% from post-recession highs in 2009. While that is a positive overall trend in decreasing poverty, there is still significant work to do. In 2018, the overall poverty rate (households with income below 100% of the federal poverty level) was 14.2%.[80] However, when that metric is expanded to include households with incomes below 200% of the federal poverty level, which are still sometimes referred to as households "in or near poverty," the percentage rises to 30%.[81] What's more, the number of census tracts in extreme poverty has increased from zero in 2000 to seven in 2019. As the report put it, "We have unprecedented geographic concentrations of extreme poverty and poor health."[82]

It is crucial to note that the census tract with the highest poverty rate (59%), encompassing the North Bottoms neighborhood, is also in the Salt Creek floodplain.

Lincoln has an increasing aging population; the number of residents over age 65 has grown by 42% in the last ten years according to the Vital Signs report. These aging seniors are at higher risk of developing climate-related health problems and to suffer economic stress that may follow a natural disaster.

5. Financial and Workforce Resources Not Aligned with Climate Risks and Opportunities

The health and resilience of Lincoln's economy is key to its climate resilience capacity. A strong economy will allow businesses to recover more quickly and allow displaced workers to find new jobs. Maintaining a strong bond rating will be key to Lincoln continuing to obtain financing for infrastructure projects. Ensuring that the goods and services local businesses provide are aligned with the climate risks and opportunities of the future means that local business owners and employees won't falter and suffer economic losses.

The Climate Resilience Task Force found that currently, climate risks exist because Lincoln's economic and workforce development efforts have not taken climate change into account. Some businesses risk damages and interruptions from extreme weather events. Lincoln's workforce has generally not been trained in some of the skills that will be in demand in the future, like energy efficiency analysis, solar panel installation, wind turbine construction and maintenance, electric vehicle repair and sustainable food production. In addition, increasing rates of automation in low-wage job environments points to the need for additional focused skills training and workforce development for those who could be displaced.

Up to now, the community has not set aside funding to address the range of risks and to help build preparedness and resilience across sectors of the city. Low-income renters who live in floodplains and don't have flood insurance, for example, do not have access to philanthropic resources that could help them recover from a catastrophic flood. Nor has funding been created to incubate and launch climate-smart business start-ups or re-train low-wage workers with new skills for specifically climate-smart industries.

6. City Policies Not Aligned with Climate Risks and Opportunities

Like all cities, Lincoln has conventionally based its policies and ordinances on the notion that the climate operates within historical and stable limits. Average rainfall amounts, for example, could be counted on when developing stormwater management infrastructure. As we now enter an age characterized by what climatologists call "non-stationarity,"[83] climate norms can no longer be relied upon and there is a need to update the City's policies to reflect projected climate hazards. Many of the strategies in this plan aim to close Lincoln's policy gaps so that future programs, policies and initiatives are aligned with the climate risks and opportunities of the future.

Another climate-related effect that Lincoln will need to consider is the potential impact to its credit rating, which is currently outstanding. In November 2017, Moody's Investor Service issued a report evaluating the impact of climate change on U.S. states and cities. The report concluded that climate change will have an increasing economic impact on cities, and that climate risks will create negative credit factors for investors in the absence of appropriate mitigation and planning measures. Those mitigation and planning measures themselves will require access to credit to address, creating potential negative feedback loops if left

unaddressed. As Michael Wertz, a Moody's Vice President, put it, "while we anticipate states and municipalities will adopt mitigation strategies for these events, costs to employ them could also become an ongoing credit challenge. Our analysis of economic strength and diversity, access to liquidity and levers to raise additional revenue are also key to our assessment of climate risks as is evaluating asset management and governance."[84] The company's municipal bond managers plan to quantify climate risks for localities, and apply them in their analysis of a city's creditworthiness.[85] Lincoln may need to show evidence of climate planning and resilience efforts in order to maintain its AAA rating in the future.

7. Auto-Reliant Transportation System

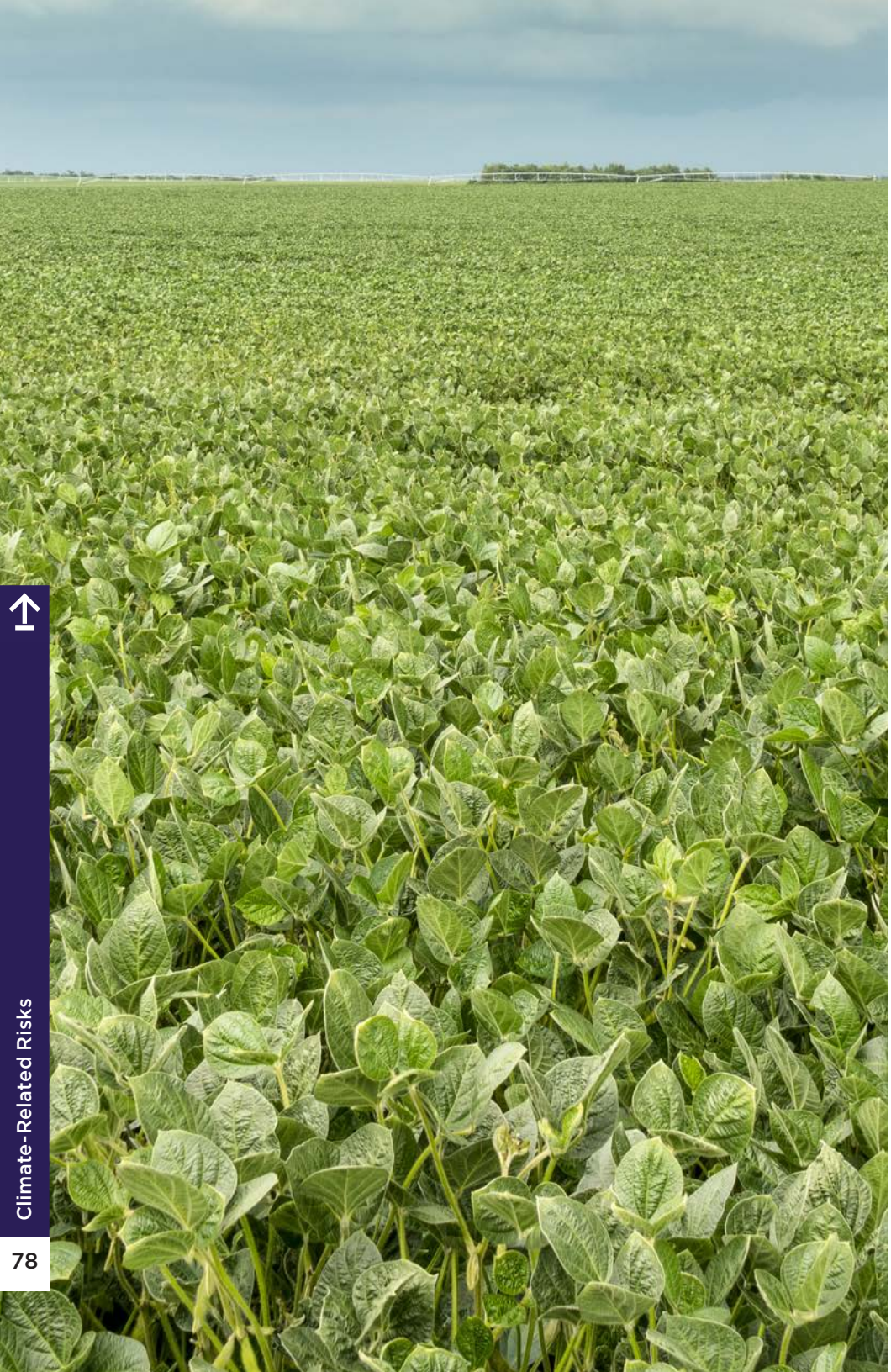
Like most American cities, Lincoln's urban development has favored the automobile. Most residents have to drive to go to work, school, a grocery store or doctor's office. Large dispersed shopping centers, big parking lots and parking garages, drive-through services and narrow or inconsistent sidewalks incentivize travel by car and make it difficult or impossible to travel by foot. One important bright spot, however, is the wonderful interconnected bike trail system in Lincoln, which allows for safe bike travel across town.

Sustainable cities are those that encourage dense urban development with interconnected transit networks so that residents can walk, bike or bus to their daily destinations easily. When electric buses are used, the combination of these modes makes for a carbon-free transportation system.

The auto-reliant infrastructure in Lincoln, combined with the fact that most cars are combustion engine vehicles, means that greenhouse gas emissions from the transportation sector will be a challenge to reduce. With increasing numbers of electric vehicles coming to market and the possibility of hydrogen fuel cell vehicles becoming available for heavy-duty trucks in the future, these emissions may decline over time. Still, cars create congestion, require expensive parking infrastructure and create wear and tear on roads. Electric cars should not be seen as a panacea for Lincoln's transportation system; rather, as Lincoln grows, it is important to emphasize housing and transportation planning that incentivizes and supports lifestyles with reduced reliance on automobiles.

8. Reliance on Fossil Fuels

The lives of Lincoln residents are intertwined with fossil fuels. Currently, 54% of the electricity delivered to Lincoln customers comes from coal.[86] A vast majority of residents drive vehicles powered by gasoline or diesel. Most homes are heated with natural gas, which is also used in many stoves. Coal, gasoline and diesel, and natural gas are all fossil fuels which emit greenhouse gases like carbon dioxide and methane into the atmosphere. To make significant progress in reaching the goal of reducing community-wide net emissions by 80%, the way that everyday life is powered in Lincoln will need to shift. The good news is that as the community reduces electricity demand, shifts to more renewable sources of electricity, drives less and transitions to electric vehicles, there is plenty of opportunity to reduce vulnerabilities related to overreliance on fossil fuels.



9. External Control Over Food Supplies

Nebraska includes nearly 45 million acres (92% of the state's land area) of farmland. In one of the richest breadbaskets of the world, Nebraska sits on a vast aquifer that provides abundant water resources. Yet nearly one-third of Nebraska's farmland is allocated to crops that people cannot readily eat: corn and soybeans. Corn is used as feed for cattle and poultry, as fuel for ethanol, and even for bioplastics. Soybeans are similarly used for animal feed and biodiesel, as well as for human food products. Another ten million acres are used for hay, which is another crop used as an animal feed product.[87] Forty-eight percent of Nebraska's farms are devoted to poultry or livestock operations.[88] On the official USDA tally of Nebraska crops, only about 50,000 acres are listed for crops that people could readily eat: potatoes and peas.[89]

All edible food for Lincoln residents must be shipped in from far away and stocked in the city's grocery stores, which generally carry a three-day supply. This food supply is vulnerable to crop failures due to climate change elsewhere in the world. But the city's food supply is also vulnerable to disruptions in the supply chain distribution systems that bring food to Lincoln from the coasts and from other countries. Residents saw the effects of these kinds of supply chain disruptions during the COVID-19 crisis, when certain products were in short supply at local grocery stores. If a disruption were to cause a delay of food shipments lasting longer than three days, Lincoln could have food shortages. This dependence on external sources for the city's food supply therefore presents a vulnerability related to Lincoln's climate risks.

10. Vulnerable Natural Resources

Climate change can have a range of negative effects on the natural resources on which we depend for clean air, water and soil. Droughts affect water availability, and in serious cases could lead to conflicts between agricultural and urban users. Extreme flooding events could affect Lincoln's drinking water quality. Warming temperatures combined with runoff from agricultural chemicals also creates harmful algal blooms in Nebraska's lakes. The Department of Health and Human Services and the Nebraska Department of Environmental Quality have had to issue Health Alerts each summer in recent years to warn visitors of risks to pets, children and adults of coming into contact with the water in these lakes. The contact can be fatal to pets and farm animals, and can lead to lesions, ulcers, vomiting and liver failure in adults.[90]

The agriculture sector will most likely be significantly affected by climate change. Plant populations will be affected by warming temperatures, longer growing seasons and increased pests in important ways. According to the Fourth National Climate Assessment, "early springs with comparatively late (but climatically normal) frosts can directly affect plant growth and seed production and indirectly disrupt ecosystem services such as pollination. By the middle of this century, early onset of spring could occur one out of every three years; however, if the date of last freeze does not change at the same rate, large-scale plant damage and agricultural losses as well as changes to natural resource markets, are possible."[91] Farmers may encounter higher costs for crop insurance, less water availability or, on the other hand, sodden fields due to heavy rain, changes in production practices and pest and disease problems. A 2017 study shows that agricultural yields in eastern Nebraska at the end of the 21st century could decline by as much as 90%.[92] Clearly, such an outcome would have disastrous consequences on the state's economy, which would create an additional layer of vulnerability for Lincoln's economy.

Lincoln has historically had very good air quality, but climate change is bringing increasing levels of ground-level ozone to cities across the nation, leading to harmful air quality that can have serious health consequences for children, the elderly, and those who work outside. A 2019 study showed that the number of days that persistent hot weather traps harmful pollutants in the air, a phenomenon known as "stagnation, has steadily increased in Lincoln since 1973.[93]

11. Public Awareness

The Climate Resilience Task Force felt that a lack of public awareness of the seriousness of climate change was an important dimension of Lincoln's vulnerability to climate risks. They felt that climate change is not being discussed enough in homes, workplaces and civic organizations, and that most Lincoln residents were unaware of the dangers that climate change poses to them and what they could do to reduce greenhouse gas emissions.

At the same time, a recent statewide poll conducted by the UNL Bureau of Sociological Research showed that more than 7 in 10 Nebraskans feel that climate change is happening. Also, about 9 in 10 Nebraskans are concerned to some degree that flooding and droughts will impact the agriculture sector.[94] So while attitudes are changing, it may be that many Lincolnites do not yet have a personal connection with climate change. In coming years, public awareness can be increased by more public discussion of climate impacts to the city, prioritization of climate-smart projects and funding, educational and behavior change efforts, and more emphasis on natural resource management. As individuals understand more about their own vulnerabilities to climate risks, they can choose to shift their behaviors to reduce emissions and help create a more resilient future.

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Photo courtesy of Lincoln Parks and Recreation

Strategic Visions

Three strategic visions guide the action areas and strategies presented in this plan. Ultimately, the vision for Lincoln is to significantly reduce its greenhouse gas emissions and become resilient to the risks posed by climate change, largely by integrating resilience strategies throughout City plans and processes.

Lincoln will reduce net greenhouse gas emissions 80% by 2050 (relative to 2011 levels).

Following the 80x50 framework implemented by cities such as New York, Los Angeles, Chicago and Denver, the City of Lincoln ambitiously commits to reducing net emissions 80% from 2011 levels by 2050. The year 2011 was chosen as the base year because new greenhouse gas reporting protocols were instituted that year, which allows for subsequent data tracking to be consistent. Net reduction affords Lincoln the ability to meet the city's reduction goal while also benefiting from the ecological, societal and economic benefits from carbon sequestration. Virtually all sectors of life in Lincoln will be responsible for implementing strategies that help the city achieve this goal.

Lincoln will be resilient to the climate hazards it will face.

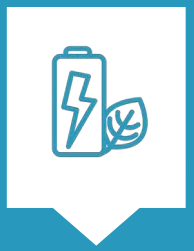
By 2050, Nebraska is projected to have 20-40 days each year where temperatures are above 95°F. More frequent and intense floods, as well as more frequent droughts will also impact the state and the city of Lincoln. The changing climate compounded with socio-economic factors and infrastructure vulnerabilities present significant risks to residents of Lincoln. Implementing strategies in this plan will help the city become more resilient to these risks, thereby creating a more equitable and enjoyable environment for all residents.

Strategic climate directions and climate resilience will be integrated throughout City actions and ordinances.

Integrating and aligning climate resilience efforts throughout City planning and departmental work is necessary for success. Sustainability must be woven throughout existing plans, such as the Comprehensive Plan, and future updates of these plans. Having leaders who can reimagine what city growth looks like, including a vision of growth that acknowledges greenhouse gas emissions reductions, climate resilience, habitat conservation, local foods and protection of greenspace will be vital to ensuring initial and continued integration of resilience throughout all City planning and ordinances.

Action Areas for Making Lincoln a Climate-Resilient City

The sections that follow outline specific strategies Lincoln should implement to meet its strategic visions.



