

FINAL DELIVERABLE

Title	Iowa City Climate and Action Adaptation Strategies	
Completed By	Zhi Chen, Michael Delp, Olivia Felber, Ursula Ferrier Harrison Freund, Amina Grant, Joshua Harris, Nelson Loring Hannah Neel, Melisa Ribikawskis	
Date Completed	May 2019	
UI Department	School of Urban and Regional Planning	
Course Name	URP:6256:0001 Environmental Policy and Management	a substant
Instructor	Scott Spak, Lucie Laurian	-10 234
Community Partners	Brenda Nations, City of Iowa City	

This project was supported by the Provost's Office of Outreach and Engagement at the University of Iowa. The Office of Outreach and Engagement partners with rural and urban communities across the state to develop projects that university students and faculty complete through research and coursework. Through supporting these projects, the Office of Outreach and Engagement pursues a dual mission of enhancing quality of life in Iowa while transforming teaching and learning at the University of Iowa.

Research conducted by faculty, staff, and students of The University of Iowa exists in the public domain. When referencing, implementing, or otherwise making use of the contents in this report, the following citation style is recommended:

[Student names], led by [Professor's name]. [Year]. [Title of report]. Research report produced through the Office of Outreach and Engagement at the University of Iowa.

This publication may be available in alternative formats upon request.

Provost's Office of Outreach and Engagement The University of Iowa 111 Jessup Hall Iowa City, IA, 52241 Phone: 319.335.0684 Email: outreach-engagement@uiowa.edu Website: <u>http://outreach.uiowa.edu/</u>

The University of Iowa prohibits discrimination in employment, educational programs, and activities on the basis of race, creed, color, religion, national origin, age, sex, pregnancy, disability, genetic information, status as a U.S. veteran, service in the U.S. military, sexual orientation, gender identity, associational preferences, or any other classification that deprives the person of consideration as an individual. The University also affirms its commitment to providing equal opportunities and equal access to University facilities. For additional information contact the Office of Equal Opportunity and Diversity, (319) 335-0705.



Iowa City Climate Action and Adaptation Implementation Strategies



University of Iowa Students

- Zhi Chen Urban and Regional Planning
- Michael Delp Urban and Regional Planning
- Olivia Felber Civil and Environmental Engineering
- Ursula Ferrier Urban and Regional Planning
- Harrison Freund Urban and Regional Planning
- Amina Grant– *Civil and Environmental Engineering*
- Soshua Harris Urban and Regional Planning
- Nelson Loring Urban and Regional Planning
- ↔ Hannah Neel Urban and Regional Planning
- Melisa Ribikawskis Urban and Regional Planning

University of Iowa Faculty

- Lucie Laurian Professor, Urban and Regional Planning
- Scott Spak Assistant Professor, Urban and Regional Planning

City of Iowa City

Srenda Nations – Sustainability Coordinator

This document was prepared by the Environmental Policy and Management Class at the University of Iowa School of Urban and Regional Planning.

May 10, 2019

Contents

Contents	1
Executive Summary	5
Climate Change Vulnerability Assessment	6
Alignment to the Iowa City Climate Action and Adaptation Plan	6
Assessing Climate Change Vulnerability in Iowa City	6
Social Vulnerability to Flooding Events at the City Level	11
Alignment to the Iowa City Climate Action and Adaptation Plan	11
The Motivation for this Analysis	11
Designing the Index	12
Application of the Index	
Social Vulnerability Index, Buildings, and Floodplain	
Methodology	
Iowa City Analysis	
Eastside Vulnerability	
Downtown Iowa City Flood Vulnerability	14
Southside and Airport Vulnerability Areas	15
Heat Events	16
Alignment to the Iowa City Climate Action and Adaptation Plan	16
Background Information	16
Policy Recommendations	20
Recommended Framework for Climate Change Community Outreach and Engagement in Iowa City	22
Alignment to the Iowa City Climate Action and Adaptation Plan	

Climate Change Community Outreach and Engagement Experiences	
The City of Minneapolis	22
The City of Cleveland	22
Recommended Framework	23
Extreme Weather Preparedness: Shelter	
Alignment to the Iowa City Climate Action and Adaptation Plan	
Sheltering Network: Iowa City's Daily Preparation for the Worst	
Extremes- Heat and Cold	
Displacing the Threat and Reducing Stigmas	27
Building a Comprehensive Program	27
Defining the Need: An Exploration of Agency Needs-to-Know	
Developing the Bigger Picture: Basic Infrastructure Locations and Spatial Needs	
Developing the Bigger Picture: Consideration of Special Needs and Family Dynamics	
Suggested Next Steps: Building a Shelter Component into the Implementation Plan	
A Bit More About Communications	
Building and Energy Efficiency	
Alignment to the Iowa City Climate Action and Adaptation Plan	
Buildings' Efficiencies: Issue and Goals	
Current and Future Trends, Policy, and Issues	
Spatial Equity	41
Policies and Programs	41
Residential	41
Building Codes	
Recommendations	

Sustainable Lifestyles	
Alignment to the Iowa City Climate Action and Adaptation Plan	
Local Food Advocates: Food Policy Councils and Planners	
Local Goods Redistribution and Resale Systems	
Recommended Solution: Local Foods and Goods Database	
Vulnerability Analysis	
Future Research	
Recommendations: Local Foods Passport	
Vehicle Miles Traveled and Electric Vehicles	51
Alignment to the Iowa City Climate Action and Adaptation Plan	
Background	51
Current Conditions	53
Key Barriers for Adoption of Electric Vehicles	54
Solutions to Overcome the Key Barriers	
Recommendations	
Glossary	
Appendices	
Appendix: Approaches to Assessing Climate Change Vulnerability	
Academic Approach: Social Vulnerability Index (SoVI)	
Municipal Approach: The City of Minneapolis Climate Change Vulnerability Assessment	
Comparing the Academic and Municipal Approaches	
Appendix: Iowa City Climate Change Vulnerability Assessment Methodology	61
Appendix: Climate Change Communication and Outreach and Engagement Resources	
Appendix: Examples of Projects for Climate Action Fund	72

R	eferences	73
	Climate Change Vulnerability Assessment	73
	Social Vulnerability to Flooding Events at the City Level	76
	Heat Events	77
	Extreme Weather Preparedness: Shelter	78
	Building and Energy Efficiency	79
	Sustainable Lifestyles	79
	Vehicles Miles Traveled and Electric Vehicles	80

Executive Summary

The City of Iowa City is preparing to respond to the upcoming challenges that will be associated with climate change over the remainder of the 21st century. Iowa City is expected to experience a greater number of major precipitation events, as well as more frequent and severe flooding and extreme temperature events. These impacts worsen with increasing Green House Gas emitted at the local, regional, national and global levels. In 2018, Iowa City adopted its first Climate Action Mitigation and Adaptation Plan. The plan's main goals are to reduce carbon dioxide emissions by 30 percent in 2025 and 80 percent in 2050 compared to a 2005 baseline. In 2015, Iowa City achieved a 23 percent reduction compared to the 2005 baseline, largely because of changes in the utility provider's energy portfolio and in the fuel mix used by the University of Iowa power plant. Iowa City is striving to further increase the usage of renewable energy sources, and to reduce energy demand. This report will support Iowa City as it seeks to achieve its 2025 and 2050 goals.

Brenda Nations, The City of Iowa City's Sustainability Coordinator, approached the Environmental Policy and Management class at The University of Iowa School of Urban and Regional Planning to develop an implementation plan focused on adaptation and equity. This document evaluates vulnerability in Iowa City, and identifies actions the City can take to protect vulnerable populations and to enhance resiliency and adaptability. The following areas are addressed in this document:

- Overall social vulnerability and equity regarding environmental hazards, extreme heat and cold events, and flood events
- Buildings and energy usage
- Electric vehicles and transportation systems
- Sustainable lifestyles

Each section introduces the topic area, presents specific analyses of the Iowa City context, and provides policy recommendations. Words appearing in bold may have a more technical meaning and are defined in detail in the glossary.

Climate Change Vulnerability Assessment

Alignment to the Iowa City Climate Action and Adaptation Plan

Targets

• Identify vulnerable populations in Iowa City and develop communications and outreach approach

Actions

• 4.1 Conduct a Vulnerable Populations Asset Mapping Exercise

Assessing Climate Change Vulnerability in Iowa City

Based on the Climate Change Vulnerability Assessment conducted by the City of Minneapolis, the following factors from the U.S. Census 2012-2016 American Community Survey (ACS) 5-year estimates were used to perform a climate change vulnerability assessment for Iowa City:

- Rent
 - Median Gross Rent as a Percentage of Household Income
- No Vehicle Access
 - Housing Tenure by No Vehicles Available
- Limited English
 - Household Language by Household Limited English-Speaking Status
- Poverty
 - Poverty Status of Individuals in the Past 12 Months by Living Arrangement
- Race
 - o Race (Nonwhite)
- Young Children
 - Sex by Age (Under 5)

- Older Population
 - Sex by Age (Over 65)
- Disability
 - Disability Status (From Ages 20 to 64)
- Air Conditioning
 - Properties with Central Air Conditioning
 - Obtained by the City of Iowa City Assessor

For a discussion on the different approaches to climate change vulnerability assessments and the methodology used to conduct the lowa City climate change vulnerability assessment, please refer to the Appendix.

The figure that follows depicts the census block groups in Iowa City vulnerable to climate change. Specifically, there are three census blocks groups that are the most vulnerable to climate change. The neighborhoods in Iowa City that most closely correspond to those census block groups are:

- Walnut Ridge
- Galway Hills
- Wetherby/Broadway



Climate change vulnerability by census block group in Iowa City.

Within the three neighborhoods, the following neighborhood associations that most closely correspond are:

- Walnut Ridge
 - o Walnut Ridge
- Galway Hills
 - Mormon Trek Village
- Wetherby/Broadway
 - Broadway
 - Pepperwood
 - Wetherby
 - South Pointe



The following pages display maps of each of the nine climate change vulnerability indicators in Iowa City.







The percentage of children under 5 in each block group in Iowa City.

The percentage of elderly over 65 in each block group in Iowa City.



The percentage of properties without central air conditioning in each block group in Iowa City.

The percentage of rent-burdened households in each block group in Iowa City.

The percentage of dwelling units without vehicle access in each block group in Iowa City.





The percentage of individuals in poverty in each block group in Iowa City.

The percentage of limited English-speaking households in each block group in lowa City.

Social Vulnerability to Flooding Events at the City Level

Alignment to the Iowa City Climate Action and Adaptation Plan

Targets

• Identify vulnerable populations in Iowa City and develop communications and outreach approach

Actions

• 4.1 Conduct a Vulnerable Populations Asset Mapping Exercise

The Motivation for this Analysis

It has been more than a decade since the Flood of 2008 struck lowa City, but the memory still lingers. While every form of hazard and natural disaster warrants special attention to ensure they cannot cause too much damage, floods are unique, as they can last much longer than others, shutting down local activities and limiting residents' mobility. In addition to that, as seen in the figure to the right, lowa City needs to be particularly well prepared for floods, as they endanger large portions of the city. Flood events do not affect all people equally, however. Some residents have resources (e.g., wealth, education) that increase their resilience to disasters. Conversely, others are particularly susceptible to these events (e.g., low income, minority, elderly and isolated individuals). Thus, if Iowa City is to be made more resilient, then the most vulnerable communities should be identified and increasing their resiliency should be a priority.



Social Vulnerability to flooding in Iowa City. Relative to the 100-&-500-Year Floodplains.

For this reason, it is important that vulnerability is examined at many different levels, so that those who need it may be identified, which is reflected in the report's structure. In the previous section, those who are vulnerable to what will come as climate change progresses were examined. This section discusses which places are vulnerable in the present day, and the next section looks at the vulnerability within these census blocks.

Designing the Index

One way to quantify vulnerability is to construct an index which considers all the social variables which make individuals vulnerable to hazards in the first place. Drawing on data from the Census Bureau's American Community Survey, such an index was designed. It was based on a study of what made Cedar Rapids, lowa vulnerable, as no research for lowa City itself could be found, and Cedar Rapids is a reasonable analog of lowa City for this purpose (Tate et. al., 2016). As can be seen in the figure to the right, the index was split into three "pillars" with varying degrees of importance, or "weights." Variables within the index were quantified with the geometric mean, which is an attempt to account for how the variables interact with one another. The pillars, however, were summed together merely based on their weights. The index was then split into five classes and mapped at the census block level.

Application of the Index

As seen in the figure on the previous page, vulnerability varies dramatically throughout the city. Much of the floodplain affects citizens living in census blocks which are ranked as marginal or less vulnerable, which means that they contain either some concentration of a few variables or a larger concentration of a smaller number of variables. These less vulnerable blocks likely contain some individuals who are more susceptible than those around them, and the converse is true for more vulnerable blocks. The index is a useful



tool to guide efforts for new investments, and where to look for those who need help during a flooding event, but all areas must receive attention to ensure the best level of resistance.

Social Vulnerability Index, Buildings, and Floodplain

Methodology

This part of the analysis focuses on expanded the social vulnerability and the flood vulnerability risk to buildings within the floodplains. This is done by using ARCGIS, FEMA shapefiles, Johnson County Building shapefiles, and the SVI index. All layers are turned on within ARCMAP and the building layer is clipped to include the features present in the SVI index. Then the SVI/building layer is clipped to represent all the buildings and their SVI index within the 500/100-year floodplains. This allows for spatial representation of buildings with the most flood vulnerability and the need inclusion in emergency preparedness plains.

Iowa City Analysis



First clip of building data to include SVI index data.

Eastside Vulnerability

Ralston Creek provides a majority of flood dangers. Longfellow properties are including in the 500/100-year floodplain risks, but higher income areas exist. Creekside neighborhood contain marginal index vulnerability with properties in the floodplain. Friendship St. and 1st avenue contain significant vulnerability in properties within the floodplains. This is illustrated on the map with the orange coloration within the blue.

Building layer, FEMA Floodplain, SVI Index layers







Downtown Iowa City Flood Vulnerability

A majority of the flood risk in downtown Iowa City comes from the Iowa River and Ralston Creek floodplains. This analysis includes commercial, University of Iowa buildings, and residential properties. Some of the significant risk buildings along the Iowa River are University buildings. Downtown buildings bordering Ralston Creek are significant for flood risk because of Iower income student populations and proximity to 100- year and 500-year floodplains. Higher density development has occurred in this area and greater impacts and relocations might need to happen in extreme flooding events.

Southside and Airport Vulnerability Areas

Some airport buildings are within the median vulnerability area and 100- and 500-year floodplains. Significant flood vulnerability exists bordering the Iowa River and south of Highway 6. Significant low-income housing exists within the median vulnerability locations and should be a priority for emergency plans in flood situations.





Heat Events

Alignment to the Iowa City Climate Action and Adaptation Plan

Targets

• Identify vulnerable populations in Iowa City and develop communications and outreach approach

Actions

- 4.1 Conduct a Vulnerable Populations Asset Mapping Exercise
- 4.3 Analyze Climate-Related Public Health Impacts in Iowa City

As the climate of Iowa City changes over the course of the 21st Century, several action steps are needed to ensure that residents can respond appropriately to extreme heat and cold events. According to the Iowa City Climate Action Plan, Iowa will have a winter climate like Kansas and a summer climate like Mississippi by the end of century given current trends. This mean that Iowa City will have to cope with more extreme weather events. Heatwayes will be more common as temperatures increase overall, placing vulnerable populations, especially the elderly, at high risk. Additionally, although Iowa will have a warmer overall climate and milder winters by the end of this century, extreme cold events will be increasingly severe. These cold periods, commonly known as Polar Vertices, arise out of the weakened Jet Stream allowing frigid arctic to travel much further south than historically precedented. These events place lower income communities and the homeless population at high risk of frostbite or even death.

Background Information

Following state law, residential units in Iowa City are required to "... have heating facilities which are properly installed and are capable of safely and adequately heating all habitable rooms, bathrooms and toilet rooms located therein to a temperature of at least sixty eight degrees Fahrenheit (68°) (20°C) and shall be capable of maintaining in all said locations a minimum temperature of sixty five degrees Fahrenheit (65°) (18°C) at a distance of three feet (3') above the floor level at all times." Enforcement of this law through the Building Inspector ensures non-transient populations are not vulnerable to extreme cold. Low income populations are protected from having their heat shut off during the winter months due to a moratorium in place that is done in coordination with the Low-Income Home Energy Assistance Program (LIHEAP) and the Iowa Utility Board.

However, there is no such requirement in state law or local ordinance regarding cooling units, such as air-conditioners. This could be devastating to households that lack air-conditioning or are unable to use it due to financial reasons. Having a central air conditioner in the home is found to reduce the odds of dying in a heatwave by 49%.

Special attention needs to be given to elderly populations because age-related processes reduce the body's cooling efficiency.



Residents cooling off by the fountain in the Pedestrian Mall.

Specifically, sweating and skin vasodilation (the widening of blood vessels) are impaired. Heatwaves are known to deadliest for elderly populations. Following a heatwave in 2003 that killed thousands, researchers in France found that those who are socially isolated are over 6 times more likely to die in a heatwave. Social isolation means that an individual does not engage in any activity with others, be it religious, cultural, leisurely, or social. Living alone does not necessarily imply social isolation, however living with another person who can respond to an emergency would reduce vulnerability to heat related death.

Attention needs to also be given to impoverished populations. Research focusing on New York found that there was a statistically significant relationship between poverty and heat-mortality. This is because areas high with poverty tend to have lower quality buildings, less air-conditioning, and a more severe urban heat island effect.

There are several best-practices that have been adopted in other cities. Following the 2003 Heatwave in France, the government developed a database called Calex. The database has information about populations identified as vulnerable or those wishing to opt-in. During a heat-related emergency, a phone call is placed to residents in the database with reminders to drink plenty of water, wear lighterweight clothing, and engage in other cooling behaviors that reduce heat mortality. A similar program in Philadelphia, called Heatline, works allows residents to call in to get information about cooling. The city also a response unit to do welfare checks for vulnerable people or in dire circumstances if needed.

Transient populations in Iowa City are known to congregate in the downtown and near the Shelter House on the southern side of town. These populations can be served by opening public buildings as cooling locations. For example, this could mean reserving a room in the Iowa City Public Library for residents to cool down on heatwave days, even on public holidays. More details regarding shelters can be found in its specific chapter in this plan. Finally, police officers, whether responding to a call or on patrol should be able to identify the difference between heat stress and heat stroke and respond accordingly until medical services arrive.

Iowa City's risk to extreme heat events was evaluated using satellite images showing thermal radiation. This data was obtained through the United States Geographic Service (USGS). USGS satellite images provide 30 m resolution data of thermal radiation, which is used to identify temperature variations within Iowa City, every 16 days. The following images show a satellite view of Iowa City as well as the thermal images over the same area depicted on 18 May 2018. May 18^{th} was selected because it was a clear day with a daytime high air temperature of 97°F (36 °C).



Satellite image showing Iowa City



USGS Thermal Radiation Layer

The first satellite image of this section shows the area of the **thermal radiation** map over lowa City, where lighter shades of gray indicate higher amounts of thermal radiation. Areas with more intense development, the downtown and South/Southeast lowa City, have greater thermal radiation and vulnerability. The lowa River, provides a cooling effect, shown by its dark line. The next two figures zoom in to the area of interest previously identified. The figure to the on the next page shows areas with lower thermal radiation in green and areas of higher thermal radiation in shades of browns and reds. This confirms that the downtown area has higher thermal radiation. Additionally, the **urban heat island effect** is observed to be intense

near the Iowa City Municipal Airport, University of Iowa Hospitals and Clinic, The University of Iowa, and the Downtown District.



Closeup Satellite of Iowa City Downtown



USGS Thermal Radiation image of Iowa City

The population in the downtown and The University of Iowa area is at a generally lower risk of heat-related illness or death than expected given the extent of the urban heat island effect because the residential population in this area is composed largely of students, who are younger and have social-networks of roommates, friends, and access to University of Iowa resources. During the day, when temperatures peak, students, workers, residents and homeless who are downtown have access to cooled public buildings, and to other people who could aid them in the event of an emergency. The map to the right was created using GIS and creating a vulnerability score considering air conditioning, age demographics, and poverty statistics. These variables were assigned equal weight for the model, however given that most deaths were in the elderly and those who lacked air conditioning, more focus should be placed on those factors. With that consideration, it is recommended that there be an emphasis on the Morningside and Glendale neighborhoods given the high concentration of elderly persons. This area is composed largely of single-family residential homes, meaning the likelihood of somebody living alone and possibly being social is higher in this area. Using poverty as a **proxy**, it has been determined that the Riverside area on the West Bank of the Iowa River north of Highway 6 has a higher concentration of employment in these sectors and relatively few air conditioners. To its south is the airport, which has a high number of buildings without air-conditioning.



Heat Vulnerability Map of Iowa City.

Policy Recommendations

Based on the review of city specific data and practices incorporated in other areas, the following actions are recommended:

 Develop a robust warning system based on National Weather Service categories to inform and to respond to extreme heat and cold events.