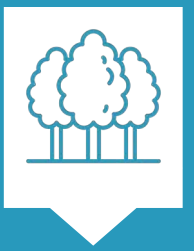
Transition to Low-Carbon Energy

Build a Decarbonized and Efficient Transportation System

Align Economic Development Goals with Climate Realities to Ensure a Thriving Economy

Improve Protections for and with Lincoln Residents

Build a Resilient Local Food System



Maximize Natural Climate Solutions

Reduce Waste

Engage Residents in Co-Creating A Climate Smart Future

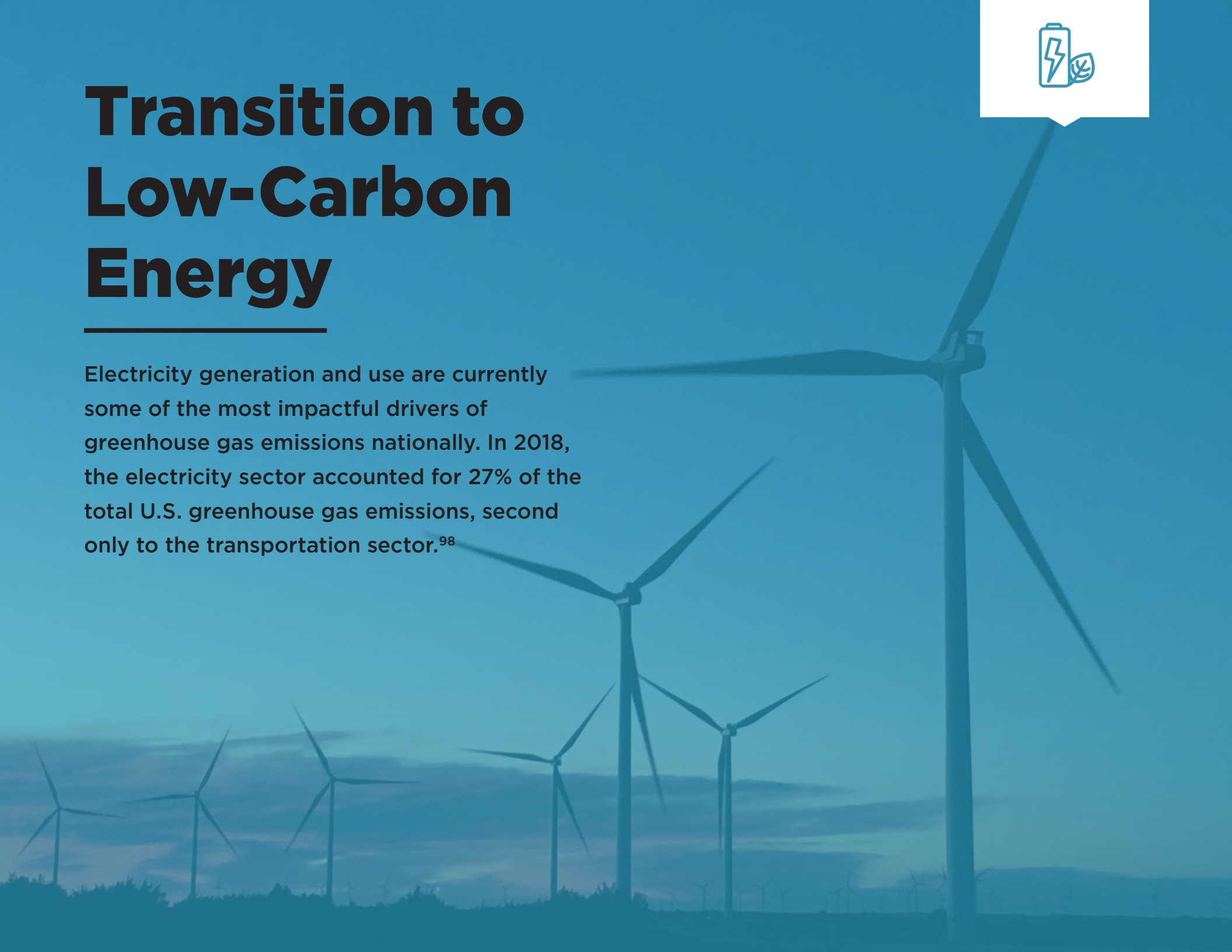
The eight categories reflect the focus that emerged from the planning sessions. The strategies themselves were developed from a variety of sources:

- **Climate Resilience Task Force:** A 45-member planning group representing a cross-section of the Lincoln community and appointed by the Mayor to participate in the climate action planning process.
- **Sustainability Working Group:** A 16-member group of City staff providing subject matter expertise in the key areas of the plan.
- **Mayor's Environmental Task Force:** This group consists of over 150 interested members of the public and City staff, many of whom participated in the planning process via regular monthly meetings.
- **2017 Lincoln Environmental Action Plan (LEAP):** The strategies included in Lincoln's first sustainability plan were updated, clarified and expanded for inclusion in this plan.
- **Coalition for Environmental Improvement:** This is a local citizen group of environmental leaders who provided valuable input to the process.
- ***American Cities Climate Challenge Action Playbook,*** a 2019 publication from Bloomberg Philanthropies.[95]
- ***Sustainable Development Code,*** a resource that offers best practices for sustainable community development policies.[96]
- ***The Carbon Free City Handbook,*** a 2017 publication from the Rocky Mountain Institute that helps cities implement climate policies and actions that place their communities on the path toward sustainable, low-carbon economies.[97]

The strategies that follow are to be read as recommendations to help frame and spur further policy discussions. It will take further community discussions, cost-benefit analyses, prioritization and viability analysis to determine the specifics of how they will be implemented. But together they constitute the scope and scale of actions that will need to be taken to make Lincoln a climate-resilient city.

Transition to Low-Carbon Energy

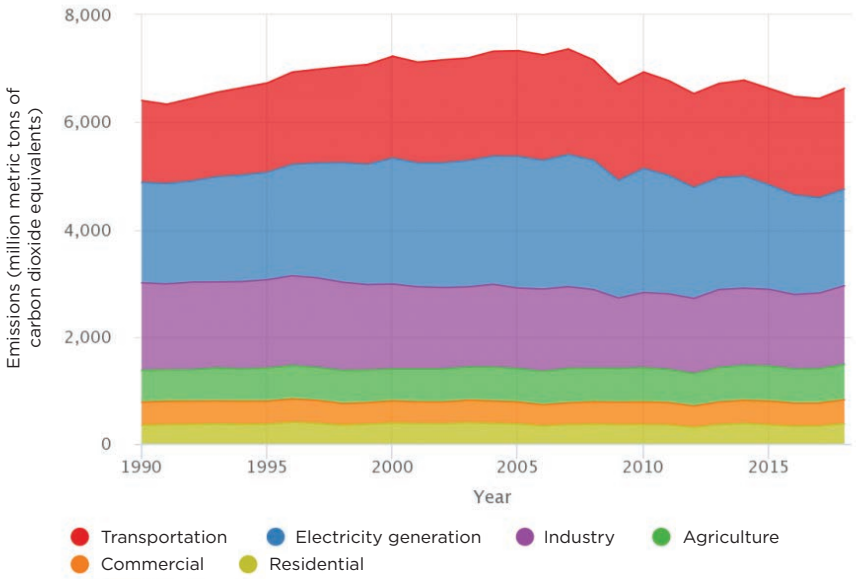
Electricity generation and use are currently some of the most impactful drivers of greenhouse gas emissions nationally. In 2018, the electricity sector accounted for 27% of the total U.S. greenhouse gas emissions, second only to the transportation sector.[98]



Lincoln's electricity is delivered by the Lincoln Electric System (LES), a City-owned public power utility. LES produces/purchases its electricity from numerous generation sources, including coal, wind, hydropower, oil and natural gas, landfill gas, and solar. Many of those sources are located in Nebraska, but some are located in Iowa, Kansas, Wyoming and Oklahoma. Very few combustion plants are located in and around Lincoln, which is beneficial for the city's overall air quality.

LES has steadily increased the amount of renewable energy in its portfolio over the past ten years. In 2019, a full 41% of the energy LES produced/purchased came from renewable sources, mainly wind farms.[99] From 2010 to 2019, the electric utility's move to more renewable energy generation, as well as their exit from the Sheldon Station coal plant contract with Nebraska Public Power District, resulted in a decrease in carbon intensity—the pounds of CO2 per net megawatt hour—of 38%.[100]

U.S. Greenhouse Gas Emissions by Economic Sector, 1990-2018

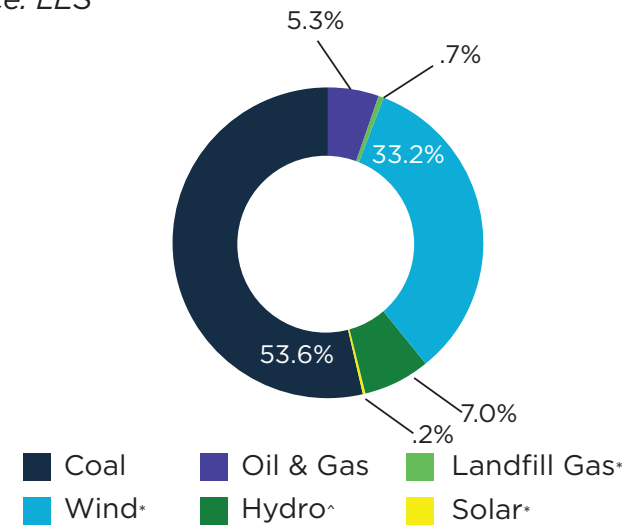


Source: U.S. EPA [102]

Despite these impressive gains in their portfolio, fossil fuel generation remains a significant part of LES's energy mix. In 2019, 53.6% of the electricity that LES produced/purchased came from coal and 5.3% from oil and gas, resulting in a total of 58.9% of electricity coming from fossil fuels. [101]

LES 2019 Sources of Energy

Source: LES [103]



** LES is selling the Renewable Energy Certificates (RECs) and the renewable attributes are transferred to the REC recipient.*

^ Western Area Power Administration contract purchases, including a portion of non-hydro, supplemental energy.

Usage of fossil fuels, particularly coal and natural gas, to generate electricity results in greenhouse gas emissions of carbon dioxide, methane, and nitrous oxide. While there are many technical and financial reasons why coal remains in LES's generation mix—it is financially inexpensive, produces consistent rather than intermittent energy, and is in plentiful supply—the long-term emissions reduction goal of this plan calls for the phasing out of greenhouse gas-emitting energy sources over time.

It is important to note that given the projections of a warming climate for Lincoln, demand for heating should decrease in coming years. However, demand for cooling will increase due to rising temperatures, thus requiring more electricity delivery from LES. With increasingly hot summer days, warmer summer nights and higher temperatures in spring and fall, Lincoln residents will depend more and more on air conditioning. As Nebraska's State Climatologist states, "[by mid-century,] given the temperature projections and warming trend, cooling degree days [the sum of the number of degrees for which a day's mean temperature is above 65°] are projected to be 40% to 60% more than the current average (approximately 1,000 degree-days per year). Heating degree days [the sum of the number of degrees for which a day's mean temperature is below 65°] average about 7,000 units annually in today's climate. By mid-century, projections indicate a 10% to 20% decrease."[104] Consistent with their historical operations, it will be important for LES to meet this increasing demand with non-carbon-emitting sources of electricity.

The strategies in this chapter describe the ways in which Lincoln can transition to low-carbon energy sources. Most of them pertain to building construction and operations in the municipal, commercial and residential sectors.

Did You Know? Nebraska is the only state in the country that provides 100% of its electricity from publicly-owned institutions. Residents pay some of the lowest electricity rates in the country, and revenues are reinvested in infrastructure. Residents also have a voice in how their utilities are run, including how they generate electricity.[105]

The first section of strategies in this chapter pertains to energy use. The most important and most cost effective steps to take to reduce emissions associated with energy use are to greatly increase energy efficiency in Lincoln's buildings. A 2019 report from the American Council for an Energy-Efficient Economy found that energy efficiency measures alone could cut U.S. emissions by a remarkable 50%.[106] The report stated that new homes and commercial buildings could cut their emissions by 70% with efficient design and use of cleaner electricity. Existing homes and buildings could cut emissions with energy-efficient upgrades, smart control technologies, and electrification of heating and cooling. All of these measures result in the added benefit of significant cost savings from avoided energy use. In discussions about housing affordability, it is important to remember that both the cost of the house and the cost to operate the house need to be taken into account.

Tracking and disclosing energy use is an important part of increasing energy efficiency. The EPA maintains a tool called Energy Star Portfolio Manager where building operators can report and track their energy consumption. They can then choose to make it public if they wish. This kind of disclosure provides an accountability loop between building operators and users, and lets the public know how well a business or organization is performing relative to its goals.

Identifying and encouraging private sector leaders to establish a Lincoln 2030 District could help catalyze many of these strategies for reducing emissions associated with the built environment. A 2030 District is a coalition through which property managers/developers, with the help of community stakeholders, commit to significantly reducing energy consumption, water usage, and transportation emissions within an identified boundary by 2030, through data monitoring, building upgrades, education, and collaboration.

On the residential side, strategies encourage the construction of new homes and apartments to be electric vehicle (EV)-ready, meaning they are built with electrical conduit to accommodate EV chargers for residents who choose to use them. This kind of policy change can help encourage a more widespread adoption of electric vehicles, which will in turn make a significant impact in reducing Lincoln's overall greenhouse gas emissions (see Transportation chapter).

Strategies also call for the gradual transition from natural gas-powered home appliances like furnaces, water heaters and stoves to electric versions. Natural gas systems invariably leak methane, which is a potent greenhouse gas. While methane emissions from home appliances are low,[107] leakage from the natural gas supply network is a serious problem. A 2018 study found that methane leakage was 60% higher than official estimates from the EPA.[108]

While LES and building operators can make important decisions in the transition to low-carbon energy, every Lincoln resident has a role to play in reducing the emissions associated with energy use. Programming home thermostats to heat and to cool only as necessary will save energy and money. Weatherizing doors and windows, upgrading to Energy Star-certified appliances, unplugging large appliances when not in use, using LED light bulbs, and using smart power strips are other actions that every resident can take to reduce energy use. Using recommended temperature settings in residences can greatly help reduce greenhouse gas emissions. The Department of Energy recommends the following temperature settings to help lower emissions and save money:

- Winter: 68° when residents are home and lower when they're away;
- Summer: 78° when residents are home and higher when they're away.[109]

The second set of strategies in this section pertains to energy generation. The commercial and residential sectors can be supported and encouraged to install rooftop (and ground-mounted, where feasible) solar arrays. While in most cases the buildings will remain tied to the electric grid, the panels will generate electricity during daylight hours that can be used directly by the building, and any excess power can be directed back into the grid for a billing credit. This is known as net metering.

Solar energy is another area that should be targeted for expansion in Lincoln. According to the National Renewable Energy Laboratory (NREL), Nebraska is ranked 13th among states with the greatest energy potential from solar power.[110] However, there is much more opportunity to realize that potential: the state currently ranks 45th out of the 50 states in the amount of solar actually installed. The price of solar has fallen 40% over the last five years, making a ripe opportunity for Lincoln to expand use of this renewable source.[111]

Geothermal is another renewable energy source that is already widely used in Lincoln and could be further expanded. Geothermal energy systems use the constant temperature of the earth (around 54°F) to provide heat in the winter and cooling in the summer. Lincoln Public Schools has retrofitted many of their buildings with geothermal heat pump systems, which now heat or cool 90% of the school district's square footage.[112] The Nebraska State Capitol has also recently been retrofitted with a geothermal energy system.[113] Because these systems require less energy to do the work of heating and cooling, they can provide significant cost savings over the long term. In the residential sector, geothermal heat pump systems were found to save consumers 33-65% of the cost of energy over a conventional HVAC system.[114]

The energy sector will be a crucial component of Lincoln's climate progress. By working together across sectors and with a combination of policy, market-driven and voluntary efforts, the residents of Lincoln can achieve their ambitious goal of reducing net emissions 80% by 2050.

Strategies to Transition to Low-Carbon Energy

S = Short-Term (next 0-10 years); M = Medium-Term (next 10-20 years); L = Long-Term (next 20-30 years.)

'Crossover' strategies that appear in more than one Action Area are noted with the icon of the corresponding section.

Reduce emissions associated with energy use.	Phase
Residential Sector	
Require single- and multi-family homes to be energy efficient.	S
Expand community partnerships between LES, Community Action Partnership and other social service agencies to provide funding and services to increase insulation in multifamily housing, with priority given to most vulnerable populations. 	M
Adopt future updates of the International Energy Conservation Code (IECC) for the City of Lincoln.	M
Provide incentives such as rebates and tax incentives to developers who install energy-efficient fixtures and appliances such as air conditioners, water heaters and heat pumps.	S
Encourage the development of net zero energy affordable housing. Work with local architectural schools and local builders to create a net zero, low cost home construction plan. Adopt the plan as pre-approved housing plan for redevelopment/in-fill housing in low income neighborhoods.	M
Create incentives for net zero energy residential new construction and retrofitting.	S
Require energy disclosures at time of sale for residential buildings to identify electrical and heating costs and list recommendations to reduce energy costs and improve energy efficiency.	S
Inspect heating and cool appliances, such as gas-powered furnaces, to check for leaks and other problems that may inhibit enery efficiency and cause harm to human health.	L
Incent adoption of direct use high efficiency natural gas appliances, including gas absorption heat pumps, furnaces and water heaters, as well as combined heat and power technology.	S

Transition from natural gas to all-electric heating and cooking systems.	
Create incentives for homeowners to adopt all-electric heating and cooking systems.	**S**
Require all new homes be built with all-electric HVAC systems. Encourage all-electric cooking appliances.	**M**
Encourage Lincoln residents to adopt low-carbon behaviors.	
Conduct a consumption-based greenhouse gas inventory to show the emissions impact of the consumer behaviors of Lincoln residents.	**S**
Create a public engagement campaign to educate and create behavior change to reduce energy consumption. 	**S**
Reduce CO2 emissions from combustion engine vehicles.	**M**
Require all new homes and apartments to be built EV-ready. All electrical conduits would be ready for hookup if and when the building owner decides to install electrical chargers. 	**M**
Commercial Sector	
Require commercial buildings to be energy efficient.	
Adopt the commercial provisions of the 2018 International Energy Conservation Code (IECC).	**S**
Adopt future updates of the International Energy Conservation Code (IECC) for the City of Lincoln.	**M**
Require existing buildings to meet a specified energy efficiency metric based on whole-building energy consumption per unit area after a "trigger" event, such as a sale, a building refinancing, or a major renovation, or in tandem with life safety upgrades.	**M**
Create incentives for the creation of net zero energy buildings, whether through new construction or renovation.	**S**
Create a plan to proactively promote and market the LES Sustainable Energy Program to incentivize building owners and landlords to weatherize and insulate commercial properties, especially multi-family housing units.	**S**
Require that new commercial construction meet third-party green building standards, like LEED, Green Globes or Living Building Challenge.	**L**

Obtain commitments from large institutions and businessess to reduce emissions 80% by 2050. These commitments will help drive demand for energy efficiency retrofitting, which will in turn create new jobs.	S
Incentivize the use of "green leases" in commercial rental properties to ensure the ongoing sustainability operation of a building by both tenants and building owners.	M
Investigate the feasibility of developing a public-private partnership for an entity that would finance energy efficiency retrofits of existing buildings.	S
Create a community challenge that incentivizes new development and major renovation to dedicate a portion of roof space as a green roof. The portion of dedicated green space shall increase as the building's gross square footage increases. 	M
Disclose energy use.	
Encourage commercial buildings over a certain size to benchmark and report their annual energy use using the Environmental Protection Agency's Energy Star Portfolio Manager.	S
Require commercial buildings over a certain size to benchmark and report their annual energy use to the City. Only aggregate data will be made public.	M
Recognize and celebrate leaders in energy efficiency.	
Create a recognition program that incentivizes commercial buildings to track and report their building energy use using the Environmental Protection Agency's Energy Star Portfolio Manager, and that awards commercial buildings that achieve certain levels of energy efficiency.	S
Collaborate with LES and local food producers to develop a program that allows on-site solar arrays for less productive, agricultural land. Installation of solar arrays can help off-set costs from underperforming plots of land while also contributing to a cleaner energy landscape. 	M
Identify and encourage private sector leaders to establish a Lincoln 2030 District, where property managers and developers within a certain boundary commit to reporting and monitoring building data through Energy Star and to achieving target reductions in energy use, water use, and transportation emissions through collaboration/use of 2030 District Network resources.	S
Municipal Sector	
Develop a comprehensive approach to increasing energy efficiency in municipal buildings.	

Create a plan to power all municipal operations with 100% renewable energy by 2035. Options will include some combination of the following: rooftop solar, ground-mounted solar, geothermal, virtual net-metering, power purchase agreement through LES with a solar or wind power facility, and/or purchasing rewnewable energy credits.	**S**
Complete an analysis of rooftop solar potential from all municipal buildings.	**S**
Implement recommended energy conservation measures from previous ESCO project energy audit reports in municipal buildings.	**S**
Create an Asset Management Plan including Facility Condition Assessments.	**S**
Create a policy that specifies that new construction and significant renovations of municipal facilities will be zero energy buildings, meaning that the energy they require is supplied by onsite renewable energy, including geothermal and solar.	**M**
Perform deep energy retrofits on all existing municipal buildings, including affordable housing, to make municipal facilities ultraefficient and net-zero energy ready.	**M**
Create policies to require energy efficient practices in municipal government. This would include taking an inventory of all technology assets; reducing individual printers in favor of shared multi-function devices; utilizing network settings to power down computers at night; reducing paper use by requiring electronic document retention; switching to LED lighting; not heating or cooling unused spaces; and many more.	**S**
Disclose energy use.	
Require municipal buildings to benchmark and report their annual energy use using the Environmental Protection Agency's Energy Star Portfolio Manager.	**S**
Designate a staff person responsible for tracking and reporting energy use from municipal facilities.	**S**
Reduce emissions in City-contracted projects.	
Require that vendors responding to City contracts over a certain amount indicate whether or not they publicly disclose their greenhouse gas emissions, and if so, to provide a web site where this information is provided. The rule would not establish evaluation criteria to be used in a vendor selection decision, but is meant to encourage transparency and modeling in meeting the City's emission reduction goals.	**M**
Explore the use of "green concrete" to be used in all city contracts. This is concrete that has been injected with CO2, which makes stronger concrete and also sequesters carbon.	**M**

Reduce emissions associated with energy generation.

LES and Municipal Sector	
Set a goal of reducing net emissions from electricity provided by LES 80% by 2050 (relative to 2011 levels).	**S**
Continue the decarbonization of LES' resource portfolio by (a) transitioning to new renewable and low-carbon sources, and (b) mitigating and reducing the carbon emissions from existing resources.	**S**
Prioritize the research, testing and funding of new low-emissions energy technologies, including energy storage, hydrogen, biomass, advances in wind and solar, grid optimization and all other future technologies that may be relevant for use in Lincoln.	**S**
Create partnerships between LES, the City, local colleges and universities and businesses to research, test and pilot new energy technologies.	**S**
Explore the feasbility of implementing Vehicle-to-Grid (V2G) technology to optimize the energy potential of batteries from parked EVs. 	**M**
Encourage the expansion of district energy systems powered by combined heat and power or by renewable energy.	**M**
Explore the integration of solar into the Haymarket District Energy Corporation system.	**S**
Expand and maximize system that captures energy value from landfill gas at the Bluff Road Landfill.	**M**
Begin reporting community greenhouse gas emissions through a standardized city reporting platform like CDP on an annual basis.	**S**
Residential Sector	
Encourage the adoption of residential solar.	
Create a suite of incentives for residential building owners to install renewable energy systems like solar and geothermal. Incentives may include offering rebates on purchasing equipment, attractive net metering pricing, tax incentives, height allowances, setback and area-based incentives, expedited permitting, and others.	**S**
Create an ordinance that regulates optimum siting and orientation for solar installations.	**S**
Work with state legislature to create an ordinance that exempts the added value of renewable energy systems from property tax.	**S**

Incentivize new residential buildings to be built solar-ready. To be solar-ready, rooftops should be properly angled for the specific location and/or sloped toward the south, and should be able to handle the equipment weight and weather conditions after installation. All collateral materials on the roof, such as vents, chimneys, and mechanical equipment, should be grouped to reserve as much space as possible for solar collectors. For larger solar water heater systems, consideration should be given to ensuring that the proper plumbing system is installed, connecting the rooftop to the equipment room at the time of construction. Finally, solar-ready PV energy collectors require forethought on how the system will connect to the grid, the location of the electric panel on the structure, as well as the size and output of the array.	**M**
Update Lincoln ordinance to allow residential applications for Property Assessed Clean Energy Projects (PACE) on properties other than only multi-family housing properties comprised of 5 or more dwelling units.	**M**
Create a process to resolve disputes regarding tree interference with solar access.	**S**
Commercial Sector	
Encourage the adoption of onsite renewable energy.	
Create a suite of incentives for commercial building owners to install renewable energy systems like solar and geothermal. Incentives may include offering rebates on purchasing equipment, attractive net metering pricing, tax incentives, height allowances, setback and area-based incentives, expedited permitting, and others.	**S**
Create an outreach and incenctive program to the commercial sector to significantly increase the number of commercial Property-Assessed Clean Energy (C-PACE) projects in the city.	**S**
Create an ordinance that regulates optimum siting and orientation for solar installations.	**S**
Incentivize the installation of combined heat + power (CHP) systems where feasible.	**S**
Offer density bonuses to developers if a certain portion of the new development gets its power from solar or renewable energy.	**S**
Require new commercial buildings to be built solar-ready. To be solar-ready, rooftops should be properly angled for the specific location and/or sloped toward the south, and should be able to handle the equipment weight and weather conditions after installation. All collateral materials on the roof, such as vents, chimneys, and mechanical equipment, should be grouped to reserve as much space as possible for solar collectors. For larger solar water heater systems, consideration should be given to ensuring that the proper plumbing system is installed, connecting the rooftop to the equipment room at the time of construction. Finally, solar-ready PV energy collectors require forethought on how the system will connect to the grid, the location of the electric panel on the structure, as well as the size and output of the array.	**M**
Encourage the expansion of district energy systems powered by combined heat and power or by renewable energy.	**M**

Build a Decarbonized and Efficient Transportation Infrastructure

Vital to meeting the goal of reducing net emissions 80% by 2050 will be the City of Lincoln's commitment to reducing emissions from transportation.

The transportation sector recently became the nation's largest source of greenhouse gas emissions, surpassing the electric power sector.[115] Personal and commercial travel via cars, trucks, planes, trains, and boats emit around 1.9 billion metric tons of carbon dioxide every year in the U.S., accounting for 28% of the country's total emissions.[116],[117] Emissions from transportation in the U.S. have risen every year since 2012 and most activity continues to be powered by fossil fuels, mainly gasoline and diesel.[118] As noted in the Greenhouse Gas Emissions Reduction Target section of this plan, Lincoln has also seen a steady annual increase in emissions from transportation. The strategies outlined below describe how the City of Lincoln and residents can positively contribute to a healthier transportation system by reducing reliance on fossil-fuel-powered vehicles and increasing the efficiency of low-carbon transportation systems.

With strategies and goals in the Comprehensive Plan, efforts by the Lincoln Metropolitan Planning Organization (MPO) and Complete Streets Committee, and recommendations from the 2019 Lincoln Bike Plan, the City of Lincoln is already engaging in climate-smart transportation planning. Examples of current climate-smart strategies that decarbonize transportation in Lincoln include the phasing in of electric buses in the City-owned StarTran bus system and the expansion of the City's bike trail system. Continuing to implement recommendations from these groups and reports will advance and enhance Lincoln's decarbonization and efficiency efforts in the transportation sector.

Public transportation and bike trails help Lincolnites participate in active commuting. Active commute modes include walking, taking public transit, riding a bike and carpooling. Implementing a comprehensive active commuting program is one way the City could partner with private businesses, nonprofit organizations, and educational institutions to reduce emissions from transportation. An active commuting program at the University of Nebraska Medical Center in Omaha was able to prevent 800 cars per day from coming to campus; increase bus rides by 60,000 in a single year; avoid costs of at least $30 million by not having to build a new parking garage; and report physical and emotional health improvements on the part of employees such as weight loss, lower blood pressure and cholesterol levels, and reduction in stress.[119] By encouraging employees at large employers to use active commuting modes to get to work, Lincoln could reduce congestion, improve air quality and save taxpayer dollars on parking infrastructure.

Photo courtesy of Lincoln Parks and Recreation

Policies focused on transit-oriented development complement and support programs for active commuting and climate-smart transportation. Adopting transit-oriented development policies shifts a city's landscape from individual, vehicular and carbon-intensive commute modes to transportation that is people-centered, communal and climate-friendly. Having a more people-

centered and transit-oriented development plan results in a more equitable city: Accessibility to different parts of the city opens up to residents whose mobility has previously been restricted due to high costs and other constraints related to owning and driving a car. Not having to own and operate a car to get around the city also allows residents to dedicate more of their income to health, education, and general wellbeing rather than on a car and associated costs such as maintenance and insurance. Offering incentives to developers who build within a specified radius of a bus stop or station is one way the City of Lincoln can contribute towards that shift to a more transit-oriented city. Other policies that can transform how Lincolnites move around the city while helping the City meet its emissions goal include evaluating parking standards, assessing the impact of implementing maximum parking limits rather than requiring a minimum number of parking spots, and offering density bonuses for affordable housing developments located near transit stops and/or near major employment centers.

When active commute modes are not feasible and people need to drive single-occupancy vehicles, electric rather than fossil fuel powered vehicles should become the norm. According to the U.S. Department of Energy, electric vehicles (EVs) not only help reduce greenhouse gas emissions and save drivers money, EVs also help provide national economic security.[120] Domestic electricity production is much more reliable and affordable than the global petroleum industry, which is highly susceptible to disruptions in supply and drastic price increases. Consumers and policy-makers in the U.S. are recognizing the benefits of EVs. In 2018, demand for EVs increased 40% compared to 2017.[121] Installing public charging stations, continuing to promote the benefits of EVs, incentivizing purchasing of EVs, and replacing City fleet vehicles with EVs are some ways Lincoln can support and prioritize zero and low emissions travel.

Regional transit development, teleworking, and evaluating the city's current waste hauling system are additional strategies to help Lincoln reduce its greenhouse gas emissions and improve quality of life for residents. City officials are already engaged in working with Nebraska Department of Transportation (NDOT), City of Omaha, and other stakeholders to develop a sustainable mass transit system, ideally an electric bus shuttle service, between Lincoln and Omaha, the state's largest cities. Such a system can positively contribute to municipal and regional economic development, as well as individual wellbeing and greenhouse gas emission reductions.

Teleworking, also known as remote working, is another policy-based strategy that helps reduce the number of individual vehicles on the road and the associated emissions from commuting. During the coronavirus pandemic, many Lincoln residents began teleworking, starting a practice that may continue long afterwards. Improved employee productivity and work satisfaction are co-benefits from remote working policies.

Evaluating the efficiency of the city's waste hauling system, which currently includes multiple haulers, has the potential to reduce the number of heavy-duty vehicles on Lincoln streets and the associated emissions. Neighborhood zoning ordinances, a waste halter cooperative, geographic franchising, or even a single contract for one waste hauler to service the city's waste and recycling needs are some ways Lincoln could explore to achieve cost savings, increase recycling rates, and reduce emissions from recycling and landfill collection.

Within and beyond city limits, Lincoln can reshape its development policies, shift collective and individual behaviors, and encourage a future environment where transportation systems provide more positive social, economic, and ecological benefits than the current model.

Strategies to Build a Decarbonized and Efficient Transportation Infrastructure

S = Short-Term (next 0-10 years); M = Medium-Term (next 10-20 years); L = Long-Term (next 20-30 years.)

'Crossover' strategies that appear in more than one Action Area are noted with the icon of the corresponding section.

Continue to integrate active and equitable transportation planning into long-range plans.	**Phase**
Ensure that all transportation infrastructure development projects are evaluated according to climate hazards and smart climate goals.	**S**
Continue mixed use development efforts as described in the Comp Plan.	**S**
Continue the work of the Complete Streets Committee to identify appropriate Complete Streets projects and increase funding as-needed.	**S**
Following the recommendations from the 2013 Lincoln Metropolitan Planning Organization (MPO) study, create a travel demand management program that is coordinated between appropriate City departments to identify and work with large employers, including the State of Nebraska, University of Nebraska-Lincoln, local businesses, public entities and appropriate community stakeholders.	**S**
Develop and implement a teleworking policy for City employees to reduce greenhouse gas emissions from commuting and to increase employee wellbeing and productivity.	**S**
Update the 2015 Complete Streets Gap Analysis and Prioritization Strategy in order to evaluate needed improvements for bike and walk lanes.	**S**
Adopt pedestrian-oriented development policies.	**M**
Create pedestrian focused overlay zones that prioritize pedestrian safety and comfort and include human-scaled design.	**M**
Continue to work with the Nebraska Department of Transportation (NDOT), City of Omaha and other engaged parties to develop a commuter bus service between Lincoln and Omaha. Ensure this service uses emissions-free electric buses. 	**S**
Adopt transit-oriented development (TOD) policies.	**S**

Continue to incorporate TOD zones in comprehensive planning.	**L**
Offer incentives to developers who choose to build within a specified radius of a transit hub, including bus stops/ stations and train stops/stations.	**S**
Re-evaluate parking standards and explore feasibility of shifting from minimum parking requirements with new development to maximum parking requirements.	**S**
Offer density bonuses for affordable housing developments located near transit stops and/or major employment centers.	**L**
Continue to research and implement TOD policies as relevant to Lincoln's growth.	**S**
Increase active commuting.	
Collaborate with Metropolitan Planning Organization (MPO) to promote active commuter incentives (e.g., free or subsidized StarTran transit passes, priority parking spots for employees who carpool, guaranteed ride home) to reduce single occupancy commutes by city employees. 	**S**
Expand commuter incentives to large employers.	**M**
Strengthen public transportation.	**L**
Continue to transition StarTran bus fleet to electric and/or low-emissions.	**M**
Pilot an electric on-call vanpool program in areas not reached by the StarTran system.	**M**
Continue the implementation of recommendations and service expansion for StarTran detailed in the Lincoln Transit Development Plan, such as installing transfer stations throughout the community so passengers do not need to go Downtown to transfer.	**S**
Continue the exploration of increasing the efficiency of StarTran service (e.g., through more efficient transit pass technology).	**M**
Create a public engagement campaign to encourage bus ridership from all residents. 	**S**

Continue pilot test of dockless scooters and implement recommendations based on the findings from the pilot test.	**S**
Provide an active commuter pass that allows individuals to ride transit, use bike share, and future scooter and other appropriate programs.	**S**
Consider the addition of an EV shuttle that provides service loops downtown.	**M**
Designate dedicated electric shuttles circulating between Southeast Community College and UNL. 	**S**
Encourage and facilitate bike commuting.	**S**
Continue to expand bike trail network to facilitate bike travel and recreation within city limits and throughout the county.	**S**
Implement recommendations from the Lincoln Bike Plan (2019).	**S**
Encourage and assist businesses to become League of American Bicyclists, Bicycle Friendly Businesses.	**S**
Encourage large employers and public agencies to provide for bike parking, lockers and shower facilities.	**S**
Strengthen Lincoln Public School (LPS)'s active commuting efforts.	**M**
Support and enhance the existing outreach and education campaign to encourage parents to walk their children to school via the "walking school bus" program. 	**M**
Continue the identification of funding sources for LPS to increase the number of electric and/or low emissions vehicles in their school bus fleet.	**S**
Discuss more energy efficient student transportation options.	**M**
Collaborate with private schools on active commuting efforts.	**M**
Reduce emissions in City fleet vehicles.	
Prioritize replacement of City fleet vehicles to first remove the oldest and most polluting vehicles from the fleet.	**M**

Prioritize heavy fleet replacements to take advantage of cleaner, renewable fuels.	M
Identify, capture and utilize additional sources for biogas production and expand Renewable Natural Gas usage in heavy duty fleets, including garbage trucks, school buses and public transportation.	S
Implement a policy that specifies purchasing decisions will prioritize smaller and lower-emissions vehicles (electric, CNG and RNG) when applicable (e.g., vehicles used in emergency preparedness and response must not be compromised).	S
Explore lease-to-own purchasing to help finance cleaner, renewable fuels when procuring all fleet assets.	S
Work with Lincoln Electric System (LES) to install necessary charging infrastructure.	M
Install telemetry in all vehicles to gather data on usage patterns in order to analyze and inform decision-making. Drive cycles and usage patterns will also help determine alternative fuel vehicle targets.	S
Ensure that data collection occurs within one system (e.g., LIGO) for all vehicles.	M
Create a city-employee car and equipment sharing program populated with a variety of assets fueled by clean renewables, that are widely available and meet the needs of the operating environment. Eliminate underutilized assets.	M
Centralize fleet management to optimize efficiency across all city vehicles.	S
Identify the most appropriate department under which the City's fleet would be most efficiently centralized. Establish a new, autonomous Fleet Management department that would work closely with embedded personnel/ liaisons in appropriate departments.	S
Create prioritized parking for EVs in public parking lots.	
Pursue and promote grants that can be used for rebates to residents who purchase EVs and charging stations with partners such as Lincoln Electric System (LES) and the Nebraska Environmental Trust (NET).	S
Continue to promote EV education and incentives to encourage the adoption of EVs.	S
Collaborate with LES and their EV interest group to host and promote events and incentives.	S
Collaborate with Metropolitan Planning Organization (MPO) to incentivize adoption of EVs by city employees.	S

Consider providing priority parking for city employees who drive EVs, as well as employees who drive hybrids and who carpool.	**S**
Expand incentive programs to large employers in the city.	**M**
Support the piloting and development of electric autonomous vehicle infrastructure.	
Ensure transportation system allows for safe and efficient use of autonomous vehicles.	**L**
Evaluate a broad spectrum of programmatic and/or systematic options to increase efficiency, including cost savings from eliminating neighborhood collection sites, increased recycling rates, reduced waste handling rates for residents and future expansion to organics collection. 	
Conduct an analysis of emissions generated and road damage incurred from current waste hauling system.	**S**
Evaluate a full spectrum of alternatives to current system, including neighborhood zoning requirements for haulers, the formation of a hauler cooperative, or multiple or single contracts for one hauler with the City for all garbage and recycling pickup.	**S**
Evaluate potential efficiency improvements that could be achieved with an improved system, including cost savings from eliminating neighborhood drop-off sites, increased recycling rates, reduced waste handling rates for residents and future expansion to organics collection.	**S**
Consider a phased approach to implementing efficiency improvements to current waste hauling system.	**S**

Align Economic Development Goals with Climate Realities to Ensure a Thriving Economy

A resilient city is one that plans and then develops its capacity to bounce back successfully from natural disasters while maintaining its essential characteristics and functions.