	NAMA S	не	at Ir	ndex			Te	empe	rature	e (F)							
		80	82	84	86	88	90	92	94	96	98	100	102	104	106	10	B 11
	40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	13	0 13
33	45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	13	7
	50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
5	55	81	84	86	89	93	97	101	106	112	117	124	130	137			
	60	82	84	88	91	95	100	105	110	116	123	129	137				
	65	82	85	89	93	98	103	108	114	121	128	136					
	70	83	86	90	95	100	105	112	119	126	134						
	75	84	88	92	97	103	109	116	124	132							
	80	84	89	94	100	106	113	121	129								
	85	85	90	96	102	110	117	126	135							1	
	90	86	91	98	105	113	122	131									NORA
	95	86	93	100	108	117	127										Z,
	100	87	95	103	112	121	132										ALC: NO
				1	~}	vv	III	IU	nn	II U	ла	ITU	200	12			
				200	as l					_			·	s ^o			
								Te	mper	ature	≘ (°F)		· · · · ·	s ^{or}			
c	alm	40	35	30	25	20	15 1	Tei 10 5	mper 0	ature -5	e (°F) -10	-15	-20	-25	-30 -	-35	-40 -
¢	alm 5	40 36	35 31	30 25	25 19	20	15 1 7	Tei 10 5	mper 0 5 -11	ature -5 -16	e (°F) -10 -22	-15 -28	-20 -34	-25 -40	-30 -	-35 -52	-40 -
c	Calm 5 10	40 36 34	35 31 27	30 25 21	25 19 15	20 13 9	15 1 7 3 -	Ter 10 5 1 - 5 -4 -1	mper 0 5 -11 0 -16	ature -5 -16 5 -22	e (°F) -10 -22 -28	-15 -28 -35	-20 -34 -41	-25 - -40 - -47 -	-30 - -46 - -53 -	-35 -52 -59	-40 - -57 - -66 -
0	alm 5 10 15	40 36 34 32	35 31 27 25	30 25 21 19	25 19 15 13	20 13 9 6	15 1 7 3 - 0 -	Te 10 5 1 -5 4 -1 5 7 -1	mper 0 5 -11 0 -16 3 -19	ature -5 -16 -22 -26	e (°F) -10 -22 -28 -32	-15 -28 -35 -39	-20 -34 -41 -45	-25 - -40 - -47 - -51 -	-30 - -46 - -53 -	-35 -52 -59 -64	-40 - -57 - -66 - -71 -
	Calm 5 10 15 20	40 36 34 32 30	35 31 27 25 24	30 25 21 19 17	25 19 15 13 11	20 13 9 6 4	15 1 7 3 - 0 - -2 -	Ter 10 5 1 -5 4 -1 -7 -1 -9 -1 -9 -1	mper 0 5 -11 0 -16 3 -19 5 -22	ature -5 -16 -22 -26 2 -29	-10 -22 -28 -32 -35	-15 -28 -35 -39 -42	-20 -34 -41 -45 -48	-25 -40 -47 -51 -55	-30 - -46 - -53 - -58 - -61 -	-35 -52 -59 -64 -68	-40 - -57 - -66 - -71 - -74 -
	calm 5 10 15 20 25	40 36 34 32 30 29	 35 31 27 25 24 23 22 	30 25 21 19 17 16	25 19 15 13 11 9	20 13 9 6 4 3	15 1 7 3 - 0 - -2 - -4 -	Ter 10 5 1 - 5 4 -1 -7 -1 -9 -1 11 -1 11 -1	mper 0 5 -11 0 -16 3 -19 5 -22 7 -24 0	ature -5 -22 -26 -26 2 -29 4 -31	e (°F) -10 -22 -28 -32 -35 -37	-15 -28 -35 -39 -42 -44	-20 -34 -41 -45 -48 -51	-25 -40 -47 -51 -55 -58	-30 - -46 - -53 - -58 - -61 - -64 -	-35 -52 -59 -64 -68 -71	-40 - -57 - -66 - -71 - -74 - -78 -
	alm 5 10 15 20 25 30	40 36 34 32 30 29 28	 35 31 27 25 24 23 22 21 	30 25 21 19 17 16 15	25 19 15 13 11 9 8	20 13 9 6 4 3 1	15 1 7 3 - -2 - -4 - -5 -	Ter 10 5 1 -3 4 -1 -7 -1 -9 -1 11 -1 12 -1 12 -1	mper 0 5 -11 0 -16 3 -19 5 -22 7 -24 9 -26 1 -24 9 -26	ature -5 -22 -26 2 -29 4 -31 5 -33	(°F) -10 -22 -28 -32 -35 -37 -39	-15 -28 -35 -39 -42 -44 -46	-20 -34 -41 -45 -48 -51 -53	-25 -40 -47 -51 -55 -58 -60	-30 - -46 - -53 - -58 - -61 - -64 - -67 -	-35 -52 -59 -64 -68 -71 -73	-40 - -57 - -66 - -71 - -74 - -78 - -80 -
	alm 5 10 15 20 25 30 35	40 36 34 32 30 29 28 28 28 28	35 31 27 25 24 23 22 21 20	30 25 21 19 17 16 15 14	25 19 15 13 11 9 8 7	20 13 9 6 4 3 1 0	15 1 7 3 - -2 - -4 - -5 - -7 -	Ter 10 5 1 -: 4 -1 -7 -1 -9 -1 11 -1 12 -1 14 -2 15 -0 15 -0	mper 0 5 -11 0 -16 3 -19 5 -22 7 -24 9 -26 1 -27 2 -26 1 -27 2 -26 -27 -24 -26 -27 -26 -27 -26 -27 -27 -26 -27 -26 -27 -26 -27 -27 -26 -27 -27 -26 -27 -27 -26 -27 -27 -27 -27 -27 -27 -27 -27	ature -5 -22 -26 -26 2 -29 4 -31 5 -33 7 -34	(°F) -10 -22 -28 -32 -35 -37 -39 -41	-15 -28 -35 -39 -42 -44 -46 -48	-20 -34 -41 -45 -48 -51 -53 -55	-25 -40 -47 -51 -55 -58 -60 -62	-30 - -46 - -53 - -58 - -61 - -64 - -67 - -69 -	-35 -52 -59 -64 -68 -71 -73 -76 -70	-40 - -57 - -66 - -71 - -74 - -78 - -80 - -82 -
	calm 5 10 15 20 25 30 35 40	40 36 34 32 30 29 28 28 28 27 26	 35 31 27 25 24 23 22 21 20 10 	30 25 21 19 17 16 15 14 13	25 19 15 13 11 9 8 7 6	20 13 9 6 4 3 1 0 -1	15 1 7 3 - -2 - -4 - -5 - -7 - -8 -	Ter 10 5 1 -5 4 -1 -7 -1 -9 -1 11 -1 11 -1 12 -1 14 -2 15 -2 15 -2 16 -2 17 -2 16 -2 17 -2 17 -2 17 -2 17 -2 18 -2 19 -1 11 -1 12 -1 12 -1 14 -2 15 -2	mper 0 5 -11 0 -16 3 -19 5 -22 7 -24 9 -26 1 -27 2 -29 2 -29	ature -5 -22 -26 -26 2 -29 4 -31 5 -33 7 -34 9 -36	e (°F) -10 -22 -28 -32 -35 -37 -39 -41 -43	-15 -28 -35 -39 -42 -44 -46 -48 -50	-20 -34 -41 -45 -48 -51 -53 -55 -57	-25 -40 -47 -51 -55 -58 -60 -62 -64	-30 - -46 - -53 - -58 - -61 - -67 - -67 - -69 - -71 -	-35 -52 -59 -64 -68 -71 -73 -76 -78	-40 - -57 - -66 - -71 - -74 - -78 - -80 - -82 - -84 -
	alm 5 10 15 20 25 30 35 40 45	40 36 34 32 30 29 28 28 28 27 26	 35 31 27 25 24 23 22 21 20 19 10 	30 25 21 19 17 16 15 14 13 12	25 19 15 13 11 9 8 7 6 5	20 13 9 6 4 3 1 0 -1 -2	15 1 7 3 - -2 - -4 - -5 - -7 - -8 - -9 -	Ter 10 5 1 -: 4 -1 -7 -1 -9 -1 11 -1 12 -1 14 -2 15 -2 16 -2 16 -2	mper 0 5 -11 0 -16 3 -19 5 -22 7 -24 9 -26 1 -27 2 -29 3 -30 -3	ature -5 -22 -26 2 -29 4 -31 5 -33 7 -34 9 -36 0 -37	e (°F) -10 -22 -28 -32 -35 -37 -39 -41 -43 -44	-15 -28 -35 -39 -42 -44 -46 -48 -50 -51	-20 -34 -41 -45 -48 -51 -53 -55 -57 -58	 -25 -40 -47 -51 -55 -58 -60 -62 -64 -65 -65 	-30 - -46 - -53 - -58 - -61 - -67 - -69 - -71 - -72 -	-35 -52 -59 -64 -68 -71 -73 -76 -78 -78 -79	-40 - -57 - -71 - -74 - -78 - -80 - -82 - -82 - -84 - -86 -
	calm 5 10 15 20 25 30 35 40 45 50	40 36 34 32 30 29 28 28 28 27 26 26 26	 35 31 27 25 24 23 22 21 20 19 19 19 	30 25 21 19 17 16 15 14 13 12 12	25 19 15 13 11 9 8 7 6 5 4	20 13 9 6 4 3 1 0 -1 -2 -3 -	15 1 7 3 - -2 - -4 - -5 - -7 - -8 - -9 - 10 -	Ter 10 5 1 - 5 4 -1 -7 -1 -9 -1 11 -1 12 -1 14 -2 15 -2 16 -2 17 -2 17 -2	mper 0 11 0 -16 3 -19 5 -22 7 -24 9 -26 1 -27 2 -29 3 -30 4 -31 19 19 19 19 19 19 19 19 24	ature -5 -16 -22 -26 -26 -26 -26 -31 -33 -34 -36 -37 -38	e (°F) -10 -22 -28 -32 -35 -37 -39 -41 -43 -44 -45	-15 -28 -35 -39 -42 -44 -46 -48 -50 -51 -52	-20 -34 -41 -45 -48 -51 -53 -55 -57 -58 -60	 -25 -40 -47 -51 -55 -58 -60 -62 -64 -65 -67 -67 	-30 - -53 - -58 - -61 - -67 - -69 - -71 - -72 -	35 -52 -59 -64 -78 -77 -78 -79 -81	-40 - -57 - -66 - -71 - -74 - -78 - -80 - -82 - -84 - -86 - -88 -
	Calm 5 10 15 20 25 30 35 40 45 50 55	40 36 34 32 30 29 28 28 27 26 26 25	 35 31 27 25 24 23 22 21 20 19 19 18 	30 25 21 19 17 16 15 14 13 12 12 11	25 19 15 13 11 9 8 7 6 5 4 4	20 13 9 6 4 3 1 0 -1 -2 -3 -3 -3	15 1 7 3 0 - -2 - -4 - -5 - -7 - -8 - -9 - -10 -	Ter 10 5 1 -: 44 -1 -7 -1 9 -1 11 -1 12 -1 14 -2 15 -2 16 -2 17 -2 18 -2 18 -2 18 -2 18 -2	mper 5 0 5 -11 0 -16 3 -19 5 -22 7 -24 9 -26 1 -27 2 -29 3 -30 4 -31 5 -32 4 -31 5 -32	ature -5 -22 -26 -26 2 -29 4 -31 5 -33 7 -34 -36 0 -37 1 -38 2 -39	(°F) -10 -22 -28 -32 -35 -37 -39 -41 -43 -44 -45 -46	-15 -28 -35 -39 -42 -44 -46 -48 -50 -51 -52 -54	-20 -34 -41 -45 -48 -51 -53 -55 -57 -58 -60 -61	-25 -40 -47 -51 -55 -58 -60 -62 -64 -65 -64 -65 -67 -68	-30 - -46 - -53 - -58 - -61 - -64 - -69 - -71 - -72 - -74 - -75 -	-35 -52 -59 -64 -68 -71 -73 -76 -78 -79 -81 -82	-40 - -57 - -71 - -74 - -78 - -80 - -82 - -82 - -84 - -88 - -88 - -89 -
	alm 5 10 15 20 25 30 35 40 45 50 55 60	40 36 34 32 30 29 28 28 27 26 26 25 25 25	 35 31 27 25 24 23 22 21 20 19 19 18 17 	30 25 21 19 17 16 15 14 13 12 12 11 10	25 19 15 13 11 9 8 7 6 5 4 4 3	20 13 9 6 4 3 1 0 -1 -2 -3 -3 -3 -4 -4	15 1 7 -7 2 -4 -5 -7 -8 -9 -10 11	Ter 10 9 1 -: 4 -1 -7 -1 9 -1 11 -1 12 -1 14 -2 15 -2 16 -2 17 -2 18 -2 18 -2 19 -2	mper 5 0 5 -11 0 -16 3 -19 5 -22 7 -24 9 -26 1 -27 2 -29 3 -30 4 -31 5 -32 6 -33	ature -5 -22 -26 -26 2 -29 4 -31 5 -33 7 -34 9 -36 0 -37 1 -38 2 -39 3 -40	(°F) -10 -22 -28 -32 -35 -37 -39 -41 -43 -44 -45 -46	-15 -28 -35 -39 -42 -44 -46 -48 -50 -51 -52 -54 -55	-20 -34 -41 -45 -48 -51 -53 -55 -57 -58 -60 -61 -62	-25 -40 -47 -51 -55 -58 -60 -62 -62 -64 -65 -67 -68 -69	-30 - -53 - -58 - -61 - -64 - -67 - -69 - -71 - -72 - -74 - -75 - -76 -	-35 -52 -59 -64 -68 -71 -73 -76 -78 -79 -81 -82 -84	-40 - -57 - -71 - -74 - -78 - -80 - -82 - -82 - -84 - -88 - -88 - -88 - -88 - -89 - -91 -
	calm 5 10 15 20 25 30 35 40 45 50 55 60	40 36 34 32 30 29 28 27 26 26 25 25	 31 27 25 24 23 22 21 20 19 19 18 17 	30 25 21 19 17 16 15 14 13 12 12 11 10	25 19 15 13 11 9 8 7 6 5 4 4 3 rostbit	20 13 9 6 4 3 1 0 -1 -2 -3 -3 -3 -4 -4 -4 -4	15 1 7 3 3 - -2 - -2 - -4 - -5 - -7 - -8 - -9 - -10 - 11 - 11 -	Ter 10 5 11 -: 44 -1 7 -1 9 -1 111 -1 112 -1 114 -2 115 -2 115 -2 115 -2 115 -2 116 -2 117 -2 118 -2 119 -2 119 -2 30 mi	mper 0 -11 0 -16 3 -19 5 -22 9 -26 1 -27 2 -29 3 -30 4 -31 5 -32 6 -33	ature -5 -16 -5 -22 -26 2 -29 -31 5 -33 -34 -36 -37 -38 2 -39 3 -40	e (°F) -10 -22 -28 -32 -35 -37 -39 -41 -43 -44 -45 -46 -48 0 minut	-15 -28 -35 -39 -42 -44 -46 -48 -50 -51 -52 -54 -55 -55	-20 -34 -41 -45 -48 -51 -53 -55 -57 -58 -60 -61 -62 -52	-25 - -40 - -51 - -55 - -58 - -62 - -64 - -65 - -64 - -65 - -68 - -69 -	-30 - -46 - -53 - -58 - -61 - -664 - -667 - -669 - -71 - -72 - -74 - -75 - -76 -	-35 -52 -59 -64 -68 -71 -73 -76 -78 -79 -81 -82 -84	-40 - -57 - -66 - -71 - -74 - -78 - -88 - -88 - -88 - -88 - -88 - -88 - -89 - -89 - -91 -
	Calm 5 10 15 20 25 30 35 40 45 50 55 60	40 36 34 32 30 29 28 28 27 26 26 25 25	35 31 27 25 24 23 22 21 20 19 19 18 17	30 25 21 19 17 16 15 14 13 12 12 11 10 F	25 19 15 13 11 9 8 7 6 5 4 4 3 rostbit (20 13 9 6 4 3 1 0 -1 -2 -3 -3 -3 -4 -2 PF) = 2	15 1 7 3 0 - -2 - -4 - -5 - -4 - -5 - -6 - -7 - -8 - -9 - -10 - -11 - <td>Term 00 5 11 -5 12 -1 13 -1 14 -2 111 -1 112 -1 114 -2 115 -2 116 -2 117 -2 128 -2 130 mil -2 30 mil -4</td> <td>mpera i 0 5 -11 0 -16 3 -19 5 -22 7 -24 9 -26 9 -26 1 -27 2 -29 3 -30 4 -31 5 -32 3 -30 4 -31 5 -32 5 -3</td> <td>ature -5 -16 -5 -22 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -22 -29 -26 -22 -29 -26 -22 -29 -26 -22 -29 -26 -22 -29 -26 -29 -26 -29 -26 -29 -26 -29 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -33 -37 -38 -38 -39 -36 -37 -38 -39 -40 -37 -40 -37 -40 -37 -40 -37 -40 -37 -40 -40 -37 -40 -40 -40 -37 -40 -40 -40 -40 -40 -40 -40 -40</td> <td>e (°F) -10 -22 -28 -32 -35 -37 -39 -41 -43 -44 -45 -46 -48 0 minut 75(V</td> <td>-15 -28 -35 -39 -42 -44 -46 -50 -51 -52 -54 -55 tes</td> <td>-20 -34 -41 -45 -48 -51 -53 -55 -57 -58 -60 -61 -62 -58 -60 -61 -62 -59 -60 -61 -62 -59 -60 -61 -62 -59 -60 -61 -62 -62 -62 -63 -64 -64 -64 -64 -64 -64 -64 -64 -64 -64</td> <td>-25 - -40 - -51 - -55 - -58 - -62 - -62 - -63 - -63 - -68 - -69 - nutes 275T(</td> <td>-30 - -53 - -58 - -61 - -64 - -66 - -71 - -72 - -77 - -75 - -76 - V^{0.16}</td> <td>-35 -52 -59 -64 -68 -71 -73 -76 -78 -79 -81 -82 -84 -82 -84</td> <td>-40 - -57 - -71 - -74 - -78 - -88 - -88 - -88 - -88 - -89 - -91 -</td>	Term 00 5 11 -5 12 -1 13 -1 14 -2 111 -1 112 -1 114 -2 115 -2 116 -2 117 -2 128 -2 130 mil -2 30 mil -4	mpera i 0 5 -11 0 -16 3 -19 5 -22 7 -24 9 -26 9 -26 1 -27 2 -29 3 -30 4 -31 5 -32 3 -30 4 -31 5 -32 5 -3	ature -5 -16 -5 -22 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -22 -29 -26 -22 -29 -26 -22 -29 -26 -22 -29 -26 -22 -29 -26 -29 -26 -29 -26 -29 -26 -29 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -26 -29 -33 -37 -38 -38 -39 -36 -37 -38 -39 -40 -37 -40 -37 -40 -37 -40 -37 -40 -37 -40 -40 -37 -40 -40 -40 -37 -40 -40 -40 -40 -40 -40 -40 -40	e (°F) -10 -22 -28 -32 -35 -37 -39 -41 -43 -44 -45 -46 -48 0 minut 75(V	-15 -28 -35 -39 -42 -44 -46 -50 -51 -52 -54 -55 tes	-20 -34 -41 -45 -48 -51 -53 -55 -57 -58 -60 -61 -62 -58 -60 -61 -62 -59 -60 -61 -62 -59 -60 -61 -62 -59 -60 -61 -62 -62 -62 -63 -64 -64 -64 -64 -64 -64 -64 -64 -64 -64	-25 - -40 - -51 - -55 - -58 - -62 - -62 - -63 - -63 - -68 - -69 - nutes 275T(-30 - -53 - -58 - -61 - -64 - -66 - -71 - -72 - -77 - -75 - -76 - V ^{0.16}	-35 -52 -59 -64 -68 -71 -73 -76 -78 -79 -81 -82 -84 -82 -84	-40 - -57 - -71 - -74 - -78 - -88 - -88 - -88 - -88 - -89 - -91 -