After a natural disaster, residents need to be able to go back to work and businesses need to re-open to ensure a resilient economy. Without it, residents risk economic harm from the secondary effects of disaster. Unemployment, evictions, lack of access to food and health care and a rising poverty rate are all disastrous secondary effects that can be avoided by implementing strategies to ensure Lincoln's economy is resilient to the challenges of the future.

This chapter details strategies to align Lincoln's future economic development with its future climate realities. By looking carefully at the social as well as the climate dimensions of the future, city leaders can identify several strategic areas around which to shape Lincoln's economy, bringing multiple benefits to the city.

Several social and demographic trends were identified during the planning process as heightening Lincoln's vulnerability to climate impacts. These included Lincoln's 14.2% poverty rate,[122] an aging population, increasing job automation, and the possibility of climate migration. These trends were taken into account in developing strategies that address these challenges while also growing Lincoln's economy.

Lincoln should take an equitable approach in growing its economy so that the well-being of the most vulnerable and underrepresented communities is protected and enhanced. Such an approach requires staying well-informed of the realities and challenges faced by residents who are low-income, LGBTQ+, communities of color, and who live with disabilities. Ensuring the representation of these communities in decision-making and implementing strategies to address historic discrimination will help ensure that every resident has access to education, healthcare, job training, child care, living wage jobs, affordable housing and entrepreneurship mentoring.

By 2050, the number of Nebraskans aged 65 or older will more than double. In 2050, older residents will make up 15% of the population in Lancaster County.[123] With lengthening life expectancies, Baby Boomers stand to have many decades of their later years in which they will want to work, increase their financial resilience and make contributions to the community. Some strategies seek to combat ageism in the workforce by expanding educational and workforce opportunities in ways that can benefit everyone.

Climate migration is an issue that will have increasing importance across the United States in coming decades. As sea levels rise on the coasts, extreme flooding events increase in the Southeast, drought and heat conditions increase in the Southwest, people will have to relocate. A 2016 study estimated as many as 13 million Americans may need to relocate due to rising sea levels alone.[124] While one 2020 study estimates that Lancaster County will not be affected,[125] it will be important for City leaders to keep abreast of population and migration developments in coming decades and to prepare appropriately for a possible increase in city residents from other parts of the country and the world. What is most important is to recognize that new arrivals to the city can provide great benefits to the local community and economy with their skills and workforce abilities.

Another important demographic shift in coming decades will be the increasing use of automation to perform jobs that are now done by humans. PwC projects that by the mid-2030s, as many as 50% of jobs in transportation, 45% in manufacturing, and nearly 40% in construction could be replaced by automation, with an average replacement rate of nearly 30% across all employment sectors. The impacts will not be distributed equally: those with low educational attainment levels will be the hardest hit.[126] With many low-income Lincoln residents employed in these fields, the economic impact from automation could be serious.

However, there are many opportunities to embrace in a climate-smart future. The transition to efficient, renewable energy will bring with it many job opportunities. In 2018, nationwide clean energy jobs grew 3.6%, to 3.3 million individuals employed in fields such as solar, energy efficiency, electric vehicles and battery storage. In fact, clean energy jobs outnumbered those in fossil fuel industries by 3 to 1 in 2018.[127] Strategies in this chapter include encouraging and incentivizing the growth and development of sustainable energy research, development, and manufacturing in Lincoln. This includes wind, solar, geothermal, biomass, battery storage and others. Partnering with new research developments coming from the University of Nebraska-Lincoln (UNL) in the food, agriculture, water and energy sectors is a possibility rich with potential.

To create these kinds of jobs in Lincoln, it will take strategic, collaborative planning on the part of the public and private sectors. Would-be workers in this new economy need to be trained. Fortunately, Lincoln has excellent resources in the form of UNL, Southeast Community College, Doane University and Nebraska Wesleyan, and these institutions can create training programs to meet the needs of the future.

As the Climate Action Playbook puts it:

The energy efficiency sector is one of the fastest growing job markets in the country. Energy efficiency companies added 76,000 new jobs in 2018, accounting for over half of all new clean energy jobs. However, 73% of employers across the energy efficiency sector reported difficulty hiring qualified workers over the last 12 months. The leading issues for hiring were insufficient education, certifications, and hands-on training for technical skills.

> This gap in the supply-and-demand of qualified workers provides opportunity for cities to link their climate goals with economic and equity goals by creating or supporting pre-existing energy efficiency workforce development training programs and connecting them to available energy efficiency jobs. Workforce development training programs can help people receive the technical training, industry-recognized certification, work experience, and career readiness skills they need to succeed in the energy efficiency workforce, while also providing the energy efficiency industry with skilled workers.

Depending on the existing workforce development programs, cities can act as the creator, convener, funder, or promoter of programs. To ensure the workforce development program will meet the needs of the energy efficiency industry and provide workers (especially from underserved communities) with support services and career pathways, cities must engage and partner with utilities, labor unions, community-based organizations, and other local stakeholders in the design and implementation process."[128]

Encouraging and supporting the growth of local businesses can help to create a stronger, localized economy that creates jobs, retains local dollars and improves social cohesion and quality of life. Local entrepreneurs should be supported in starting and growing businesses of all kinds in Lincoln. One example, as the Build a Resilient Local Foods section in this plan articulates, is the potential for Lincoln to grow its local agricultural economy, including farms, markets, food trucks, cafés and restaurants.

By embracing a vision of a climate-smart and equitable economy, Lincoln can substantially increase its resilience to the changing climate and ensure that it remains a thriving place to live, work and play for decades to come.

Strategies to Align Economic Development Goals with Climate Realities to Ensure a Thriving Economy

S = Short-Term (next 0-10 years); M = Medium-Term (next 10-20 years); L = Long-Term (next 20-30 years.)

'Crossover' strategies that appear in more than one Action Area are noted with the icon of the corresponding section.

Align economic development with the opportunities and risks of the future Lincoln climate.	**Phase**
Encourage and incentivize the growth and development of sustainable energy research, development, and manufacturing in Lincoln. This includes wind, solar, geothermal, biomass, battery storage and others.	**S**
Encourage local food culture in order to increase demand for local foods and products. 	**S**
Maintain Lincoln's AAA bond rating in part by disclosing annual greenhouse gas emissions and implementing an environmental management system.	**S**
Investigate and consider the use of climate resilience bonds to finance resilience-building projects including renovations and new construction. Resilience bonds are a novel insurance product that raises capital to be specifically earmarked for projects that increase resilience to climate change.	**M**
Create training programs at local colleges to prepare workers for climate-smart jobs.	
Create a task force of vocational, educational, business, union and community stakeholders to study and develop a climate-smart workforce development plan to ensure community efforts are focused on filling gaps in trainings and existing job opportunities to create viable pathways to good-paying jobs. The task force must include potential trainees from under-served populations so that the target audience has a key role in shaping policy.	**S**
Create or enhance programs to train solar and wind technicians, building energy efficiency technicians, electricians, sustainable food producers, EV technicians, biofuel developers and others.	**S**
Provide wrap around support services to training program participants (case management, training wage, child care, transportation stipend) to ensure that they are able to successfully complete programs.	**S**
Recruit low-wage earners for participation in job training programs.	**S**

Support the growth of local colleges and universities to strengthen their capacity to produce a climate-ready workforce.	
Establish a higher ed climate resilience task force comprised of representatives from local colleges and universities to meet regularly to align climate-related research goals, training programs, transportation programs, purchasing collectives, and more.	S
Promote Southeast Community College's Learn to Dream Scholarship that provides a tuition-free associate degree for low-income students.	S
Promote the community college's training solutions programing to ensure under-employed populations have access to affordable training opportunities.	S
Add climate-focused paths to the Career Academy for Lincoln's high-school juniors and seniors to earn up to 1-year of college credit toward a degree.	S
Continue progress in creating a seamless transition from Southeast Community College to a 4-year institutions through 2+2 arrangements.	S
Using a combination of public and private funding, invest in community college climate-smart programs including energy generation, automotive technology, diesel technology, construction, HVAC technology, welding, and many others.	S
Develop an undergraduate research institute at Southeast Community College that includes tracts focusing on climate resiliency.	S
Convert the Southeast Community College Lincoln Campus into a sustainable destination that includes community green spaces, healing and herb gardens, and other outdoor gathering areas.	S
Designate dedicated electric shuttles circulating between Southeast Community College and UNL. 	S
Create an International Student Center at Southeast Community College to recruit students into high-demand technical programs.	S
Create a "Technical Graduate" program by incentivizing enrollment in a community college technical program among students who already have a 4-year degree in a low demand field.	S
Promote legislation to incentivize public-private partnerships for construction of climate-smart academic facilities.	S

Support and incentivize climate-smart entrepreneurship.	
Develop an integrated sustainability research and entrepreneurship incubator for local businesses that is integrated across local educational institutions.	S
Bring investors, the workforce development task force (see above), Prosper Lincoln, LPS, college/university and other stakeholders together to strategize community needs and business opportunities.	S
Promote the expansion of Southeast Community College's Entrepreneurship Center to includes climate-smart businesses and services.	S
Create a social impact investment fund that will help support local climate-smart businesses.	S
Encourage the growth of agritourism in Lancaster County.	S
Create and incentivize employment and educational opportunities for seniors. (By 2050, the number of Nebraskans aged 65+ will more than double.In 2050, they will make up 15% of the population in Lancaster County. To ensure this population is financially resilient, Lincoln should look for ways to increase employment opportunities for this demographic.)	
Develop a task force to study and recommend strategies to increase employment opportunities for seniors. The task force would include educational institutions, large employers, AARP, Aging Partners, the City, seniors, and non-profit organizations.	S
Provide resources to employers regarding how to retain older workers. These can include offering flexible schedules, transportation, a variety of benefits, phased retirements, finding better and easier ways to get the job done, use training to increase engagement.	S
Educate employers on the value of older workers and reduce "ageism" in the hiring process and in the workplace.	S
Promote and expand continuing education opportunities provided through Southeast Community College and other educational entities.	S
Incentivize employer tuition-reimbursement programs for continuing education and credit courses for seniors.	S

Hold job fairs directed at the senior worker.	S
Make job counseling services available to seniors.	S
Provide training for older workers to meet job skills needs.	S
Improve protections from natural disasters for local businesses.	
Ensure that businesses located in floodplains are aware of their risks and options.	S
Work with businesses to identify and reduce risk, establish disaster plans and create business continuity plans	S
Explore the creation of a philanthropic fund to assist small businesses in recovering from natural disasters.	S
Ensure equitable economic development.	
Monitor and assess the growth and impact of automated jobs in Lincoln, particularly low-wage jobs, so that community leaders are aware of the risk of job loss and its associated impacts in the community. Target these workers for job training programs.	S
Create job to career incentives for vulnerable populations.	S
Incentivize migration into Lincoln.	
For any out-of-state student who has completed a two-year degree at a Nebraska college, grant in-state tuition status as an incentive to complete additional degrees.	S
Continue to work with the Nebraska Department of Transportation (NDOT), City of Omaha and other engaged parties to develop a commuter bus service between Lincoln and Omaha. Ensure this service uses emissions-free electric buses.	S
Strengthen partnership with Omaha to attract businesses to either city through collaborative sharing of resources, ideas, and infrastructure.	S
Create an “Onboard Center” that helps new residents integrate and thrive in Lincoln.	S

Improve Protections for Lincoln Residents

While this Climate Action Plan aims to help protect all residents of Lincoln from the harmful effects of climate change, specific attention must be focused on those who are most vulnerable to the projected impacts.

Photo courtesy of Collin Rasmussen and Lincoln Unites

Race and ethnicity, along with a variety of social, cultural, economic, and political factors combine and contribute to a person's vulnerability related to climate change. An individual, family, or community may "face double or multi-jeopardy due to the layered dynamics/characteristics within which they exist."[129] Understanding the interconnectedness of factors such as demographics, access and affordability of housing, food security, mobility, employment, health and health care, the City of Lincoln can better prevent and prepare for climate-related risks faced by the city's most vulnerable people.

Strategies in this section strive to achieve environmental justice, defined here, along with fair treatment, by the U.S. Environmental Protection Agency:[130]

"**Environmental justice (EJ)** is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies.

Fair treatment means no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies."During the recent global pandemic of COVID-19, the health disparities between residents of color and White residents in the U.S. became undeniably clear[131]. As of July 2020, in Lancaster County, 17.2% of individuals testing positive with COVID-19 have been Asian, while Asian residents comprise only 4% of the county's population. Likewise, Hispanic/Latinx residents represent 23.3% of positive cases, while these residents comprise 7.2% of Lancaster County's population.[132] Black and Indigenous residents have likewise been disproportionately impacted by COVID-19. Pandemics such as COVID-19 and critical issues such as addressing systemic racism highlight the urgent need for the City of Lincoln to take immediate steps toward continued inclusivity and transformative reimagination of public life to ensure the city is a welcoming and equitable place for all Lincolnites now and in the future."

Recommended actions and proposed policies here provide a solid foundation to begin intentional efforts on environmental justice. However, strategies in this plan are not a complete list of all the work the City of Lincoln can undertake to create a more equitable and inclusive city. This is a section of Lincoln's Climate Action Plan that will need to rapidly evolve and adapt as the city and its residents work together to heal past and current injustices.

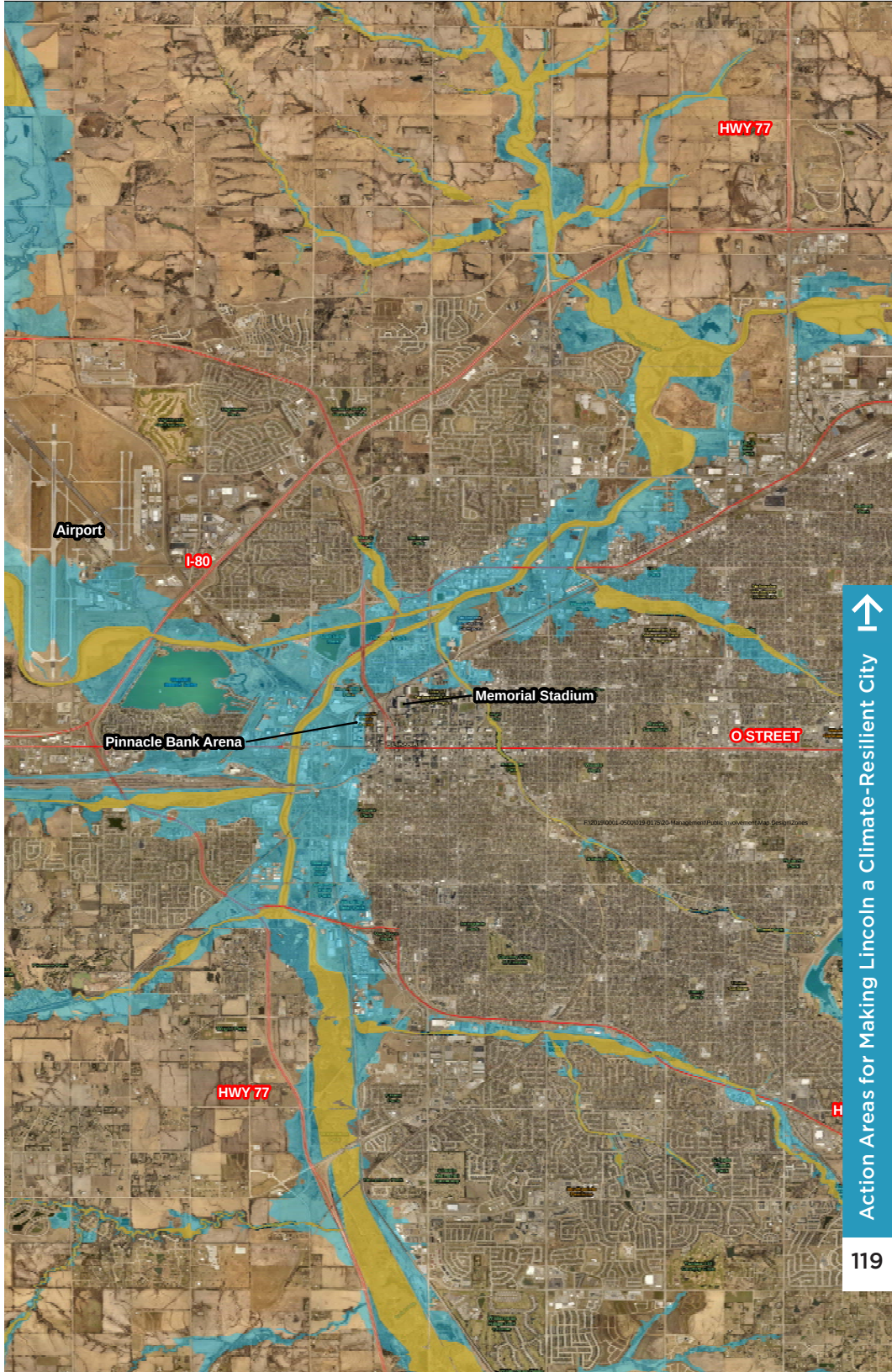
Sizeable segments of Lincoln and Lancaster County's populations are vulnerable to the impacts from flooding and heat-related illnesses. As described in the Vulnerable Populations section of the Climate-Related Vulnerabilities chapter of this plan, 10% of Lincoln households include adults 65 years or older living alone and 7% of Lincoln's population are under 5 years old. Youth and the elderly living alone, along with people who do not speak English, people who work or live outdoors, are some of the most vulnerable groups when it comes to extreme heat events.

As of 2017, approximately 23% of Lancaster County's population lives within the floodplain.[133] This floodplain is defined by the most recent National Flood Insurance Maps from the Federal Emergency Management Agency (FEMA). Lincoln-Lancaster County Emergency Management classifies 14 dams as "High Hazard Dams" in the 2017 Local Emergency Operations Plan. If at least one of these dams were to fail, around 30% of Lancaster County's residents could be affected. In the city of Lincoln, nearly 6,000 people are vulnerable to the negative impacts of flooding. Additional risk for people living in Lincoln's floodplain comes from economic vulnerability. One of the city's GIS maps overlays demographic data with the floodplain. Based on this map which

includes data from 2013-2017, Lincoln's floodplain includes areas of the city where 25-50% of the residents are living below the poverty line (north of O Street and west of 17th Street) and areas where 50-59% of residents are living below the poverty line (north of O Street and west of 9th Street). According to the 2020 Olsson study described in the Climate-Related Risks chapter of this plan, a scenario in which the levees along Salt Creek are over-topped or breached is possible, which would cause dangerous flooding in nearby neighborhoods. One strategy to address this threat is to implement a voluntary buy-out program for residents living in the floodplain, which could be paired with a program that constructs sustainable, affordable housing outside the floodplain and gives priority to those residents.

Reducing the severity of climate change is ultimately the best strategy for reducing flood risk. According to the 2020 *Salt Creek Floodplain Resiliency Study:* "If society takes significant actions to reduce greenhouse gas emissions in the next 20 years, precipitation patterns in the Salt Creek watershed are NOT expected to change much by the year 2100."[134] Therefore, the most proactive and high-level flood risk mitigation efforts the City can pursue are strategies that mitigate climate change itself and reduce greenhouse gas emissions. At the same, the City of Lincoln must take immediate steps to implement non-structural strategies that will mitigate the potentially devastating impacts of flooding.

The most proactive and high-level flood risk mitigation efforts the City can pursue are strategies that mitigate climate change itself and reduce greenhouse gas emissions.



Having access to a second water source is another key priority for the City. Lincoln Water System (LWS) is already deeply engaged in the proactive management of the city's water supply and has incorporated recent climate change data into their planning models used to identify needs for a second water source. A second source may be needed earlier than projected, given that warming temperatures and extreme heat may increase current demand on Lincoln's water supply and future flooding events could harm infrastructure, as occurred in 2019. It will be essential for the City to prioritize planning for the securing of a second water source as soon as possible.

Research has shown that community connectedness and cohesion (social capital and trust), more so than physical or financial resources, predict a community's resilience to disasters. For example, a low income, immigrant Vietnamese neighborhood in New Orleans impacted by severe flooding after Hurricane Katrina was able to recover much more quickly and efficiently than higher income, less damaged neighborhoods based on the Vietnamese neighborhood's social connections.[135] Strong individual and community connections can help provide life-saving access to resources such as immediate physical assistance and rescue, food, information, financial resources, child care and general emotional support. As the City of Lincoln prepares for the effects of climate change, identifying and implementing strategies that cultivate social and emotional connectedness among all residents is vital to the city's ability to adapt and persevere through future disruptions.

One strategy to foster community cohesion that the City of Lincoln could implement is inspired by the NeighborLNK program begun during the recent COVID-19 crisis. The NeighborLNK program was "designed to facilitate personal connections by directly linking volunteers with seniors (age 60 and over) or persons with disabilities who are homebound and

seeking additional support" during the pandemic.[136] Volunteers in the program helped not only with immediate needs, such as delivering groceries and medication, but also provided regular phone calls and friendly connection to vulnerable individuals. This program could be expanded to exist beyond the COVID-19 pandemic as a way to strengthen bonds between neighbors and improve Lincoln's resilience by increasing its social capital.

Strategies in this section will contribute to a safer, healthier, and better connected city for all residents. Careful planning and consideration for vulnerable populations will ensure individuals of all ages, income levels, races and ethnicities, abilities, and location of residence in Lincoln will thrive.

Strategies to Improve Protections for and with Lincoln Residents

S = Short-Term (next 0-10 years); M = Medium-Term (next 10-20 years); L = Long-Term (next 20-30 years.)

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Support the planning efforts of Lincoln Water Supply (LWS) in maintaing a safe and secure water supply. Prioritize the procurement of a second water source for Lincoln.	**Phase**
Utilize the Water Supply Task Force of city staff to explore, assess and recommend (by 2021) a strategy to procure a second water source. Task Force should analyze scenarios for different year horizons and the requisite funding in situations where a second water source would be needed earlier than currently planned.	**S**
Proactively manage flood risk through non-structural efforts.	
Implement cluster subdivision regulations to protect flood-prone areas by grouping new development in less-sensitive areas within a subdivision.	**S**
Use overlay zoning to implement higher standards for floodplain management in flood-prone areas.	**S**
In partnership with affected neighborhoods, consider the creation of a voluntary buyout program where property owners in flood-prone areas could sell their property on a voluntary basis. Partner with the Lower Platte South Natural Resources District in ways that leverage federal funds to fund the project.	**S**
Create a companion program that gives preference to these residents in moving into sustainably-built affordable housing outside of the floodplain.	
Restrict development in flood-prone hazard zones along creeks and rivers with setback regulations that extend beyond the minimum floodplain corridor and that also preserve riparian habitat.	**S**
Consider making low-impact development (LID) regulations mandatory to reduce water runoff and improve water quality in development and redevelopment projects.	**S**
Implement higher floodplain management standards. Increase regulatory standards for freeboard (the amount of space needed to raise a building above projected floodwater elevation level); restrict the development of of critical infrastructure like schools, hospitals, emergency and communication infrastructure within flood-prone areas	**S**

Together with the Lincoln-Lancaster County Emergency Management Office, the city Urban Development Department, city Stormwater management experts and neighborhood leaders, develop a comprehensive Salt Creek levee breach and overtop scenario analysis and communications plan to affected residents. 	**S**
Continue to require air conditioners and heat pumps to be installed at high enough levels so as to avoid floodwaters in homes and apartment buildings in the floodplain for new construction, existing buildings and retrofits.	**S**
Consider a voluntary, incentives-based policy to infill basements at risk of flooding in the floodplain.	**M**
Amend the requirements of the Drainage Criteria Manual to account for proper management of projected stormwater runoff based on climate projections (currently in-progress).	**S**
Prepare and make publicly available an updated floodplain map for Lincoln that reflects increased precipitation and streamflow projections.	**M**
Continue and enhance current outreach and education efforts with landowners and business owners located in the revised flooplain about their flood risk.	**S**
Develop a comprehensive outreach and education strategy with residents in the revised flooplain about their flood risk.	**S**
Preserve floodplain as open spaces and evaluate which floodplain lands should be preserved as recreation spaces in light of climate change projections.	**M**
Codify the use of green infrastructure design principles in new development projects. Section 502 of the Clean Water Act defines green infrastructure as "...the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters."	**S**
Proactively manage flood risk through structural efforts.	
Continue implementing green infrastructure strategies such as rain gardens, bioswales and permeable pavement to reduce stormwater runoff.	**S**
Expand guidance/resources, incentives and implementation.	**S**
Invest in appropriate equipment to manage permeable pavement. Equipment may be purchased and used in a shared capacity between departments.	**S**

Integrate most recent climate change data and associated risks into emergency management plans.	
As floodplain maps are updated based on the most recent climate change data, identify specific vulnerabilities related to Salt Creek levees and include prevention, protection, mitigation, response and recovery strategies in the Lancaster County Local Emergency Operations Plan (LEOP), the county's Hazard Mitigation Plan, and the Lower Platte South's Hazard Mitigation Plan.	S
Incorporate climate change projections related to extreme temperature events in the planning process for the Lincoln Emergency Operations Plan (LEOP), the county's Hazard Mitigation Plan, and the Lower Platte South's Hazard Mitigation Plan.	S
Evaluate the necessity of including a specific heat response plan in the Lincoln Emergency Operations Plan (LEOP).	S
Ensure vulnerable populations are prioritized in emergency management plans.	S
Develop and implement processes that invite vulnerable people to a participatory-decision making process that results in better care for groups such as non-English speaking people, residents living in poverty, and elderly residents.	S
Include enhanced provisions in caring for non-English speaking people, residents living in poverty and elderly residents (in-progress through the June 2020 update of the Hazard Mitigation Plan).	S
Provide outreach and education for Low Income Home Energy Assistance Program (LIHEAP).	S
As needed, based on climate projections, consider expanding cooling centers on extreme heat/cold days to spaces additional to city/village rec centers.	M
Continue to adapt the "MyLNK" app to best communicate emergency management situations and updates to residents and visitors.	S
Continue and adapt the NeighborLNK program beyond the COVID-19 pandemic to cultivate social cohesion throughout the city.	S
Enhance public health plans to respond to specific climate-related health risks.	
As climate change increases the risk of vector-borne illnesses, continue disease-outbreak (human, plant, animal, agricultural) management planning.	S

Assess the heat index of pavements in communities throughout the city, beginning with communities of color. Create and share data via a publicly accessible website.	S
Develop and implement strategies to reduce the effects of excess heat and associated health risks due to excess pavement.	S
Consider developing a public health heat response plan following guidance from CDC.	S
Consider developing a Workplace Heat Alert Program (WHAP): Follow guidance from National Institute for Occupational Safety and Health (NIOSH), which describes a process for making indoor and outdoor work environments safer for employees during extreme heat events.	S
Coordinate with local National Weather Service & meteorologists, to provide heat index health warnings, etc. Heat wave early warning systems can protect people by communicating heat wave risks and suggesting protective actions.	S
Expand disease reporting system and integrate with animal disease reporting systems to monitor zoonosis, vectorborne illness, animal illness, and potential vectors of concern.	S
Consider developing a tick surveillance program in collaboration with the Nebraska Department of Health and Human Services and UNL.	S
Enhance current mosquito surveillance programs to be prepared for new mosquito-borne illnesses; update the Public Health Mosquito Action Plan and expand to other vectors, such as ticks.	S
Educate and enage residents on Air Quality Index (AQI).	S
Enhance air monitoring system to include additional real time monitors for PM2.5 in multiple areas of city and county.	S
Develop capacity to forecast AQI.	S
Enhance public notification systems using social media (Twitter, Facebook).	S
Enhance public outreach to prevent drowning from major rain and flooding events.	S
Develop standard public health informational package for residential and business properties impacted by flood waters that addresses mold, reuse of materials and furnishings, proper clean up and disinfection, etc.	S

Educate childcare providers on heat related health issues for young children.	S
Ensure safe, affordable and sustainable housing for Lincoln residents.	
Encourage the development of quality, affordable mixed-use neighborhoods.	S
Provide more strategies for allowing Accessory Dwelling Units (ADUs, including "in-law units" and “tiny houses”) that are well-designed and appropriately placed on existing private lots. These strategies can allow multi-generational living situations, increase the financial resilience of Lincoln residents, and facilitate more efficient public transportation.	S
Incorporate conservation design principles into subdivision ordinances and in Comp Plan to reduce heat island effect, increase shade, protect habitat, slow stormwater runoff and improve mental health.	S
Incorporate equitable design principles, such as those found in the WELL Building Standard or the International Living Future Institute's Living Building Challenge framework, for all new construction and major renovation projects to ensure safe and inclusive spaces for all Lincoln residents. Equitable design principles include a variety of aspects, some of which include making outdoor spaces accessible to all residents regardless of age, ability, housing status, and other socio-economic factors; and protecting access to fresh air and sunlight.	S
Evaluate the City's procurement processes and identify opportunities to prioritize women and Wminority-owned businesses.	S
Assess tree canopy coverage in low-income neighborhoods and prioritize tree-plantings in these neighborhoods. Trees reduce heat island effect, reduce utility bills and increase property values.	S
Expand community partnerships between LES, Community Action Partnership and other social service agencies to provide funding and services to increase insulation in multifamily housing, with priority given to most vulnerable populations.	S
Improve flood protections for homes and businesses.	
Continue working with Lower Platte South Natural Resources District to identify and implement flood risk mitigation strategies (structural and non-structural) in Salt Creek watershed.	S
Maintain the Community Rating System (CRS) rating that allows for a 25% reduction in flood insurance premiums for property owners in floodplains.	S

Build a Resilient Local Food System

One of the more striking facts that arose from the planning process was that our community food retailers only keep a three-day supply of product in their stores.

Photo courtesy of Sunday Farmers Market

A sudden crisis that prevented food from coming into the city would present challenges that would have to be addressed in an extremely short time frame.[137] Reliance on a national and global food supply system puts the residents of Lincoln at risk during a potential future disruption caused by climate change. Additional risk related to food security comes from the local agricultural landscape: In Lancaster County, the vast majority of cropland is dedicated to corn and soybeans--products that are not readily available for human consumption--and only a small percentage of farms (8%) sells directly to consumers.[138] Currently, the market for agricultural producers to grow and sell local food is small. Promoting local food is one area of impact the City of Lincoln can make to strengthen the local economy, increase local food security, and reduce greenhouse gas emissions related to industrialized and globalized agriculture.

Although there are significant economic and political forces that have shaped U.S. agriculture into monocultures of corn and soybeans, agriculture in Lancaster County has strong potential for creating a more resilient local food system. For example, according to the U.S. Department of Agriculture's 2017 census, 95% of farms in Lancaster county are family-owned and 55% of all farms in the county are less than 50 acres in size. Smaller, family-owned farms may be more adaptable to change and willing to participate in local food production and markets given the right incentives. Some changes are already happening in the state: The number of produce growers in Nebraska has increased 700% over the past decade, from 78 growers in 2000 to more than 600 growers in recent years. Additionally, Nebraska has approximately 100 farmers' markets, 240 roadside stands and 40 "u-pick" operations.[139] Another more local strength is the existence of groups such as Lincoln-Lancaster County Food Policy Council and Community Crops. The Food Policy Council develops "policies that promote a healthy and sustainable local food system" and focuses on policy areas related to food security, production, processing, distribution, and markets.[140] Community Crops provides education and advocacy for the Lincoln community, as well as community gardens, a training farm, and a production greenhouse.[141] The City's Parks & Recreation Department also provides local food resources with the creation and maintenance of community gardens and pollinator gardens. Prioritizing native, edible, and perennial species in these spaces would enhance the resilience impact of the Department's current work.

Overall, strategies in this chapter provide guidance for public and private entities to take a leadership role in promoting and supporting a more robust local food culture and marketplace. One exciting idea is the creation of a thriving, year-round indoor local foods market, or public market, as such places are known in other cities. This enterprise could be housed in a large, centrally-located building and contain stalls for local growers and producers to sell vegetables, fruits, dairy items, meats, wine, beer, spirits, honey, jams, prepared foods, coffee, baked goods and much more. The market could include micro-cafés from local restaurants and open seating areas. Other vendors could include artisans and local businesses. Local musicians could play at certain times. Friends could meet for lunch, shoppers could purchase produce, workers could pick up coffee, kids could play and community events could be held in common and/or adjoining spaces. The market could also function as a cooling center for residents on extreme hot days.

The City and its partners could increase demand for local foods with an "Eat Local" campaign, and a recognition program for restaurants that use locally-sourced ingredients and products. By incentivizing large institutions like schools and hospitals to commit to purchasing ingredients and products from local food producers, the City could secure a reliable demand for local food producers, which in turn would allow them to expand.

A vibrant local food culture makes for a more interesting, more connected city that is more appealing to visitors and potential workers from outside the area. At the same time, it builds climate resilience, addresses food deserts, encourages more healthy lifestyles and provides economic development. The strategies in this chapter will help the city of Lincoln become an innovative hub for local, resilient food and healthy, food-secure residents.

Strategies to Build a Resilient Local Food System

S = Short-Term (next 0-10 years); M = Medium-Term (next 10-20 years); L = Long-Term (next 20-30 years.)

'Crossover' strategies that appear in more than one Action Area are noted with the icon of the corresponding section.

Promote local food production.	Phase
Support local food initiatives through engagement and assistance, including support for the efforts of the Lincoln-Lancaster County Food Policy Council (LLFPC) and other organizational efforts to: • Increase the quality and quantity of community gardens and orchards. • Develop enhanced food production and marketing strategies that expand local farming, such as updating regulations and implementing policies that incentivize purchasing of local foods. • Expand and enhance pollinator habitat in natural areas and within residential areas.	S
Facilitate community conversations with appropriate stakeholders (ex., UNL Extension, Lincoln-Lancaster County Food Policy Council, Community Crops) to develop and expand educational programs for regenerative agriculture and beginning farmers.	S
Coordinate activities, events and materials that promote local food production in collaboration with partners such as UNL's Ag Econ Department and the Buy Fresh Buy Local program.	S
Develop licensing, permitting and other food safety regulations that support local, small-scale food producers.	S
Support and coordinate the formation of cooperatives for local food producers to overcome costs associated with processing, storage and packaging regulations and needs (e.g., equipment, rental fees).	S
Explore public and private partnerships that encourage cooperatives or other frameworks of social and economic support for local producers.	S
Consider collaboration with local health insurance companies to provide health insurance plans affordable for local producers. Increased participation with production within family units is limited in part by access to affordable, quality health care.	M

Support and incentivize the growth of the local foods marketplace.	
Support the growth of local farmer's markets.	S
Support and incentivize the creation of a year-round, indoor public market that could include stalls for local growers, local restaurants and cafes, merchants, artisans, and event and community spaces.	S
Encourage local food culture so as to increase demand for local foods and products. 	S
Create city-wide programs such as an "Eat Local" campaign and/or recognition program for restaurants that use locally-sourced ingredients/products.	S
Incentivize large, local institutions (e.g., businesses, schools and higher education institutions, hospitals) to commit to purchasing ingredients and products from local food producers. Securing a reliable supply for local food producers will help stabilize their current production, encourage increased production and attract new producers to the market.	S
Increase urban agriculture opportunities.	
Continue to support the Parks and Recreation Department in the creation of community gardens and pollinator gardens on park land. Prioritize the planting of native and prairie species in these spaces.	S
Identify funding sources and grant opportunities to create a program to encourage homeowners to convert a portion of their lawns to growing food and/or developing and maintaining pollinator gardens.	M
Create ways to incentivize small-scale and diverse food production in Lancaster County.	S
Develop an ordinance that incentivizes new development and major renovation to dedicate a portion of roof space as a green roof. The portion of dedicated green space shall increase as the building's gross square footage increases. 	S
Support a state-level property tax abatement program that incentivizes the development of green roofs on existing buildings.	M
Collaborate with LES and local food producers to develop a program that allows on-site solar arrays for less productive, agricultural land. Installation of solar arrays can help off-set costs from underperforming plots of land while also contributing to a cleaner energy landscape. 	M