- Engage the community using the neighborhood climate action ambassador program described in detail in the next chapter of the document.
- When temperature and humidity conditions fall into the extreme caution category, publish cooling information tips on electronic screens in public buildings and on the homepage of the city website. Do the same when condition would cause frostbite to set in within 10 minutes for information about staying warm.
- When temperatures fall into the danger category, open a city hotline that residents can call and directly receive information and help. Additionally, have city staff call residents participating in a program to verify they are receiving cooling information. During heatwaves, this should be done every other day.
- Train police officers to identify the difference between different temperature related conditions, such as heat stress, heat stroke, frostbite, and hypothermia. Equip police officers with appropriate resources to respond accordingly, such as electrolyte beverages, cool packs, and blankets until medical services arrive.
- Since air conditioning units are found to reduce heat related mortality, consider a capital improvement project to subsidize central air conditioning. This may increase green house gas emissions.
- Additional items for the City to consider addressing this issue is to increase the amount of shade provided by trees. Trees provide effective defense against the urban heat island effect because they block the sun, and they release water into the air, which absorbs heat.
- Reducing the amount of impervious surface allows for a greater amount of water to filtrate into the ground. This provides a cooling reservoir and reduces the Urban Heat Island effect.

Recommended Framework for Climate Change Community Outreach and Engagement in Iowa City

Alignment to the Iowa City Climate Action and Adaptation Plan

Targets

• Identify vulnerable populations in Iowa City and develop communications and outreach approach

Actions

• 4.2 Develop Communications and Outreach Plan for Vulnerable Populations

Climate Change Community Outreach and Engagement Experiences

The City of Minneapolis

The City of Minneapolis conducted a Climate Change Vulnerability Assessment to identify areas most vulnerable to climate change (City of Minneapolis, 2018). The City, partnering with six local community organizations or two per neighborhood, targeted the three most vulnerable communities (Longfellow, Near North, and Phillips) for community outreach and engagement, such as public discussions about the effects of climate change (heat and cold events, flooding, freeze-thaw cycles and their impacts on housing and infrastructure as well as air pollution and pollen levels) (City of Minneapolis, 2018). These community engagement events were later evaluated and summarized to guide staff recommendations on neighborhood climate resiliency for policy makers (City of Minneapolis, 2018). The City of Minneapolis then provided grant funding to community partners for their own projects. Examples of such projects include: "A Very Snow Day" event to plan for emergencies and weather events, "Prepared Parents" which is a monthly gathering of parents for preparedness, and a workshop that included discussions and emergency kits preparation (City of Minneapolis, 2018). The evaluation of the public meetings held in the three Minneapolis neighborhoods noted that providing stipends or gift cards contributed to attracting a diversity of participants, and the presence of interpreters at the meetings facilitated inclusive engagement (Phadke & Manning, 2017).

The City of Cleveland

As part of its "Cleveland Climate Action Plan", the City of Cleveland aims to engage citizens as Neighborhood Climate Ambassadors who will lead neighborhoods in preparing for the impacts of climate change, such as reducing flood risk and heat mortality and responding to rising utility costs and energy shortages (Cleveland Neighborhood Progress; City of Cleveland, Mayor's Office of Sustainability; Cleveland Urban Design Collaborative; University at Buffalo; Kent State University, 2015). Cleveland Neighborhood Progress, a regional community development organization, brought together four community development corporations to recruit eight residents "climate ambassadors" (four are neighborhood based and four are at-large) (Cleveland Neighborhood Progress; City of Cleveland, Mayor's Office of Sustainability; Cleveland Urban Design Collaborative; University at Buffalo; Kent State University, 2015). The city focused on four target neighborhoods (Slavic Village, Central-Kinsman, Glenville, and Detroit-Shoreway). The climate ambassadors received climate science and mitigation and adaptation training, and then assisted in recruiting community participants for workshops to identify and prioritize neighborhood climate resiliency projects,

programs, policies, and research needs in each neighborhood (Cleveland Neighborhood Progress; City of Cleveland, Mayor's Office of Sustainability; Cleveland Urban Design Collaborative; University at Buffalo; Kent State University, 2015). The Climate Ambassadors were also provided with the "Neighborhood Climate Action Toolkit" funded by the World Wildlife Fund, the George Gund Foundation, the City of Cleveland Mayor's Office of Sustainability Climate Action Advisory Committee (Cleveland Neighborhood Progress; City of Cleveland, Mayor's Office of Sustainability; Cleveland Urban Design Collaborative; University at Buffalo; Kent State University, 2015). The Toolkit provides a guide for community members and organizations to actualize actions and solutions by following four steps (City of Cleveland):

- 1. Learn about the Climate Action Plan
 - "Climate Action and Cleveland: Building a Green City on a Blue Lake" presentation
 - Climate Action Video
 - A 16-minute video on how Cleveland citizens are addressing climate change
 - Guide to a Climate Friendly Diet
- 2. Identify neighborhood assets and concerns and Relate them to Climate Action
 - Climate Action Collages
 - Photographs of examples of climate action across Cleveland
 - "I am Sustainable Cleveland Posters"
 - Neighborhood Carbon Footprint Calculator
 - An Excel document to calculate the amount of greenhouse gas emissions created by a neighborhood
 - Neighborhood Climate Action Case Studies
- 3. Develop a Neighborhood Climate Action Idea
 - Workshop Facilitators Guide

 A guide for how to conduct a two-hour workshop on developing a neighborhood climate action project

- Neighborhood Carbon Reduction Calculator
 - An Excel document to calculate reductions in greenhouse gas emissions from neighborhood climate actions
- 4. Develop a Neighborhood Climate Action Project Proposal
 - Proposal Development Template
 - Cleveland Climate Action Fund

Over the course of five months, climate action workshops were held in six Cleveland neighborhoods and in 2015 alone, thirteen neighborhood projects were awarded grants over two grant cycles (Cleveland Neighborhood Progress; City of Cleveland, Mayor's Office of Sustainability; Cleveland Urban Design Collaborative; University at Buffalo; Kent State University, 2015).

Recommended Framework

We recommend that Iowa City combine the approaches and strategies of Minneapolis and Cleveland for its climate change community outreach and engagement. The purpose of the climate change community outreach and engagement campaign is to establish a grassroots-based framework to catalyst citizen action for climate change adaptation and mitigation through project funding from Iowa City's existing funding sources, primarily through the Community Climate Action Grant and the Program for Improving Neighborhoods Grant. The campaign should be ongoing and continuous, first targeting specific neighborhoods that are the most vulnerability to climate change, then embarking on other vulnerable neighborhoods, and returning to the most vulnerable neighborhoods to repeat the iterative cycle. A cohort of neighborhoods approach may also be a possibility, such as three neighborhoods per fiscal year and another three neighborhoods the next fiscal year. The Iowa City Climate Change Community Outreach and Engagement framework should consist of three core stakeholders:

- 1. Neighborhood Climate Partners
 - Community organizations within a neighborhood or in lowa City at-large with an interest in advancing climate action adaptation and mitigation. The Minneapolis experience indicates that a target of two community organizations per neighborhood is preferred. One example is the Iowa City Climate Advocates. Another could be faith-based organizations, which are already working on shelters during extreme weather events.
- 2. Neighborhood Climate Ambassadors
 - Passionate and engaged residents excited to pursue climate action adaptation and mitigation within their neighborhood and community. If none are available, existing contact persons for Neighborhood Associations in Iowa City can be designated. A minimum of one Ambassador per neighborhood is recommended. Preferably, Neighborhood Climate Ambassadors should reside within the neighborhood they represent but at-large Ambassadors may also be considered. This role should not be too difficult to fill given the amount of activism wi
- 3. City-wide Climate Coordinator
 - A representative from the City of Iowa City who will serve as the City-wide Climate Coordinator in community outreach and engagement with the Neighborhood Climate Partners and the Neighborhood Climate Ambassadors. The City of Iowa City Sustainability Coordinator can assume this role for convenience, or another coordinator can be designated.



The role of the City-wide Climate Coordinator should first be determined among the three stakeholder roles. Afterwards, the Coordinator would contact community organizations for partnership in the most vulnerable neighborhoods to climate change as identified by the Climate Change Vulnerability Assessment. Following the Minneapolis experience, two or more community organizations per vulnerable neighborhood should be identified and invited to serve as the Neighborhood Climate Partners.

With the City-wide Climate Coordinator and the Neighborhood Climate Partners assigned, the two groups should first be trained on climate change and how to communicate climate change with community members, especially vulnerable populations, and then collaborate to host a variety of community outreach and engagement events and activities starting with the neighborhoods which are the most vulnerable to climate change. These events and activities should aim to reveal the vulnerabilities to climate change within each neighborhood, present neighborhood and individual climate change adaptation and mitigation strategies, and identify and enlist active citizens who can serve as the Neighborhood Climate Ambassadors. For a listing of suggested training materials for the Neighborhood Climate Partners, Neighborhood Climate Ambassadors, and the City-Wide Climate Coordinator and possible event and activity resources for them to implement, please refer to the Appendix.

After the Neighborhood Climate Ambassadors have been recruited, along with the designation of Neighborhood Climate Partners and the City-wide Climate Coordinator, the three groups of stakeholders should collaborate to conduct more targeted climate change community outreach and engagement sessions within vulnerable neighborhoods to envision climate change adaptation and mitigation projects that could be actualized and then draft proposals for project funding from Iowa City's Community Climate Action Grant and the Program for Improving Neighborhoods Grant. For a listing of examples of neighborhood resiliency projects, please refer to the Appendix. Project implementation will be led by the Neighborhood Climate Ambassador and technically supported by the Neighborhood Climate Partners and the City-wide Climate Coordinator and financially supported by the project funding from the City of Iowa City. A stipend for the Neighborhood Climate Ambassador should be provided contingent on successful project funding by the City of Iowa City.



Promotion and advertisement of the Neighborhood Climate Ambassador, various climate change community outreach and engagement events and activities, as well as the funded and completed climate change adaptation and mitigation projects should be managed by the Neighborhood Climate Partners and the City of Iowa City. The City of Austin and the City of Cleveland have experiences with promotional and advertisement campaigns that the City of Iowa City may reference. The City of Austin, Texas currently runs the "Net Zero Heroes" campaign of preparing monthly articles of community members who took actions against climate change and distributes the content through social media and other digital platforms (City of Austin). Additionally, the City of Cleveland operates a similar campaign of posters of residents taking actions against climate change through its "I am Sustainable Cleveland" posters (City of Cleveland). Additionally, the City of Iowa City may collaborated with the Marketing Institute at the University of Iowa Tippie College of Business for targeted campaigns and to measure effectivenss.



Left: An example of a "Net-Zero Hero" blog image from the <u>City of Austin.</u> Right: An example of a "I am Sustainable Cleveland" poster from the (City of Cleveland).

Extreme Weather Preparedness: Shelter

Alignment to the Iowa City Climate Action and Adaptation Plan

Targets

• Assess and plan for climate-related health impacts

Actions

 4.4 Coordinate Extreme Weather Preparedness Planning with Local Agencies

Sheltering Network: Iowa City's Daily Preparation for the Worst

Disaster and emergency preparedness is a universal concern for communities around the world. As the effects of climate change alter weather patterns and intensify storms, it is imperative that our emergency facilities, both government and privately owned, be organized, easily recognized, and ready at a moment's notice. Knowledge of where to go and what to expect in shelter settings needs to be woven into the threads of all emergency plans. Weather safety education and timely notification will be the most important factors for saving lives in extreme weather conditions and will be most effective when accompanied by eliminating an individual's reservations about seeking shelter in the event of an emergency.

The decision to seek shelter may be a varied response among different populations of a society. Lack of understanding about the weather or climate in the region, significant communication barriers, or unwillingness to part from the responsibility of a pet are among the reasons a person might not seek shelter and thereby reduce their chances of surviving an extreme weather event. It should be the collective effort of community members and local government to eliminate as many obstacles as possible and to provide a shelter system that is free from stigma and misconceptions.

Extremes- Heat and Cold

According to NOAA, heat accounted for the majority of weatherrelated deaths across the United States in 2018. In an interview with KCRG News, Angelica Vannatta, the Development Director of the lowa City Shelter House commented that "heat is actually the number on weather-related cause of death in the United States, things like heat exhaustion and heat stroke can cause death. I think our body is more tuned to the frigid weather and we can kind of feel that more so than when we're getting bogged down by the heat." Yet even with widespread acknowledgement of this serious issue, people may not pay attention to symptoms until they are beginning to suffer from them. Finding immediate relief from the heat is vital at that point. Teaching residents to understand how the body cools itself and the effects of humidity on this process may be an uphill battle, but providing clearly marked, open, and easily accessible cooling locations doesn't have to be.

The average human body temperature is 98.6°F and it is considered to be in a state of hypothermia at 95°F. Just a few degrees lower and amnesia can set in leaving a person to wonder aimlessly until they lose consciousness at 82°F. This can take as little as 10 minutes. Being aware of the location of "warming-shelters" may be the difference between life and death for those of vulnerable populations such as the homeless, the elderly, and children. Being able to stop frequently in a warm location to allow the body temperature to return to normal could save a person's life. In extreme heat, temperatures often cool below the danger point in the evenings, but because temperatures can stay extremely cold for long periods of time, it is vital that residents be aware of locations where they are welcomed to warm up both day and night.

Displacing the Threat and Reducing Stigmas

Iowa City is home, temporarily and permanently, to people from all across the world. Some from extremely frigid regions and others from arid regions. These people may be at especially high risk to suffer the effects of the increasing Midwest temperature extremes. Additionally, with statistically less education and proper job training skills, these individuals will work in positions that will expose them to the elements more readily than established residents of the area. Establishing proper dress and care protocol will be essential to survival along with education and self-care training. This can be accomplished in a variety of ways but needs to start with explaining that a "cooling/warming-shelter" is simply a public facility which is air conditioned or heated. The word "shelter" has certain connotations attached to it which may deter some people from using them. Through city-wide ad campaigns, local businesses and government could get the word out of locations, days and times of availability of such locations in a manner that is inviting and inclusive to promote usage and displace fears.



Iowa City experiences 7 of the 9 weather events tracked by NOAA for fatality rates, yet we only have 1 dedicated shelter for Cold events, none for Heat and no coordinated disaster shelter plan in place for Floods or Tornados that render

Building a Comprehensive Program

The Johnson County Emergency Management homepage links to several informative websites, such as <u>Wunderground</u>, and to <u>educational documents</u>, such as the Child Care Weather Watch which includes color-coded safety tips for children at play as well as basic definitions of common, storm-related terms. Perhaps the most beneficial aspect of this site is the <u>Emergency Preparedness</u> <u>Information page</u>. In this one location, a resident can find instruction on how to <u>maneuver a vehicle</u> in different types of weather, links to storm preparation, and guides on what to do in every stage of a flood. Yet, with all of this information at the click of a button, our grade with the *States at Risk: America's Preparedness Report Card* is only a 'C+.' We can do better.



This infographic is a stark reminder that we still have a long way to go in a very short period of time.

Clearly there is evidence that the idea of resilience and adaptation to extreme weather is an understood and meaningful goal for our region. Tools provided through Johnson County's Emergency Program are well rounded, but improvements and updates are visibly needed. Broken hyperlinks, outdated information, and pixelated images are a threat to the program's credibility. Additionally, all material and links are readable only in English, very little of the information is Iowa City specific, and the website-based structure alienates those who do not have access to or are not computer savvy, and the illiterate. These three facts within themselves will exclude a considerable portion of our vulnerable communities in Iowa City. We need to take the Johnson County base work, zero in on specifics, and expand its reach to all residents and visitors. This should be carefully carried out one task at time.