Maximize Natural Climate Solutions

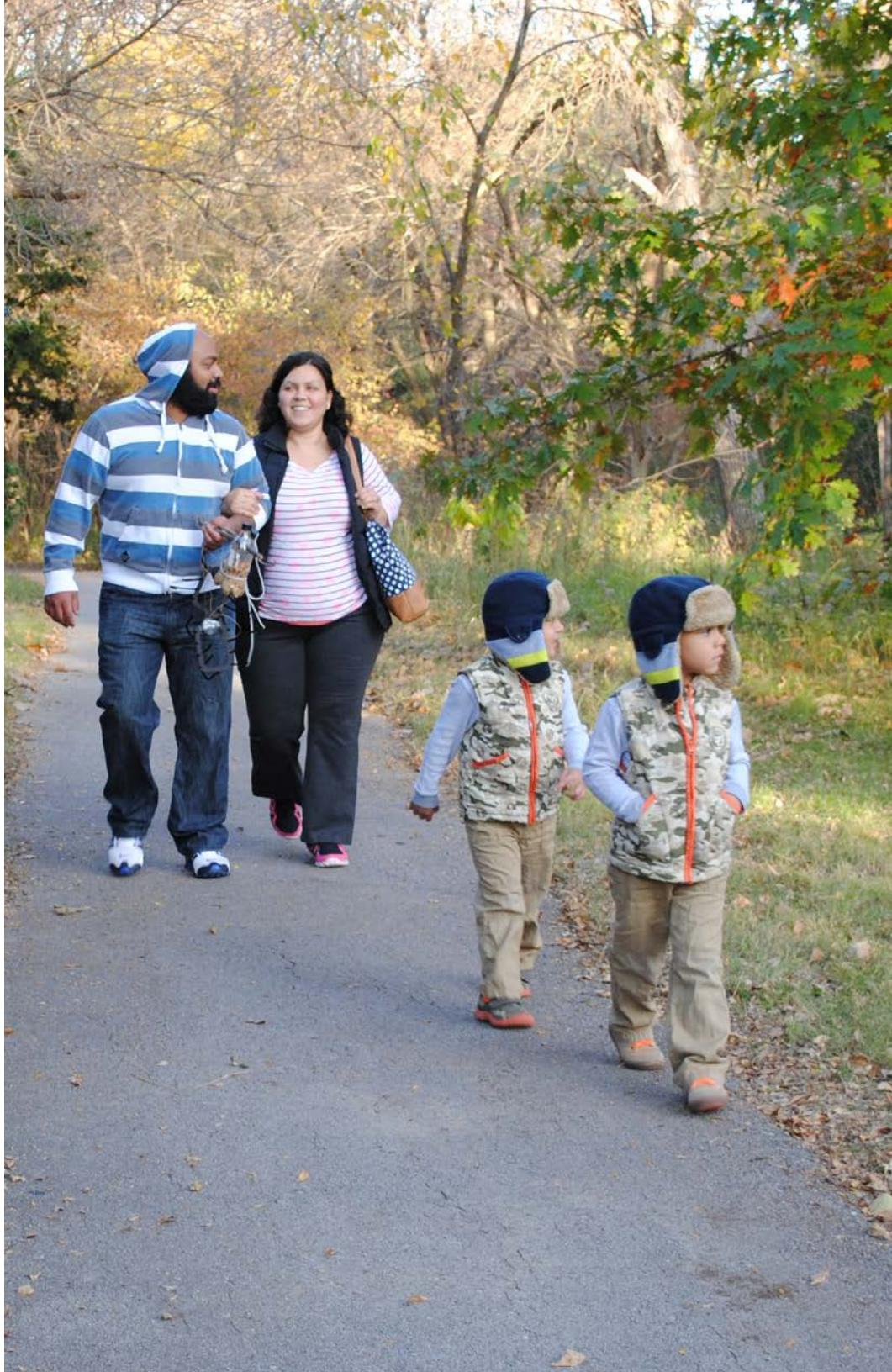
Plants and trees help us mitigate damage from flooding, provide clean air, and filter water. These are some examples of ecosystem services we receive from nature.

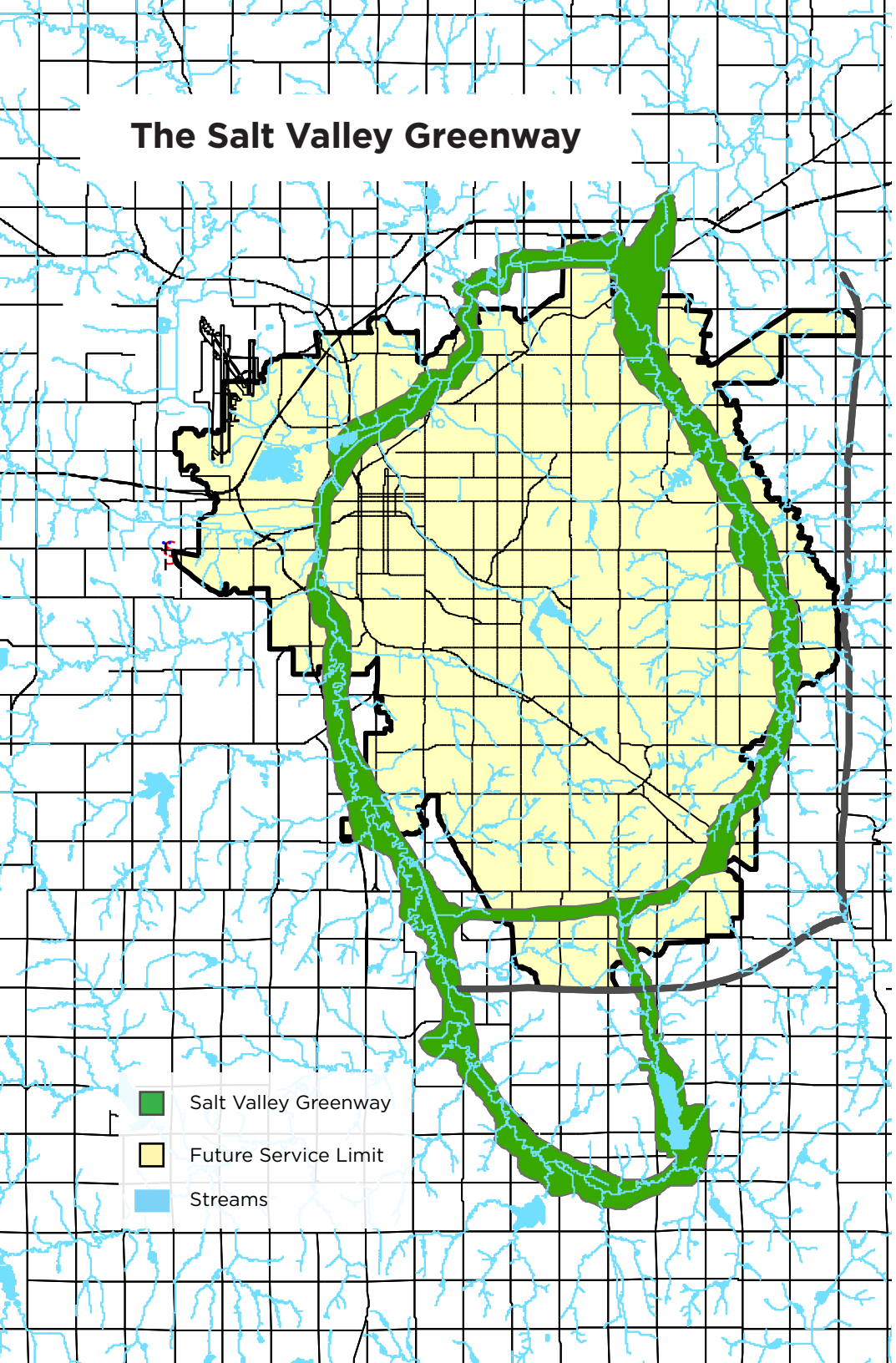
Photo courtesy of Lincoln Parks and Recreation

Conserving natural resources also allows us to reap recreational and educational benefits. By protecting our natural resources, we also protect ourselves from the effects of climate change.

This chapter includes strategies for natural climate solutions such as sequestering carbon, planting native species, increasing the city's tree canopy, and conserving water. Natural carbon sequestration by forests, grasslands, and farms has historically captured approximately 25% of U.S. carbon emissions.[142] The large carbon capture potential of agricultural land is beginning to make economic sense for the industry. In the fall of 2019, a consortium of major agribusinesses and conservation groups announced a goal of having a carbon sequestration marketplace up and running by 2022 with funds of over $20 million to pay ranchers and farmers for sequestering carbon and enhancing other ecosystem services on their land.[143] To meet the City's goal of an 80% net reduction in emissions by 2050, Lincoln should look to similar programs and develop a municipal Carbon Sequestration Plan.

Lincoln's parks and greenways already have a significant number of native plantings. Planting native species is important because local species, such as birds, have co-evolved with local plants for survival. Many species available in nurseries are from outside the U.S. and provide mainly aesthetic value . Additional concern regarding non-native species comes from the fact that natural predators that would consume these plants in their own native environment are not present in Lincoln, nor are the diseases that usually keep their populations in check. Without these predators and diseases, non-native plants can become invasive and take over local landscapes. Expanding native plantings in the city's greenspaces will continue to help increase biodiversity and survival of insect, pollinator, plant and bird species.





Connectivity of restored habitat is particularly important for the movement of plants and animals, and maintenance of healthy populations. Isolation of habitat without the ability to move between habitat patches affects not only individual species, but can also negatively impact the biodiversity of an entire ecosystem. The City and County's long-standing plan for the Salt Valley Greenway and connecting corridors will continue to connect habitat based upon the natural drainageways, protecting floodplains and connecting human communities in addition to flora and fauna.

Lincoln's Comprehensive Plan envisions the creation of an interconnected network of greenspaces encircling the city as pictured on the left. Known as the Salt Valley Greenway, the loop would be created over time through conservation easements and the acquisition of selected sites with unique environmental features or recreational opportunities. The Greenway would include parks and open space, trails, recreation spaces, stream corridors, floodplains, threatened and endangered species habitat, saline and freshwater wetlands, agricultural land, signature landscapes, wildlife corridors, lakes and streams, abandoned rail lines, and transportation corridors.

Resilience to heat and drought are also benefits of native plants, which have adapted to local climates better than non-native ornamental species. One way to expand native plantings is to require native prairie plantings at locations such as detention ponds and runoff areas. The City could also create a recognition program for homeowners who landscape their yards with native plants. Consideration should also be given to the removal of particularly problematic non-native species, such as smooth brome and Reeds canary grass, from the City's standard grass seed mixes. These non-native grasses can be particularly invasive in native prairie and wetlands. Homeowners help their bottom line and the environment when choosing native plants. Benefits of planting a yard with native species instead of turf grass include less time and money spent on watering and mowing. The Audubon Society estimates that millions of people living in the U.S. mow the equivalent acreage as eight times the size of New Jersey each growing season.[144] Not having to mow as often reduces the usage of gasoline and the associated emissions. Less mowing also means less noise pollution, creating a more comfortable environment for people and animals. Fertilizer and pesticide usage also decreases and can potentially be eliminated when planting with native species because local species are often more resilient to the local climate than exotic, ornamental species. Incentivizing a city landscape filled with native plants, Lincoln can help create a blanket of connected, restored patches of habitat that protects local species, saves water, reduces emissions, and helps sequester carbon.

City programs such as 2 for Trees, through which residents have the option to pay a little extra on their water bill so the City can replace public trees, demonstrate Lincoln's current commitment to increasing the number of and protection for its trees. Lincoln's Parks & Recreation Department has a goal to replace threatened and diseased Ash trees at a rate of one-to-one to help the city's tree canopy recover from the devastating impacts from the Emerald Ash Borer, a pest which is projected to infect all the city's Ash trees over the next decade. The Parks & Recreation Department's ability to meet this goal is limited by funding. City funding and innovative public-private funding programs should be created to help ensure the one-to-one replacement goal. Trees provide residents with natural beauty and shade, habitat for local birds and small mammals, reduction in stormwater runoff and their roots help stabilize soil, preventing erosion. Building on the City's commitment to healthy trees, Lincoln can follow recommendations of the Community Forestry Advisory Board (CFAB) that a single tree genus should not comprise over 10% of the street tree population. In addition to biodiversity strategies that help the City's natural landscape become more resilient, Lincoln could implement ordinances that not only protect existing trees but also requires developers to plant trees to cover a specified percentage of the land area. Requirements like this can help ensure trees are planted in all areas of the City, especially in neighborhoods with excessive heat burdens created from lack of shade and large amounts of pavement.

Residents and City officials have demonstrated commendable willingness and ability to conserve water in times of drought and flooding. The City's "Rainscaping Lincoln" cost share program provides funding for residents to implement landscaping projects that improve water quality and reduce demand, reduce runoff and facilitate infiltration. Continuing Rainscaping Lincoln and other existing projects, as well as creating new programs and goals, will help the city reduce water demand in a present and future where conservation will be necessary. One new initiative the City could pursue is setting a community-wide usage goal of 110 gallons of water per day per person or less. Residents have demonstrated successful participation in conservation efforts previously and with supportive information,

outreach, and incentives, Lincolnites could come together to help conserve water in the city.

All strategies and the success of water conservation efforts would greatly benefit from the creation of a Water Conservation Working Group. This group, consisting of City employees and representatives from the Mayor's Environmental Task Force, UNL Extension professionals, and other water and irrigation professionals, would research and develop recommendations for the city to achieve the greatest possible reduction in water usage during seasons of peak demand. A new Water Conservation Group, continued dedication and expansion of native plantings, increasing the number of trees, enhancing how trees are protected, and developing a Carbon Sequestration Plan are all ways Lincoln can harness natural solutions to climate change.

Photo courtesy of Lincoln Parks and Recreation

Strategies to Maximize Natural Climate Solutions

S = Short-Term (next 0-10 years); M = Medium-Term (next 10-20 years); L = Long-Term (next 20-30 years.)

'Crossover' strategies that appear in more than one Action Area are noted with the icon of the corresponding section.

Continue to preserve and increase ecosystem services from core natural resources.	Phase
Continue strategies in the Lincoln-Lancaster County [2050] Comprehensive Plan that: • Mitigate damage from flooding, protect water quality, conserve habitat and provide recreational and educational benefits. • Enhance connectivity of habitat, such as conserving land/habitat with easements and land purchases.	S
Increase public-private initiatives in securing additional donated funds for purchase of trees and organizing volunteer projects for planting and care of young trees.	S
Enhance efforts to promote participation in the 2 for Trees water bill program that provides funding to replace street trees.	M
Continue native prairie plantings.	S
Review City seeding specs for seeding mixtures used for waterways and floodplains and remove invasive and aggressive non-native species from City specs.	S
Expand native prairie plantings through strategies such as requiring the addition of native prairie plantings to detention ponds and runoff areas.	L
Expand native plantings in Lincoln's parks and greenways to increase insect, pollinator, plant and bird biodiversity and create resilience to heat and drought.	S
Create educational content for and conduct outreach with homeowner associations about how to use native plants and prairie in landscaping.	S
Amend the weed abatement policy to allow for native plants to be grown on private property with less restrictive height guidelines.	S

Increase number of and protections for trees.	M
Assess baseline tree canopy using guidance from the USDA Forest Service's Urban Natural Resources Stewardship research program on urban tree canopy assessment.	S
Explore policies and ordinances that protect existing, high quality trees and require new residential and commercial developers to dedicate a specified percentage of the land area to trees and/or prairie.	M
Evaluate options to increase funding for city's urban forest, street tree, Emerald Ash Borer recovery, and other tree-related planting and maintenance programs.	M
Create a recognition program for homeowners who landscape their yards with native plants, increasing insect, pollinator, plant and bird biodiversity and creating resilience to heat and drought.	S
Continue to replace threatened and diseased Ash trees on a 1:1 basis as per the City of Lincoln Emerald Ash Borer Response and Recovery Plan.	S
Ensure adequate funds are budgeted to complete the replacement program.	S
Continue to track and report the number of public ash trees removed annually and the number of new public trees planted to replace removed ash trees annually.	S
Increase Community Forestry resources to meet Community Forestry Advisory Board's recommended replacement goal of 1:1.	M
Reduce pruning cycle of street strees from 25+ years to under 10 years.	S
Continue to provide vouchers to neighbors near removed trees to purchase replacement trees.	S
Assess tree canopy coverage in low-income neighborhoods and prioritize tree-plantings in these neighborhoods. Trees reduce heat island effect, reduce utility bills and increase property values.	S
Contract with tree-provider to assist with tree replacement in neighborhoods with low owner-occupancy rates.	M
Update, clarify and enforce community forestry policies to provide clear direction to developers, residents and City staff.	S

Increase street tree species diversity.	
Expand the capacity of the Parks and Recreation Department and/or the Lincoln Parks Foundation to increase public-private partnerships. Funding and donated labor from these partnerships will increase the amount of trees planted on public lands and increase the quality of care for young and mature trees.	**S**
Follow recommendations of the Community Forestry Advisory Board (CFAB) that one tree genus will not represent more than 10% of the street tree population.	**S**
Require preliminary plat applications include a list of intended street trees for subdivisions to monitor the types of trees being planted.	**S**
Continue to monitor emerging pests and diseases that may have implications on Community Forestry.	**S**
Identify and implement policies, programs and projects that sequester carbon naturally.	
Create a Carbon Sequestration Plan. This plan would involve an analysis of Lincoln's tree canopy, parks and greenways, open lands, composting activity, open water areas, impervious surfaces, grasslands, native prairie and would establish baselines for Lincoln's urban heat island effect and its carbon sequestration activity. The plan would recommend strategies to increase the amount of carbon sequestered in city limits. These strategies would help to meet the City's goal of an 80% net reduction in emissions by 2050.	**S**
Conserve water.	
Appoint a Water Conservation Working Group consisting of LWS and Watershed representatives, METF Water Subcommittee members/other community representatives, UNL Extension office and local lawn irrigation professionals who would be charged with developing recommendations and a budget for a program to incentivize water conservation that would resemble the Sustainable Energy Program administered by LES to promote energy efficiency. The working group should analyze and recommend the best set of incentives that could produce the greatest reductions in peak demand.	**S**
Implement the recommendations of the Water Conservation Working Group.	**S**

Create incentives for residents and businesses to purchase rain sensors (for existing systems not currently required to be equipped with rain sensors) and/or soil moisture sensors (all customers). Section 24.12.612 of the Lincoln Municipal Code requires all new underground irrigation systems to be equipped with a rain sensor. This incentive would apply to existing systems.	**S**
Continue the "Rainscaping Lincoln" program that provides a cost share for landscaping projects that improve water quality, reduce runoff and facilitate infiltration.	**S**
Meet a community water usage goal of 110 gallons of water per day per person or less.	**M**
Continue implementing and enforcing building codes that require water efficiency standards.	**S**
Increase efforts to repair leaks in city-wide water system.	**M**
Maintain Lincoln's rating in the National Flood Insurance Program Community Rating System that allows for a 25% reduction in flood insurance premiums for property owners in floodplains. 	**S**
Reduce irrigation needs by incentivizing conservation practices and native planting.	**S**
Encourage conversion of lawns to native grasses, vegetable gardens, and/or drought-tolerant landscaping. 	**S**
Create an ordinance that requires new developments to submit a Landscape Design plan that will include native and drought-tolerant plantings, limited use of turf grass, rain gardens, bioswales, infiltration beds and constructed wetlands.	**S**
Continue implementing and enforcing building codes that require water efficiency standards.	**S**
Adopt high efficiency water use codes such as EPA WaterSense New Single Family Homes Specification or the International Green Construction Code (IgCC) for new construction and renovation in the residential and commercial sectors.	**S**

Reduce Waste

Proper waste management ensures the protection of our natural resources such as water, land and air.