A meticulously laid out implementation strategy for the Iowa City Climate Action Plan is vital to saving precious time, money and sanity. Randomly added information, lack of plan follow-through, and disorganization of efforts will render any strategy confusing, untrustworthy, and therefore, unusable. We must also acknowledge that this will be a "living" plan. As the city grows, businesses open and close, people come and go, all implementation tools will require frequent revisiting to ensure updates to points such as identified locations, inclusion of languages, and above all, protocol changes. This is especially important for those of our community who fall within the definition of 'vulnerable.' If we focus our implementation strategies to cater to the least abled of our society, it will ensure that the plan is adequate for all.

Many implementation aspects of the action plan are currently underway, including development of a more robust and inclusive notification system, but arguably, the most pressing work needs to be done for section 4.4, Coordinate Extreme Weather Preparedness Planning with Local Agencies. This work will have the most immediate and longest lasting effects for Iowa City's residents and emergency responder system as well as ingraining a sense of security for everyone.

Defining the Need: An Exploration of Agency Needs-to-Know

In developing the implementation plan, we need to sort out and define natural events which could be triggered by extremes in

weather in our specific region and the various levels of effect they could have on our residents. The following is a starting point for this organizing effort:

Extreme heat

126°F with heat index (92°F with 85% humidity) and over

• Individuals do not have effective means of cooling the home or their enclosure down to a safe temperature

Extreme cold

Between -32°F (0°F with 55mph winds) and -63°F (-45°F with 5mph winds)

• Individual does not have effective means of warming the home or their enclosure up to a safe temperature

Flood

Flood forecast triggers mandatory evacuation of the home

• Surrounding area may or may not actually flood

Accessibility to home completely eliminated but will be inhabitable immediately after event

 Flooding occurs but does not penetrate home and all utilities are restored at time of reentry

Home is either temporarily or permanently uninhabitable due to flood water inundation

 Flood waters cause unsafe health conditions within the home, condemn the structure completely, or utilities will not be restored for a period of time after the flood event

Tornado/Severe storm

Weather conditions so extreme that staying in place poses a risk to personal safety

• Tornado or high winds are in immediate vicinity but are not over the property and traveling to a shelter would not put the individual in additional danger of personal injury

Home is either temporarily or permanently uninhabitable due to wind damage

- Tornado or high winds have swept through and:
- Damage has been done to home that will require repairs before individuals can safely return;
- Damage has been done to the power lines or other utilities requiring residents to stay away from the area for a specified amount of time;
- The home has been rendered unsafe and or entirely destroyed)

Prolonged power outage

 Brownouts or blackouts that leave a home without the ability to be cooled or warmed through the use of electricity for a prolonged period of time (multiple days) during extreme weather events

These events should be met with a plan that is well-rounded and takes into consideration *all* residents of Iowa City. It needs to specifically address the topic of shelters and should identify the populations and circumstances that may lead to a community's dependence on shelter services. In addition to the weather events

mentioned above, the following are the top three reasons and descriptions of why effective sheltering is necessary in our region:

Homelessness

Loss of housing

- homeowner loses home (may or may not be of their doing)
- renter is evicted (may or may not be of their doing)

Loss of guardianship

- Loss of foster care (17 years and younger or is a dependent)
- Runaway (17 years and younger or is a dependent)
- Sudden loss of parents (17 years and younger or is a dependent)

Abuse

Verbal and/or Psychological= individual needs to escape from an abusive situation that has not manifested physically (individual may require immediate counseling services and a safe place to sleep is imperative)

Physical= individual needs to escape from an abusive situation that has manifested in physical harm (individual may require immediate medical attention and/or counseling services and a safe place to sleep is imperative)

Mental Illness

• **Mild=** individual has a social disorder or is unable to control emotions to successfully secure/retain housing

- **Moderate=** individual has temperament issues or noticeable mental deficits and is unable to successfully secure/retain housing
- **Severe=** individual appears to be out of control of cognitive functions and is unable to successfully secure/retain housing

In Iowa City, shelters may reasonably need to be provided for those who fall into the following demographics and specifications:

Scale (number of people requiring shelter after/during an event)

- 1-5 humans
- 6-100 humans
- 101-500 humans
- 501-1000 humans

Length of Stay (number of hours and/or days shelter is required after/during an event)

For the duration of the event

Meal times

Overnight

- ½ 4 days
- 5 10 days
- 11 14 days
- 15+ days

Living arrangements

- Homeless
- Renter
- Homeowner

Gender identity

- Male
- Female
- *Transgender* (if a person identifies/wants to be recognized as one gender when physically they are the other)

Age

- **child=** 0-15 (typically does not drive and depends on an adult for all or the majority of their care)
- **young adult=** 16-20 (typically is able to drive, cannot yet drink alcohol, may smoke, and may or may not depend on an adult for some of their care)
- *adult=* 21-65 (typically able to drive, can consume alcohol, may or may not be dependent on another adult for some of their care)
- senior= 66+ (typically able to drive, can consume alcohol, may or may not be dependent on another adult for some of their care)

Family dynamics

- individual person
- individual person with 1-3 dependents

- individual with 4-10 dependents
- partners (married or unmarried)
- partners with 1-3 dependents
- partners with 4-10 dependents

Pet owners

- caged animals= rabbits, hamsters, guinea pigs, etc.
- exotic animals= birds, lizards, snakes, etc.
- traditional animals= cats and/or dogs
- **non-traditional animals=** designer pigs, chickens, goats, etc.

Substance users (assessment made at time of shelter entry)

- sober/clean= individual states that they do not ever use or rarely uses alcohol/drugs/recreational medication (presents as of competent mind)
- functioning user= individual states that they use alcohol/drugs/recreational medication on a regular basis with the <u>ability</u> to go without for the length of shelter stay (presents as 'tipsy,' high, or disoriented)
- addict= individual states that they use alcohol/drugs/recreational medication on a regular basis with the <u>inability</u> to go without for the length of shelter stay (presents as intoxicated or incredibly high
- dependent user= individual uses alcohol/drugs/recreational medication daily and is not able to adequately address personal needs and is not considered a functioning member

of society for that reason (presents as belligerent and not in control of their faculties)

Physical ability (assessment made at time of shelter entry)

- **able bodied=** individual appears not to require special accommodations for basic mobility needs
- impaired= individual presents as having some minor physical requirements (cannot stand unassisted from kneeling position, unable to walk a flight of stairs, etc.) but does not seem to require assistive devices such as canes or walkers
- assistive impaired= individual appears to be able to get around on their own with some help from a cane, walker, walking pole, etc. but does not seem require assistance from care personnel
- assistive dependent= individual appears unable to get around on their own without the use of scooter, wheelchair, walker, etc., and is seems that they may require some assistance from care personnel
- **dependent=** individual is clearly unable to get around on their own and requires a care personnel (would be accompanied by a care professional at the time of entry)

Mental ability (assessment made at time of shelter entry)

- Unchallenged= individual appears to have full mental capacities and does not present as requiring assistance with basic functioning needs
- *Mildly and/or socially challenged=* individual appears to have some limits to basic cognitive function or seems to not pick up on social cues

- Severely challenged= individual appears to have noticeable limits to basic cognitive function or seems to be unable to make clear and safe decisions for themselves
- Incapacitated= individual is clearly unable to make clear and safe decisions for themselves or presents as having no grasp on where they are or what is happening

Language usage

- **Native speaker**= born and raised in the US or another country where English is their first language
- Non-native speaker
- **Fluent=** born in a country where English is not the first language, but the individual can speak English with complete accuracy and comprehension
- **Broken=** born in a country where English is not the first language and the individual can only speak some English with several mistakes and does not appear to have a full comprehension of the English language
- **No English=** born in a country where English is not the first language and the individual cannot speak any English (maybe outside of hello, yes or no)

Cultural stigma

- **Compliant=** individual does not have any reservations or cultural stigmas that will dictate their use of the shelter
- **Questioning=** individual has reservations about using a shelter (this may or may not be related to cultural stigmas)
• **Non-compliant**= individual is not happy with and is reluctant to be in the shelter

To summarize, lowa City needs a fully comprehensive sheltering system to effectively and efficiently handle any and all extreme weather events caused by climate change in the years to come. Because sheltering for prospective extreme weather conditions is sparse and sporadic yet the city is routinely in need of sheltering for members of vulnerable populations, it is our economic and social responsibility to create infrastructure that serves these individuals on a daily basis while simultaneously reserving shelter sources that will be at the ready in the face of climate change effects.

But one size will not fit all. Although Iowa City is a fairly small city, it cannot depend on a single, stadium sized arena in which all demographics are left to fend for themselves. This needs to be a network of interconnected support systems equipped to provide base-line sheltering needs and referral services to a wide variety of individuals in the throes of an even more varied set of circumstances. Therefore, we need to refer back to the previously mentioned events and situations that require sheltering services to define our spatial, service, and personnel needs.

Developing the Bigger Picture: Basic Infrastructure Locations and Spatial Needs

Scale of need and length of stay are both factors that can help determine what size of facility is needed to accommodate the targeted population. Whether or not a particular location can safely and comfortably shelter single individuals or entire families, including residents with pets, will depend on its size. Because lowa City is looking toward a future of reducing urban sprawl and to be able to provide easy access to shelter facilities, these locations need to be dispersed throughout the city while limiting the need for new construction. The spectrum of need, as defined in the previous section, may consider the following locations as potential locations for shelter services:

- Private, non-profit community meeting spaces or businesses
- Private businesses (retail stores, grocers, hotels, mobile home courts, etc.)
- Private religious institutions
- Public libraries and recreation centers
- Public schools
- City and County-owned buildings
- City and County-owned stand-alone structures
- Hospitals and medical clinics
- Sports arenas

Because these efforts are community-centered and welfareproviding, the assumption that private entities should be held responsible to provide assistance should be avoided where possible. Steps can be taken to provide a structured set of guidelines to help in the organization of such a system, but the onus of that particular portion of the implementation plan has to lie with the private institutions themselves. Having that said, private sector allies are vitally necessary in developing an implementation strategy that will work. The Iowa Disaster Human Resource Council (IDHRC) is a collaborative effort between "faith-based, voluntary and government organization active in disaster services to foster a more effective response and recovery for the people of Iowa." Combining the efforts of groups such as Citizen Corps and Iowa's Voluntary Organizations Active in Disasters (VOAD), this council is a beacon of inspiration for private sector disaster recovery efforts. Based out of Johnston, Iowa, it is a state-wide effort where Iowa City could be more effectively served by a locally sourced group. Private homes, businesses and places of worship will vary in size and could be targeted as viable options for a wide range of needs. Available help for 1 person, as in a private home or business or as many as 500, as in larger places of worship and clubhouses, allows private partners to be dispersed throughout the implementation plan.

Likewise, public schools, libraries, recreation centers, and city and/or county-owned facilities will have a wide range of usable space. These locations will require a bit more coordination than other categories in that their providing sheltering services may be appropriate in some conditions and not others. Steps will need to be taken to ensure that the public is fully aware of their rights and responsibilities within these locations. For example, although a school may be opened in the event of a large flood and displacement of hundreds of families, their doors are otherwise locked to ensure the safety of the children. Also, they may open their gymnasiums to the homeless in extreme temperature or weather conditions during the weekend, but it would not be appropriate for transients to simply walk in during school hours to cool or warm themselves. Therefore, although these locations may be larger in size, their sheltering capabilities may be limited for the majority of situations.

Hospitals and medical clinics should only be utilized by those who need or are seeking acute or even chronic medical care. If a resident, whether vulnerable or otherwise, is suffering from an injury, medical condition or appears to be unresponsive, calling 9-1-1 and getting the individual immediate medical care is a better option than simply providing them a location to rest. Both Mercy Hospital of Iowa City and the University of Iowa Hospitals and Clinics will accept walk-ins and referrals for medical attention during extreme weather, disaster, and temperature events. Once there, the individual will be assigned to an Emergency Room social worker where their non-medical related needs can be addressed. The university's Crisis Stabilization Unit (CSU) can provide much needed physical and psychological assistance to victims suffering from the effects of extreme weather. This includes, at minimum, a reclining chair for a 72 hour stay for individuals who do not require psychiatric assistance, but these are limited.[8] It should be noted that good Samaritans, unless trained as emergency responders, should not attempt to force an individual into this type of facility. Calling 9-1-1 if you are truly concerned for someone's health is the best course of action.

The largest options that the city of Iowa City will have in the event of an extreme weather event would be the Kinnick Stadium, Carver Hawkeye Arena, Field House, and the Hawkeye Tennis and Recreation Complex. These can provide space for shelter for 500 + individuals. Kinnick Stadium, because it is uncovered, would be a last resort whereas all other venues could easily provide shelter, heat and cooling if a weather event renders hundreds of residents homeless. Conversely, the smallest units of shelter within Iowa City can be found in bus huts and entrance ways to public buildings. In severe weather, these structures should not be considered shelter; however, they can serve as windbreakers when a person is traveling to an adequate shelter location. The city does not currently have 'bus-hut' types warming or cooling stations, but this idea has been suggested as an option for the city several times.

Developing the Bigger Picture: Consideration of Special Needs and Family Dynamics

When extreme weather conditions force a resident to take shelter in any place other than the comfort of their own home, it puts an incredible amount of stress on that individual. When developing shelter settings, taking the individual's specific needs into consideration can be paramount in making the situation as calm and manageable as possible for everyone. Therefore, Iowa City needs to provide a variety of shelter locations with accommodations for a wide range of needs and family dynamics. An argument can be made that during an extreme weather event or natural disaster, the primary focus should simply be a warm, cool, or dry place to rest. And understandably, these should be the bare minimum of what is provided. But in any traumatic situation, a single element of added comfort or familiarity can significantly alter the experience for both the person suffering and the individuals running the shelters and programs. A research study conducted in New Your City "indicated that poor mental health was correlated with difficulty following rules and a less favorable perception of the shelter's social environment." "In addition, length of time in the shelter was positively correlated with poor mental health..." "The findings from this study support the notion that perception of the social environment of the shelter can affect mental health.

Therefore, when creating any shelter program, care should be taken to understand and support different family structures and dynamics. This includes keeping pet owners with their pets. Not all shelters need to accept pets but an option of at least one would be very beneficial in alleviating family concerns when seeking a shelter location. In a Best Practices manual created by FEMA, reports have shown that many times "if there is no opportunity to bring their pets with them to safety, some pet owners will refuse to evacuate or will

delay evacuation." And the situation is the same for those evacuating from homes and homeless pet parents. An report from Riverside, California interviewed a homeless woman who "became homeless during the five years she's had Roger [a chihuahua/terrier mix], and she sometimes has opted to stay on the streets instead of going to a shelter where dogs aren't allowed." Iowa City is an exemplar in that we have Cooper's House through the Domestic Violence Intervention Program. This allows abuse victims to bring their pets with them into the shelter to incentivize them to leave their abusive situations. We are also fortunate to have an animal shelter in Iowa City that has a disaster strategy in place. In the event of extreme weather events or natural disasters, the shelter is able to shelter a pet for up to 10 days. They provide a Humane Society pamphlet on Disaster Preparedness for Pets and will work with pet parents to provide for their animals. But this takes a toll on the personnel, resources, and supplies of the already near-capacity shelter. A better option would be to provide a location where families can stay together through their trauma no matter how many legs they have.



There are few pet-friendly home shelters in the United States. There are none in lowa and many surrounding states.



A woman with her dog.

Keeping families together is important in times of hardship but so is the ability of an individual to maintain as much of their independence as possible. For residents with severe mental or physical handicaps, specialized care facilities such as rehabilitation centers and hospitals and clinics are better suited for their needs. But what about those who are self-sufficient but still require ADA compatible provisions? This can be simply integrated into setting up the shelter by adhering to ADA compatibility rules and regulations. A key piece to this puzzle will be the communication and transport systems that will need to be fully vetted in the implementation plan. Making sure that people with disabilities are aware of the weather threat and that they are able to get to and access a safe location is the first step in effectively managing their shelter needs.

Finally, no discussion of shelters, whether emergency or homeless, would be complete without addressing those individuals who are

under the influence of alcohol or drugs and people who are on the sex offender registry. It is imperative that these people be viewed through an equity lens and addressed with compassion. Many times, substance abuse is a physical manifestation of an internal trauma and can be exacerbated by a stressful situation. Iowa City's Shelter House accepts those who are under the influence but does not allow drugs or alcohol into their facility. Currently, the city is constructing the JoCo Behavioral Health Access Center which will provide an alternative to being taken into custody for those with public substance abuse issues. This location could also be utilized for relocating these individuals who need access to shelter but are turned away because of their current state. This will likely need to be carried out through law enforcement intervention.

Suggested Next Steps: Building a Shelter Component into the Implementation Plan

Considering these locations will need to vary in size, barriers to entry, and location, it would not be fiscally responsible to build several new shelters from the ground up. Rather, this should be a process of integrating daily with perspective emergency needs to utilize space, money, and resources efficiently. Best practice for any storm or extreme weather sheltering program will be to utilize the shelter network that lowa City already has in place. Using and expanding the metrics provided for evaluating types of shelters and reasons for necessity, the city can simultaneously develop its emergency notification system so that locations, days and times of accessibility can be pushed out to all identified demographics. Each step in developing our shelter network needs to answer the questions:

- Who is the targeted demographic?
- What location(s) will best serve our population?

- What are the possible issues that can arise at this location? How can we solve them?
- How does this shelter fit into the larger network and how does it most effectively communicate with other shelters and their needs?
- When considering the demographic(s) served, what is the best approach to advertising for/educating about/inviting into?
- What are our structural, personnel, and funding needs? How do meet all these needs?

Acknowledging, working alongside, and supporting private sector participation in developing this network should be a priority. Developing a shelter plan that includes shopping malls, places of worship, and local businesses will offset the need for building new structures and help to create an environment of inclusion. If a person feels welcomed at a particular location, they are more likely to return to that place in their time of need. It will also serve the community well to be educated on the limitations of shelter locations. Creating some type of 'sticker' system that can be adhered to a facility's window or front door could be the answer. Much like hours of operation signage, this would be simple and easily understandable to all.

A matrix for size specifications, demographic served, and stipulations to participation needs to be created and categorized by types of sheltering services available. Mapping current locations and identifying regions of need will also need to be done. This step in the process, along with the aforementioned matrix, would fall under the communications plan and will need to be available in multiple languages, including braille and an audio option, to reach out to all members of our community. As templates and points of reference, programs such as the San Francisco Department of Homelessness and Supportive Housing should be carefully evaluated and emulated. Providing transportation option to shelters for those who are unable to travel there on their own should also be integrated into the sheltering plan.

A Bit More About Communications

A sheltering network, no matter how effectively and efficiently planned, is of no good to anyone if no one knows about it. Therefore, Iowa City would benefit greatly by developing and enriching an inclusive, easy to use, and well-orchestrated communication system. To use our time and resources most efficiently, it is important to first determine the *current* assets and plans that are already in place and build a solid, cohesive structure on that foundation. Our current preparedness measures are developed by the Local Emergency Planning Committee (LEPC) in tandem with the Joint Emergency Communication Center (JECC). LEPC includes input from: the Iowa Emergency Response Commission (IERC), various companies overseeing pipelines running through Johnson County, freight railroad companies, Homeland Security, and many others. Resources such as the Special Needs Emergency Registry and the Johnson County Emergency Notification System sign-up forms are currently in place for residents to voluntarily add themselves to a notification list that helps first responders more quickly and accurately assess an individual's needs and more effectively push out warnings of impending dangerous conditions.

The "Reverse 911" emergency notification system, formerly called "Code Red," is in place to sound sirens indicating severe storm weather and tornado activity. But that's not all that it does. It is set

up to push out warnings via telephone, text or call, as well as through emails. It is also our system that includes the Amber Alert for abducted or missing children. Our communication infrastructure is mostly intact, we simply need to flesh it out and polish delivery mechanisms. Adding a personal element such as a coalition of residents that volunteer to make individual calls for warning and reminders would effectively make climate preparedness in Iowa City an example for the nation.

Building and Energy Efficiency

Alignment to the Iowa City Climate Action and Adaptation Plan

Targets

- Existing Buildings: Retrofit 10 percent of all buildings by 2025 and 90 percent by 2050.
- Identify vulnerable populations in Iowa City and develop communications and outreach approach

Actions

- 1.1 Increase Energy Efficiency in Residences
- 4.1 Conduct a Vulnerable Populations Asset Mapping Exercise

Buildings' Efficiencies: Issue and Goals

Energy efficiency is an important aspect of reducing greenhouse gasses, as residential and commercial buildings produce 39% of the nation's Co2 emissions as well as consume 70% of the nation's electricity usage. The largest energy uses in the home are cooling (15%), heating (14%), water heating (12%), lighting (6%), and refrigeration (6%) (EIA). Iowa City's Climate Action plan seeks to retrofit 10 % of existing buildings by 2025 as well as reach 45 to 48% savings in new buildings through new code enforcement. The 2050 goals set out to retrofit 90% of existing buildings and reach 80% energy savings through new code enforcement. Buildings contribute the most in terms of consumption-based greenhouse gas emissions for the city at 68% (Iowa City). Energy efficiency of buildings is an area of the climate action plan that will result in large emissions reductions

as well as added health and social equity effects. Many homes in Iowa City could benefit from weatherization, and such changes would go far in saving energy, as the average yearly savings for a weatherized home is \$284. In comparison, an energy inefficient home could be losing anywhere from \$200-\$400 of the average \$2000 annual energy cost to inefficiencies.

If buildings become more energy efficient, then Iowa City's emissions will decrease greatly. The Climate plan's actions to reach these goals include increasing energy efficiency in homes, using codes to ensure new buildings are energy efficient, as well as increasing on-site renewable energy and the electrification of household tasks such as water heating and space heating. MidAmerican's electricity in the future will be mainly wind and have a very low emission footprint. Since most greenhouse gas (GHG) emissions in Iowa City will be reduced by MidAmerican Energy's use of wind energy, lowering the amount of natural gas used through electrification is the city's primary goal of GHG reduction. Natural Gas is a non-renewable resource, and one that is commonly used in homes for heating and cooking. By switching over to electric sources for these activities, nonrenewable resources could be saved.

Challenges with residential energy efficiency arise with rental housing and lower income residents, as weatherization can be costly and is not a priority of landlords who do not have to pay the electric bill every month. Low income households who may not have the means to weatherize are also negatively affected. Low energy efficiency increases costs for residents and has a positive impact on emission. Lower-income families are susceptible to higher energy bill costs due to lack of weatherization in their homes, which leads to great inequity on spending income on heat and power utility costs. Low-income households spend 16.3% of their income on heating, compared to 3.5% for other households (DOE).