Photo courtesy of Green Quest Recycling

Reducing the amount of waste sent to landfills also has a significant impact on greenhouse gas emissions. For example, people living in the U.S. recycled and composted 94 million tons of municipal solid waste (the trash we throw away at home and at work) in 2017, which saved 184 million metric tons of carbon dioxide (MMTCO2e) from going into the atmosphere.[145] This savings is about the same as removing over 39 million cars from the road in one year. By following the waste management hierarchy of reducing, reusing, recycling and composting, and moving towards a more circular economy, we as individuals and as a city help keep our people and our environment healthy and resilient.

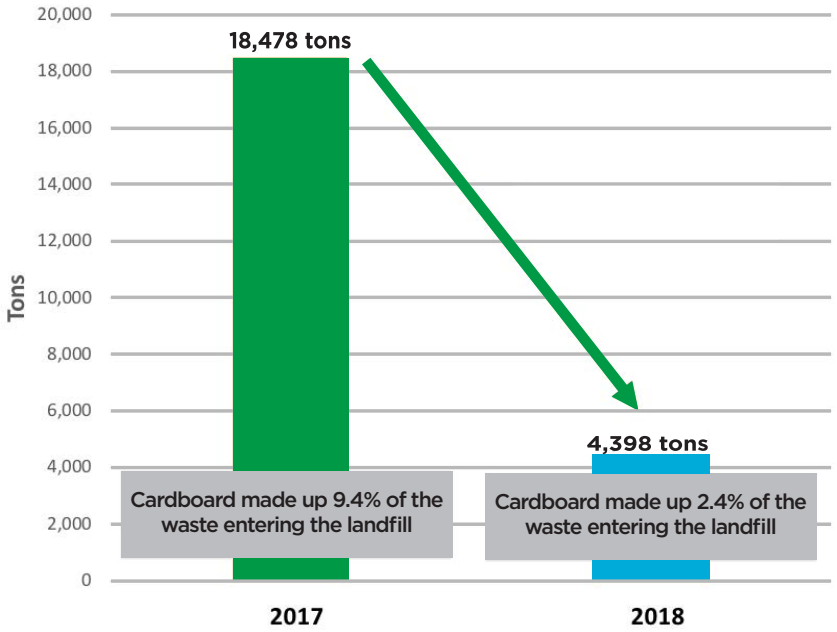
Lincoln has recently taken ambitious steps to reduce the amount of waste sent to the city's Bluff Road Landfill. One such step is the City of Lincoln's ban on corrugated cardboard going to the landfill that went into effect on April 1, 2018. This policy change (Lincoln Municipal Code 8.32.040) and its associated outreach and engagement efforts successfully diverted this highly recyclable material into better, more productive re-use. Lincoln's cardboard policy demonstrates the positive impacts made possible through effective policy, partnerships and dedicated resources for outreach and education. An executive summary characterizing the types of waste found at the landfill highlights some of the ban's success:[146]

- **Before the new ordinance,** corrugated cardboard was the second most commonly found material in the landfill, comprising almost 10% of the landfill's waste.
- **After the new policy went into effect,** corrugated cardboard dropped out of the top ten commonly found materials and comprised only 2.4% of the waste found at the landfill.

Photo courtesy of the Lincoln Journal Star

- **In 2018,** the city reduced the amount of cardboard sent to the landfill by 76% compared to 2017. This decrease freed up 120,000 cubic yards of space in the landfill, thereby extending the usable life of the landfill.
- **14,080 fewer tons of corrugated cardboard** were sent to the landfill in 2018 than in 2017. The environmental savings from recycling rather than landfilling this cardboard are shown below.

Reduction in Corrugated Cardboard Sent to the Landfill



Lincoln realized a 76% reduction in tons of corrugated cardboard sent to the landfill between 2017 and 2018. This reduction saved over 120,000 cubic yards of landfill space, further extending the landfill's life.

Another step Lincoln has taken to proactively manage its waste is to re-classify the City's Recycling Coordinator as a Waste Diversion Coordinator. This updated title indicates the City's dedication to a holistic and integrated approach to waste management. Largely responsible for implementing strategies from the Solid Waste Plan 2050 for the city of Lincoln and Lancaster County, the City's Waste Diversion Coordinator and the whole Solid Waste Management team will be critical leaders in implementing the following strategies to reduce waste for the city of Lincoln.

Strategies described in this section will help enhance the City's existing waste reduction efforts. One particular strategy—setting a zero-waste goal—will help drive many of the strategies here. Zero waste is defined by the Zero Waste International Alliance as:

"The conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health."[147]

Communities throughout the U.S. define zero waste in a variety of ways, including diverting 90% of total waste from local landfills.[148] Although language may vary by location and organization, the main tenets of zero waste are rethinking and redesigning materials in ways that account for a product's full life cycle and pursuing the reduction of waste at its source before recycling and composting. Sending materials to the landfill and using waste-to-energy recovery methods are the absolute last options in a zero-waste community.

Source reduction, or generating less waste, is an important step in achieving zero waste, followed by landfill diversion strategies such as recycling. As described earlier in this section, Lincoln's recycling efforts are greatly increasing. Another landfill-diversion strategy that Lincoln should consider is a city-wide organic composting program. Compostable materials and organics, including food waste, certain paper products, and yard and wood waste, are currently the most prevalent types of materials found in the Lincoln landfill.[149] A study by MSW Consultants, a national solid waste consulting firm, found that Lincoln could divert 59,667 tons (one third of its annual waste) from the landfill every year if compostable/organic material were separated from other materials and composted.[150] According to a 2019 report by the U.S. Public Interest Research Group and the Frontier Group, there has been a 65% increase in the number of communities in the U.S. offering composting programs.[151] Increases in the number of composting programs throughout the country is encouraging because U.S. landfills are the second largest producer of methane, a greenhouse gas that is 56 times more powerful than carbon dioxide over a 20-year period.[152] Landfills produce large quantities of methane when organic material decomposes. Lincoln mitigates this by incorporating a natural gas collection system at the Bluff Road landfill. However, composting , rather than landfilling, organic waste is an important part of the overall strategy to help prevent dangerous greenhouse emissions, increase soil health, and act as a carbon sink, a natural reservoir, such as plants, soil, and the ocean, that absorb more carbon dioxide than they emit.

Climate-smart strategies for waste reduction will involve everything from outreach and education, to the creation of new waste diversion programs, to robust public policies. Implementing these waste reduction strategies will lead to a cleaner, greener Lincoln where residents are empowered to safely and easily manage their waste, City decision-making related to waste diversion continues to be data-driven, and Lincoln's greenhouse gas emissions from the landfill are significantly reduced.

Photo courtesy of Green Quest Recycling

Strategies to Reduce Waste

S = Short-Term (next 0-10 years); M = Medium-Term (next 10-20 years); L = Long-Term (next 20-30 years.)

'Crossover' strategies that appear in more than one Action Area are noted with the icon of the corresponding section.

Set a goal that all municipal operations will be zero waste (meaning at least 90% of waste is diverted from the landfill through waste reduction, reuse, recycling and composting) by 2030.	**Phase**
Create policies and procedures for waste reduction through purchasing (see below) and waste handling for City employees.	**S**
Train custodial staff in waste diversion instructions.	**S**
Analyze the waste generated from municipal operations to establish a baseline.	**S**
Track and report progress. Increase the amount of recycling of hard and soft plastics, paper, aluminum and tin. Set interim goals for 2025, 2030, 2035 and 2040.	**S**
Engage City employees in activities to drive behavior change, like training, discussion, competitions, presentations, awards, etc.	**S**
Set a goal in the next Solid Waste Management Plan that the Lincoln community will achieve zero waste (meaning at least 90% of waste is diverted from the landfill through waste reduction, reuse, recycling and composting) by 2040.	**M**
Develop a comprehensive set of strategies for reducing waste, increasing recycling, composting organic waste and diverting construction waste to work toward this goal.	**M**
Continue to conduct periodic waste characterization studies at Lincoln's landfills to measure and report the progress of these initiatives.	**S**
Track progress toward goals and report to the public.	**M**

Reduce waste at its source.	
Continue waste reduction strategies and programs outlined in the 2020 Solid Waste Management Plan.	S
Create a green purchasing policy for municipal government. This would specify preferences for purchasing products that have lesser or reduced negative effects or increased positive effects on human health and the environment, when compared with competing products that serve the same purpose.	S
Partner with the University of Nebraska-Lincoln, Lincoln Public Schools and other large institutions or businesses to create a green purchasing collective, which could negotiate better prices on sustainable products for its members.	S
Implement a construction and demolition waste recycling strategy for publicly supported construction projects.	S
Adopt a policy to increase usage of recycled concrete and asphalt in public funded projects. Partner with UNL to research new methods / mix designs to utilize 100% of recycled asphalt and concrete in projects.	M
Consider the implementation of volume-based fees for waste collection. These systems require those who generate more waste to pay higher bills, which incentivizes waste reduction and recycling.	M
Model and promote creative repair and reuse of consumer goods. 	S
Celebrate and promote local businesses who reduce waste, compost, re-use materials, use recycled content, and/or serve locally-grown food, and help their customers do the same. 	S
Encourage reduction of single-use plastics like grocery bags, straws, to-go cups and other items.	S
Set waste diversion goals for municipal facilities. Train employees to adopt zero-waste practices.	S
Increase rates and efficiency of recycling.	
Provide Lincoln and Lancaster County residents with waste diversion education through paid City educators and contractor assistance. 	S

Increase Residential Curbside Recycling Subscriptions through continued promotion of this service.	**M**
Identify and work with residents and commercial entities to reduce the percentage of readily available materials that could be diverted from the landfill.	**L**
Require waste diversion education and infrastructure in buildings that generate 4 or more cubic yards of commercial waste per week and buildings that have 5 or more units.	**S**
Promote local businesses to engage in product stewardship such as manufacturing products from locally recycled materials, creating end-markets for recyclables and closed-loop systems.	**S**
Advocate for and leverage public-private partnerships to create recycling and reuse outlets to recycle items that cannot be accepted by curbside programs.	**M**
Implement a special event recycling program where recycling is required at any event that requires a City permit.	**S**
Encourage all neighborhood business districts to have public recycling bins on sidewalks.	**S**
Adopt policies at the City, LPS, UNL and other large institutions that waste will be diverted at large events like high school football games, city marathons, music festivals and more.	**S**
Reduce food waste.	
Recommend comprehensive strategies to reduce pre- and post-consumer food waste in Lincoln.	**S**
Develop city-wide organic waste collection and compost utilization system.	
Work with the Nebraska Chapter of the U.S. Composting Council to develop Department of Transportation (DOT) quality standards for compost utilization.	**M**
Evaluate options for intitutional organic waste composting.	**M**

Evaluate city-wide organic composting collection.	**M**
Begin city-wide organic (including food waste) composting collection.	**M**
Assess volume and consistency of compost supply generated by city-wide composting collection. Identify opportunities for municipal reuse of composting materials, such as a guideline that all street and roadway construction projects undertaken by the City, and all new residential and commercial construction and renovation projects, have the soil amended with 1-2 inches of compost.	**M**
Evaluate the impacts and feasibility of extending the yard waste disposal ban from seasonal to year-round and extend the season in which haulers pick up yard waste to year-round.	**S**
Evaluate and explore options for public-provate partnerships for composting and bio-digestion of organic food waste.	**S**
Increase efficiency of hazardous waste management.	
Continue community education about 1. Reducing hazardous materials in residential and commercial spaces and 2. Preventing toxic materials from going to the landfill.	**S**
Continue the assessment of hazardous waste program efficacy as part of the Solid Waste Management Plan and continue making appropriate recommendations based on program evaluation.	**S**
Evaluate a broad spectrum of programmatic and/or systematic options to increase efficiency, including cost savings from eliminating neighborhood collection sites, increased recycling rates, reduced waste handling rates for residents and future expansion to organics collection. 	
Conduct an analysis of emissions generated and road damage incurred from current waste hauling system.	**S**
Evaluate a full spectrum of alternatives to current system, including neighborhood zoning requirements for haulers, the formation of a hauler cooperative, or multiple or single contracts for one hauler with the City for all garbage and recycling pickup.	**S**

Evaluate potential efficiency improvements that could be achieved with an improved system, including cost savings from eliminating neighborhood collection sites, increased recycling rates, reduced waste handling rates for residents and future expansion to organics collection.	**S**
Consider a phased approach to implementing efficiency improvements to current waste hauling system.	**S**

Engage Residents in Co-Creating a Climate-Smart Future

This Climate Action Plan is intended for the whole community, not just the electric utility or municipal government. Each person, business, institution and organization has a role to play in making the transition to a climate-smart future and ensuring Lincoln's quality of life. For this reason, engaging the community effectively is a key goal going forward.

Photo courtesy of Lincoln Parks and Recreation

The goals of this plan are much more likely to be accomplished when they are embraced as a community vision, rather than seen as a list of technical details for experts to implement. Such a vision must be articulated with the community, shared through networks of relationships and most importantly, expanded through the creative and collaborative input of all who will co-create the city's future.

Appointing leadership to guide the implementation of the plan is crucial. Part of this strategy should include the creation of an ongoing Climate Resilience Task Force, a cross-sector cohort of residents from impacted communities, community and faith-based organizations, healthcare institutions, City agencies, private sector stakeholders, academic and philanthropic institutions and others who will contribute their experience, expertise, relationships, programs, technical and financial resources to advance the implementation of strategies, partnerships, resources and methods to increase Lincoln's resilience capacity.

Engaging underserved populations is critical to ensuring Lincoln's climate resilience progress is equitable. The effects of climate change will have a disproportionate impact on low-income communities of color. Ongoing communication and collaboration between these communities and the City will be needed to help mitigate the effects of climate change . Some neighborhoods have already experienced historic discrimination and will now have to face the oncoming crisis of climate change and the cascading effects of climate hazards. Listening to and engaging with residents who will be impacted by flooding and extreme heat, for example, can lead to establishing relationships and co-creating strategies that will work best for the residents themselves.

Clear and consistent communication about Lincoln's climate risks and opportunities will be key to engaging residents and achieving forward momentum. Communication from the City should be

Photo courtesy of Lincoln Parks and Recreation

translated into the top five languages spoken in the city after English: Spanish, Arabic, Vietnamese, Kurdish and Karen. Online forums that are accessible to all via computer or smartphone should be held regularly to share information and progress. A Community Climate Ambassador program should be created with the goal of appointing individuals to gather and share information about climate issues with their community. Ultimately every Lincoln resident should be aware of the climate hazards they live with, and should be prepared to take action in the case of natural disaster.

Engaging the Lincoln community in conserving natural resources is another important strategy that can help reduce emissions and waste, conserve water and increase habitat. Incentives could be developed that encourage homeowners to grow vegetables, save water, drive less and make smarter choices about where they shop. A 2019 study found that emissions associated with the purchasing habits of residents from one hundred of the world's big cities already represent 10% of global greenhouse gas emissions.[153] Buying goods locally reduces consumption-based emissions and improves the local economy.

Finally, the City could create a public messaging campaign where local residents model conservation behaviors for their peers. For example, a local musician might show how he takes the bus downtown. The Mayor might be photographed riding her bike to work. A popular restaurant owner might show how he buys local and composts his food scraps. A neighbor might show how she got a pair of shoes repaired in town rather than buying a new pair online that would have been shipped from thousands of miles away. This kind of messaging creates a fun way for Lincoln to build a narrative about itself as a climate-smart city and could go a long way toward influencing the large range of voluntary behaviors that are so important in reducing emissions.

Photo courtesy of Lincoln Parks and Recreation

Strategies to Engage Residents in Co-Creating a Climate-Smart Future

S = Short-Term (next 0-10 years); M = Medium-Term (next 10-20 years); L = Long-Term (next 20-30 years.)

'Crossover' strategies that appear in more than one Action Area are noted with the icon of the corresponding section

Provide Leadership to Transition Lincoln to a Climate-Smart Future.	**Phase**
Designate staff resources to lead implementation of the Climate Action Plan and establish organizational structure to provide city-wide direction and strategy for implementaton.	**S**
Appoint an ongoing Climate Resilience Task Force to provide accountability for implementing the Climate Action Plan. This group should be a cross-sector cohort of city-wide resident leaders, residents from impacted communities, community & faith based organizations, city agencies, private sector stakeholders, academic and philanthropic institutions who will align their experience, expertise, relationships, programs, technical and financial resources to advance the development of strategies, partnerships, resources and methods toincrease Lincoln's resilience capacity.	
Conduct a review of city financial assets to determine extent of holdings in fossil fuel companies.	**S**
Divest from fossil fuel investments.	**S**
Engage underserved populations in co-creating resilient solutions.	
Identify and lift up environmental justice leaders from communities of color who can play instrumental roles in identifying and implementing equitable strategies.	**S**
Engage with residents in neighborhoods projected to be most impacted by climate change to understand local risks and develop strategies.	**S**
Engage with local social service agencies and non-profits to communicate with underserved populations about climate risks and resilience strategies.	**S**
Communicate climate risks and opportunities to Lincoln residents.	
Create an integrated communications and community development plan to educate community groups and to facilitate conversations that help residents identify strategies and solutions.	**S**

Maintain an active online/social media presence to educate, inform and engage residents.		S
Hold virtual town hall meetings to educate residents on Lincoln's climate risks and opportunities.		S
Create an online forum for community conversation and question/answers on climate changes to Lincoln.		S
Create a community-wide, intergenerational climate reading and discussion program offered through Lincoln City Libraries.		S
Create a Community Climate Ambassador program with the goal of appointing individuals to gather and share information about climate issues with their community.		
Send a regular e-newsletter from a City Sustainability Office.		
Together with the Lincoln-Lancaster County Emergency Management Office, the City Urban Development Department, City Stormwater management experts and neighborhood leaders, develop a comprehensive Salt Creek levee breach and overtop scenario analysis and communications plan to affected residents.		S
Educate Lincoln residents and businesses on the increased risks of flooding, extreme heat, extreme storms, insect-borne diseases and other climate hazards they should be aware of to protect their safety.		S
Identify and empower community leadership across all Lincoln neighborhoods to educate residents and prepare for climate hazards.		S
Incentivize resource conservation.		
Create educational content for and conduct outreach with homeowner associations about how to use native plants and prairie in landscaping.		S
Amend the weed abatement policy to allow for native plants to be grown on private property with less restrictive height guidelines.		S
Encourage conversion of lawns to native grasses, vegetable gardens, and/or drought-tolerant landscaping.		S

Create and promote commuter incentives to reduce driving. 	S
Continue to promote EV education and incentives to encourage the adoption of EVs. 	S
Encourage organic lawn care through the use of compost and other natural soil amendments; discourage the use of chemical fertilizers and pesticides.	S
Model and promote creative repair and reuse of consumer goods. 	S
Celebrate and promote local businesses who reduce waste, compost, re-use materials, use recycled content, and/or serve locally-grown food, and help their customers do the same. 	S
Create public messaging that models and encourages conservation behaviors.	
City of Lincoln and Lincoln Public Schools (LPS) partner with each other and any other relevant stakeholders, such as UNL Extension, to develop educational and outreach materials.	S
Educate on the environmental impacts of personal consumption, such as diet choices, clothing, household and beauty products, plastics, airplane travel and more.	S
Share public biking and walking data to encourage more residents to bike and walk.	S
Educate and encourage residents to follow the waste management hierarchy of using strategic consumption practices: reduce, reuse, recycle.	S
Educate residents how to do backyard composting, and encourage this voluntary behavior with incentives like coupons or gift certificates to local businesses.	S
Promote a public engagement campaign to encourage bus ridership from all residents. 	S
Support and enhance the existing outreach and education campaign to encourage parents to walk their children to school via the "walking school bus" program. 	S

In partnership with the Parks and Rec department, Pioneers Park Nature Center, the Prairie Corridor project and potential non-profits, create curriculum for local K-12 schools to teach about the value of diverse plant, insect and wildlife ecosystems and the importance of supporting them through habitat development and protection. The curriculum would include outdoor time for students to create Prairies in the Parks native grass plantings in Lincoln's public parks.	S
Create a public engagement campaign to educate and create behavior change to reduce energy consumption. 	S
Include comparative energy and water consumption data on household energy and water bills, so that residents can see how their consumption compares to their peers.	S
Engage faith communities, social service agencies, non-profits and neighborhood associations in building neighborhood resilience.	
Bring congregational representatives together to build community-based neighborhood resilience, including disaster relief and advocacy for disadvantaged populations.	S
Develop a plan for neighborhoods with specific risks to understand their climate risks and work together to increase resilience, including flood protection, disaster relief, public health, economic development and policy advocacy.	S
Create a Climate Leadership Academy to train cohorts of community leaders on climate resilience, lead volunteer teams that can achieve neighborhood goals, have knowledge and ability to access local resources, and build trust between community sectors to cultivate a thriving network of community stewards to build resilience.	S

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What You Can Do

Achieving the goals laid out in this plan and reducing greenhouse gas emissions to the extent necessary to avoid the worst impacts of climate change will require actions at all levels. Individual efforts may seem insignificant compared with large-scale actions, but their collective impact adds up.

Photo courtesy of Lincoln Parks and Recreation

Personal lifestyle choices can help shift social norms[154] and encourage others to do the same, which results not only in a greater impact, but also puts pressure on larger entities and builds momentum for more systemic change.

Here is a menu of impactful actions that help to mitigate climate change. Consider which things you might choose to begin making a personal impact to reduce greenhouse gas emission right here in our community.

1. **Opt for active transportation.** Transportation represents approximately 28% of emissions in the U.S., and passenger vehicles account for half of that.[155] Opting to use alternative modes of transportation, such as busing, walking, biking, or sharing a ride, is one of the top ways to reduce your impact.[156]

2. **Reduce driving trips.** When you need to drive, reduce the effects of driving by combining trips, working from home/videoconferencing when possible, or buying an electric vehicle next time you're in the market for a car.

3. **Avoid unnecessary air travel.** Carbon emissions from one long flight are often more than the total emissions of the average person in many countries for an entire year, and aviation is one of the fastest growing sources of pollution.[157]

4. **Shift to a more plant-based diet.** The livestock industry is responsible for about 14.5% of global greenhouse gas emissions, and cattle (both meat and dairy production) accounts for 65% of that.[158]

5. **Buy local, in-season foods.** Fresh produce in the grocery store often travels a long way to arrive in Lincoln, so purchasing local foods that are in season (or growing your

own!) eliminates significant transportation emissions.

6. **Improve the efficiency of your home.** When you're looking to make changes in your home, consider upgrading your appliances to be more efficient, using heavier insulation, and installing LED light bulbs or smart thermostats, all of which can save you energy and money in the long-term.

7. **Conserve energy and water at home.** Simple actions like turning off lights, unplugging appliances, limiting laundry loads, and minimizing use of heating and cooling can add up to both resource and cost savings.

8. **Install or purchase renewable energy.** If you have the financial capability, consider installing solar panels on your roof or participating in community solar through LES.

9. **Reduce waste (especially food waste).** Materials sent to landfills directly release methane gas into the atmosphere, and food waste accounts for 6% of global emissions.[159] Reduce, recycle, or compost instead!

10. **Buy smarter.** Clothes and other consumer goods are often discarded after little use because of fast fashion and planned obsolescence. Extend the life cycle of existing products by purchasing second-hand items, sharing tools, or repairing broken items rather than throwing them away. Purchase goods built to last, consciously avoiding single use items.]

11. **Learn about and pursue actions that address intersectionality.** The effects of climate change disproportionately fall on communities of color and residents with lower incomes,

making it all the more important to integrate social justice into our environmental work and daily actions.

12. **Connect with community leaders and organizations.** Stay informed on the issues and communicate your thoughts and efforts toward increasing climate resiliency. Feedback is critical to businesses, schools, non-profit agencies, governmental bodies, your fellow citizens, and others as we all work together to build a more resilient and successful Lincoln.

Some of these changes require financial investments that just aren't feasible for many community members, and that's okay. The important thing is to start where you are, and take action whenever and wherever you can. Being mindful of the impact of your actions on the planet and fellow humans, investing in the Lincoln community, and building relationships with your neighbors all contribute to our collective resilience and our thriving future.

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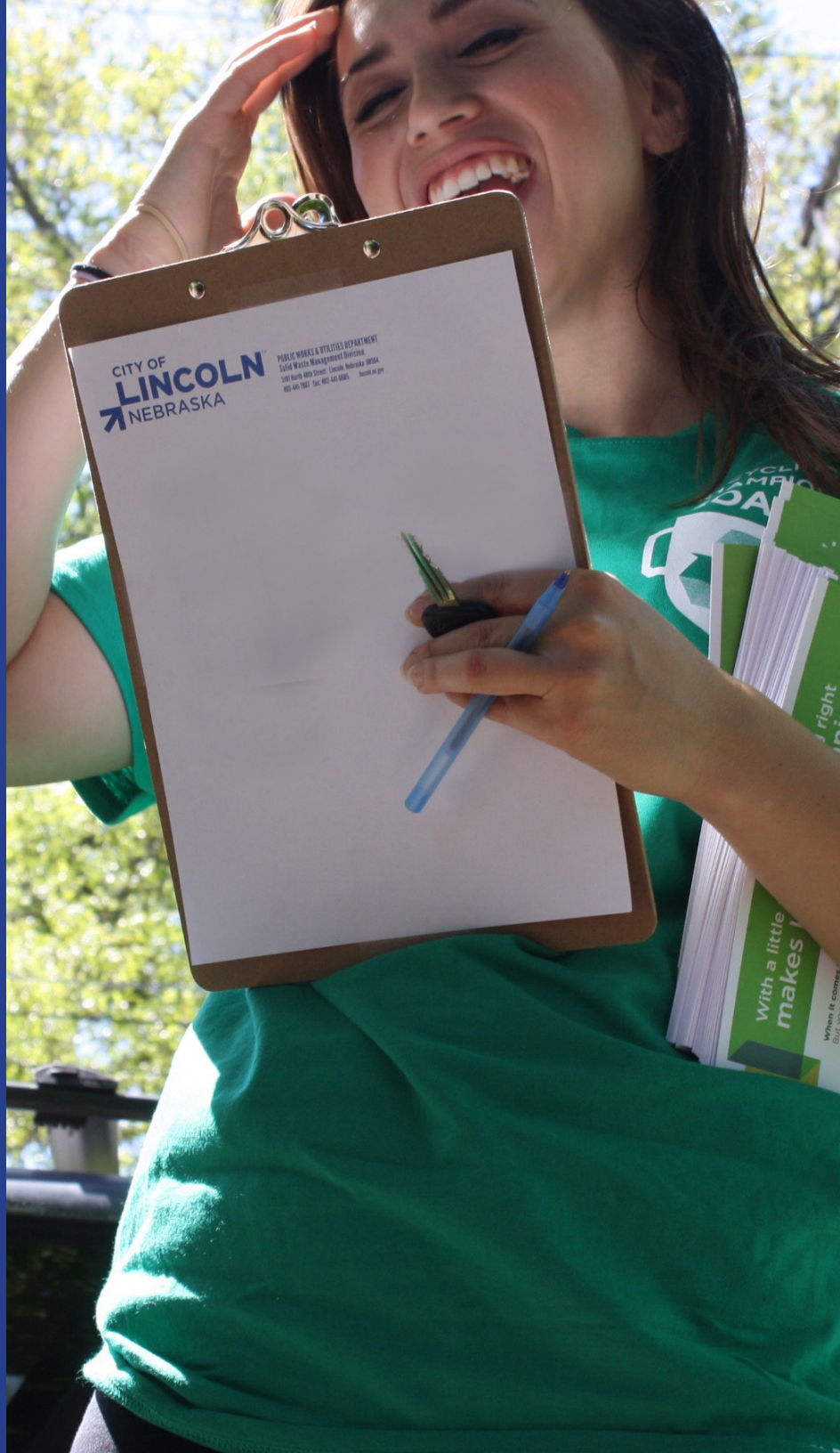
Implementation and Monitoring

The success of this plan, like any, will depend upon the degree to which its recommendations are implemented.

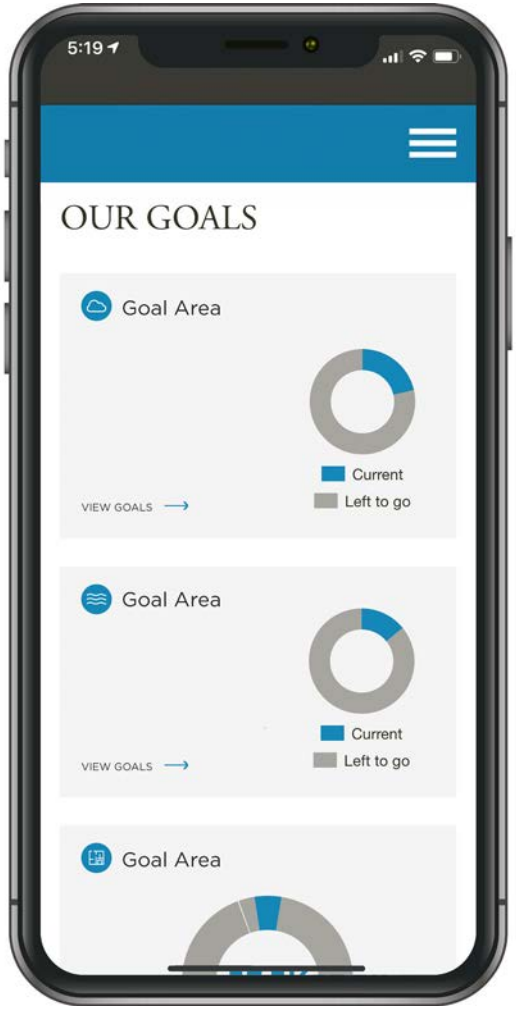


Considering the wide range of sectors this plan addresses and the intersectoral nature of many of the recommendations, it is key that progress and accountability are shared throughout City government, LES, the business community, universities and colleges, institutions and among residents themselves. It will be important to have a City staff member or office responsible for implementation, tracking and reporting. It will be equally important to have an ongoing Task Force of diverse key stakeholders to guide implementation efforts. The City should report regularly to the community on progress made in implementing strategies from this plan and achieving climate resilience.

There are two key indicators that should be regularly monitored to gauge progress toward Lincoln's climate resilience: **the amount of greenhouse gases the city emits,** and **the amount of greenhouse gases the city sequesters.** Greenhouse gas emissions are already reported every three years by the Lincoln-Lancaster County Health Department. It will be important to add a carbon sink inventory so that the City can track the gases it sequesters. The overarching goal of this plan is to reduce emissions and increase sequestration to meet the goal of an 80% net reduction in emissions by 2050, relative to 2011 levels.

A third indicator that should be monitored is **public engagement** on this Climate Action Plan. Neighborhoods with high levels of poverty and poor health status are likely to be those most impacted by climate risks. It is essential to build on the work of this plan by continuing to work with impacted communities to develop strategies and solutions. Communities of color should be engaged to ensure that their needs and vulnerabilities are addressed—and certainly not worsened—by the strategies of this plan.

These three indicators are the initial metrics to measure, track, and share with the public, but as the City makes progress on other strategies in this plan, several more progress indicators should be developed. A monitoring and reporting mechanism, like a dashboard, should be implemented and made available to the public.



Future Research Needs

During the planning process of the Lincoln Climate Action Plan, it became clear that future research would be needed to best pursue certain strategies and goals.

Many recommended strategies in this plan will require analysis and evaluation that can and will occur within the existing capacity of City departments. Future research needs described here include topics that are outside the current scope of work by City personnel and will likely require City collaboration with researchers and professionals at local institutions of higher education, businesses, and community organizations. Future research needs described here fall under the following three categories:

- Emissions Analysis
- COVID-19 & Social Connectedness
- Heat-Related Emergency Planning

Emissions Analysis

- **Establish a city-wide carbon sink inventory:** Because Lincoln's emissions goal involves a net reduction, the City must identify and assess its natural carbon sinks. Establishing an inventory of these carbon sinks will help the City track future emissions reduction from places such as the tree canopy and other green spaces, wastewater treatment, compost, and landfills.
- **Analyze emissions-reduction potential of recommended strategies:** This plan contains hundreds of strategies. Current prioritization of these strategies is based on chronology (e.g., short, medium, and long-term) and is therefore limited. Analyzing the emissions-reduction potential of strategies was outside the scope of this current plan, but such analysis should occur in the near-term to better prioritize short, medium, and long-term implementation of emissions-reducing strategies.
- **Research revenue potential from carbon sequestration in Lancaster County:** Revenue-generating opportunities exist for carbon sequestration, such as the agricultural program described in the "Maximize Natural Climate Solutions" chapter of this plan. Future research should include finding these opportunities and pursuing them to help boost economic activity in the County while also helping Lincoln achieve its emissions reduction goal.
- **Build a consumption-based GHG inventory:** As noted in the "Greenhouse Gas Emissions Reduction Target" chapter of this plan, Lincoln's current GHG inventory does not account for GHG emissions related to the use of goods and services produced within and outside city limits. Not including consumption-based emissions likely keeps Lincoln's GHG footprint artificially lower than actual totals. Reorienting the types of emissions included in the City's inventory and building a consumption-based GHG inventory will provide Lincoln with a more accurate account of its emissions. A consumption-based inventory is also a way to better engage residents because consumption-based emissions are directly related to consumer choices.

COVID-19 & Social Connectedness

- **Study the impacts, responses, and lessons learned from COVID-19:** At the writing of this plan, the global COVID-19 pandemic was still unfolding. Therefore, a comprehensive study of how the City responded during the crisis was not yet feasible. Many news articles during this time have referenced how the coronavirus pandemic is likely a harbinger of future disasters caused by climate change. Understanding how the City of Lincoln, businesses, nonprofits, community groups and individual residents responded during the COVID-19 pandemic will help the City better prepare for future crises.

- **Measure the social connectedness of residents:** A central component of a community's resilience is the degree to which people are connected to each other, including levels of trust and cohesion. Two chapters in this plan, "Improve Protections for Lincoln Residents" and "Engage Residents in Co-Creating a Climate-Smart Future," include strategies for increasing social resilience in Lincoln. However, there is currently no baseline that assesses the social connectedness of residents. A study that measures social cohesion in Lincoln can help identify strengths in the city and areas where Lincolnites may be at additional risk due to higher levels of social isolation. Having a baseline will also help the City measure progress over time.

Photo courtesy of Lincoln Parks and Recreation

Heat-Related Emergency Planning

- **Evaluate the necessity of creating a heat response plan:** Climate data presented in the "Climate Projections" chapter of this plan show that Lincoln will very likely see more extreme heat days and droughts. While the Lancaster County Local Emergency Operations Plan (LEOP) (2017) includes general guidance on extreme temperature days, the City may deem it necessary to have a specific, separate but complementary heat response plan. Just as climate data should be incorporated into floodplain management and planning, so should climate data be incorporated into emergency planning.


Capitol Fountain