Current and Future Trends, Policy, and Issues

Weatherization is the improvement of a home in terms of efficiency, and can be costly, especially when vulnerable populations disproportionally have less efficient dwellings in need of weatherization. Currently, the federal government employs a weatherization program in which the home is outfitted and insulated using various techniques to weatherize the home. Such techniques include mechanical, building, electric, water, and safety testing measures of heating systems.

Buildings are typically energy inefficient through windows, roofs, walls, doors, and the foundation. Windows alone are responsible for 25-30% of heating and cooling energy loss (DOE). In order to solve for this issue, one must either replace or update their windows. Replacing windows outright can present a large cost barrier and weatherizing existing windows can also be effective if the windows are in good condition. To improve existing windows, the Department of Energy suggests caulking and weather-stripping for homes in the MidWest. Air leaks in a home's construction is a major contributor to energy inefficiencies, and an energy audit is needed in most cases to find the location of leaks. Air leaks are a larger issue of fixing such leaks can be as simple as using caulk on areas of ducting, plumbing, electrical that come through the walls, floors, or ceiling (DOE).

Older homes use more energy per square foot than newer homes, which drives the need to weatherize older homes and why often low-income renters and homeowners living in older homes are so vulnerable. As the chart from the National Home Builder's Association shows, older homes use more energy for heating and cooling, thus the need for weatherization. Homes built before 1940 use the most energy to heat, in part due to different building and energy codes and practices. These old homes should be the target for immediate weatherization action.

Table 4: Average Energy II se on Space Heating and Air-conditioning							
Single-FamilyDetached Homes by Year Built							
	Before 1940	1940-1949	1950-1959	1960-1969	1970-1979	1980-1989	1990-2001
I. Energy consumption per unit in 1000							
Electricity consumed at the residence	5,647	7,993	7,861	9,311	14,906	16,033	13,355
Energy used to generate the electricity	16,882	23,898	23,503	27,838	44,563	47,934	39,928
Other energy used for H VAC	77,482	53,320	51,328	45,104	32,901	31,193	35,249
Total energy used for HVAC	100,011	85,212	82,693	82,254	92,370	95,160	88,531
II. 1000 Btu pers quare foot of heated a						1	
Electricity consumed at the residence	3.98	8.24	6.23	5.95	9.05	8.02	6.65
Energyused to generate the electricity	11.89	24.64	18.63	17.80	27.05	23.98	19.87
Other energy used for H VAC	47.39	38.53	31.80	28.41	19.18	14.52	16.48
Total energy used for HVAC	63.26	71.41	56.67	52.17	55.28	46.52	43.00
Average square feet of heated area	1,974	1,674	1,876	1,883	2,024	2,413	2,578
III. Total consumption by all units in Bill							
Electricity consumed at the residence	63,298	42,424	83,306	77,169	139,875	139,883	127,710
Energyused to generate the electricity	189,242	126,836	249,060	230,713	418,188	418,212	381,818
Other energy used for H VAC	868,539	282,991	543,925	373,809	308,744	272,148	337,078
Total energy used for HVAC	1,121,078	452,251	876,291	681,691	866,807	830,243	846,606
No. single family detached homes (1000	11,210	5,307	10,597	8,288	9,384	8,725	9,563
Other energy includes natural gas, fuel oil, liquified petroleum gas, kerosene, wood, and solar power							

Source: NAHB tabulation of data from the 2001 Residential Energy Consumption Survey, Energy Information Administration.

Spatial Equity

Homes in Iowa City vary by age and therefore the level of vulnerability in terms of energy efficiency. Older homes are located near the downtown area and get newer as the city expands. Many older homes are in vulnerable areas, which makes them a priority when targeting areas for weatherization efforts. The first map shows the residential parcels of the city, along with the year that they were constructed. This map allows for the general trends of home age to be observed for the city. The next map displays older homes made before 1940 on top of the vulnerability index for the city. 1940 was chosen as the cutoff year as homes that are this old use much more energy to heat and cool as compared to homes built in the 21st century.



Homes Built Before 1940 by Vulnerability



Policies and Programs

Residential

The largest weatherization program is the US Department of Energy's Weatherization Assistance Program. They assist low income households with the weatherization process and complete over 35,000 household weatherization's a year through the funding of local programs. Nationally, there are about 20-30 million households that are eligible for weatherization, which is carried out locally. In Johnson county, Hawkeye Area Community Action Program (HCAPS) is the contact for weatherization programs. The weatherization options available include lead-based paint services and Alliant Energy Home Energy Savers program. However, Alliant Energy Homes Energy Savers Program does not service Johnson County, and their website redirects residents to iowacommunityaction.org, which redirects the resident back to HCAPS. HCAPS serves 200 homes annually, and eligibility is determined on income and utility usage. The average first year savings after the program in Iowa City is \$476. This high savings demonstrates the need for weatherization in Iowa City For every dollar spent on the program, there is a \$1.54 return on the investment (DOE). One is automatically eligible if they receive supplemental security income or aid to families with dependent children. Green Iowa Americorps also weatherizes Iowa City through their free program. They conduct an energy audit as well as implement weatherization techniques. The free aspect of the program is important for reaching low income residents who would otherwise not have the resources to weatherize their home on their own.

Building Codes

Iowa City currently has adopted the 2015 International Building Code, the 2015 International residential code, the Iowa state mechanical code, the Iowa state electrical code, and the Iowa state plumbing code. The International Energy Conservation Code is also enforced by the City. The latest edition of the International Energy Conservation Code is expected to be published in late 2019. Such codes are instrumental to the energy efficiency in a home, namely the building code and energy conservation code. Local codes can be stricter than state codes in Iowa, so there is room for the establishment of stronger codes and the future implementation of a net-zero energy code to be phased into use. The updated versions of the international codes are expected to be adopted, but there is still opportunity to amend and expand energy efficiency requirements.

Recommendations

The City of Iowa City, through the initiatives and actions described in the Climate Action Plan, can make policy to address building energy use and efficiency. The weatherization programs can be promoted actively by the city, as there is great room to streamline the energy audit and weatherization process. If Iowa City can promote the utilization of Green Iowa AmeriCorps and HCAPS service to vulnerable homes and the public in general, the goal to retrofit 90% of current buildings by 2050 can be achievable. Targeting the vulnerable populations with older homes should be the first step, as those groups might be less able to set up an audit and act on their own.

Energy efficiency codes can be made more stringent that state codes, so implementing a net-zero policy is both achievable and legal. Iowa City ought to investigate ways on how to phase such a code into the building codes and focus how the same net-zero standards can be phased into existing buildings in the future. New editions of current codes should be adopted as they are published, along with research into amendments to strengthen the energy efficiency of new buildings

Sustainable Lifestyles

Alignment to the Iowa City Climate Action and Adaptation Plan

Targets

- Identify vulnerable populations in Iowa City and develop communications and outreach approach
- Create a culture of sustainability across Iowa City as a general way of life.
- Promoting local food options and considering eating less meat and dairy

Actions

- 4.1 Conduct a Vulnerable Populations Asset Mapping Exercise
- 5.2 Expand Community Gardens and Access to Healthy Local Foods
- 5.3 Encourage the Purchase of Local Products and Responsible purchasing

The Iowa City Climate Action and Adaptation Plan (CAAP) aims to protect vulnerable populations from extreme weather events. A vulnerable population may include senior citizens, minority populations, single-parent households, special needs populations, immigrants, and low-income populations. The CAAP strives to reduce socio-economic vulnerabilities, energy consumption, goods imported into the Iowa City economy (*i.e.*, reduce Iowa City's consumption footprint).

The main objective of this section is to identify establishments that locally source or redistribute food and goods in Iowa City. We aim to promote affordable goods systems and reuse. We also aim to identify where local foods and goods supply systems may be difficult to access, especially in extreme weather situations.

We will address two objectives in the Sustainable Lifestyle section of the Iowa City Climate Action and Adaptation Plan (CAAP):

The Iowa City community can access locally grown produce through a variety of ways, including farmers markets, personal gardening, community-supported agriculture (CSAs), community kitchens, soup kitchens, and selected items at local grocery stores. The municipality also operates a community garden plot leasing program and Beginning Gardening program. There are 197 garden plots available for rent at four locations: Chadek Green Park (fifty-six 10'x20' plots), Kiwanis Park (twenty 10'x20' plots), Reno Street Park (sixteen 10'x20' plots), and Wetherby Park (thirty-seven 10'x50' plots; sixty-eight 10'x23' plots).

You can support local economic development and decrease your greenhouse gas emissions associated with transportation by purchasing local foods and goods as well as more durable products. Sections of lowa City, especially areas found to be socially/climatically vulnerable do not have local and/or second-hand stores nearby. This can be an issue for people without easy access to transportation resources. Eight stores in lowa City sell low cost, redistributed items (consignment and thrift stores). The City of lowa City can help increase the percentage of purchased reused goods as opposed to purchased new products using virgin materials.

Local Food Advocates: Food Policy Councils and Planners

Food policy councils recommend and implement food policy decisions at the local and regional levels (Cotton Dean, 2012). Food policy councils can take many forms, some operate independently of government, while others are housed entirely within government departments. They are made up of a group of stakeholders and representatives from different divisions of the food system. Food policy councils often include justice and anti-hunger advocates, government officials, farmers, grocers, food processors/distributors, and concerned citizens (Harper *et al.*, 2009). Food policy councils were created as a means of analyzing and developing policies and programs for the food system. They engage with government, non-profit projects, local businesses, and food workers. "Instead of many advocates working on the isolated symptoms of a failing food system, Food Policy Councils attempt to establish platforms for coordinated action at the local level" (Harper *et al.*, 2009).

There are four formal food policy councils in Iowa: (1) the Johnson County Food Policy Council, (2) the Linn County Food Systems Council, (3) the Cass County Local Food Policy Council, and (4) the Pottawattamie Local Food Policy Council. In addition to these food policy councils, there are two resources available on food policy in Iowa. Dean (2012) examines the challenges and opportunities of the Iowa Food Policy Council (IFPC), one of the most prominent statelevel food policy councils created. The IFPC became the second statewide food policy council in existence, and it offered a voice for small-scale producers, food justice advocates, and others who represent an alternative to the typical commodity-dominated agricultural interests of Iowa (Cotton Dean, 2012).

The Johnson County Food Policy Council (JCFPC) works to improve communication between community stakeholders and provides advice on food and agriculture issues within the county. In the 2018 Comprehensive Plan, the JCFPC adopted two priority issues: agexemption based on land use rather than minimum acreage size and adoption of a rural agritourism zoning district (JCFPC, 2018). Agexemption is an issue because a farmer operating on less than 40 acres has limited opportunity to build a home or their land or develop important farm infrastructure (JCFPC, 2018). Johnson County needs to define a farm based on land use instead of lot size (JCFPC, 2018). Johnson County also needs creative ideas on how to better support agricultural production of varying scales and variety (JCFPC, 2018). Agritourism zoning is an issue because the current permits only allow for limited operation and can make predictability and growth harder for small producers to project (JCFPC, 2018). Johnson County needs more diverse rural economic development, including a focus on agritourism, in unincorporated areas of the county (JCFPC, 2018).

In 2015, the Johnson County Board of Supervisors created the Local Foods and Planning Specialist position, which is housed in the Planning, Development and Sustainability department. The Board of Supervisors recognized the importance of local foods and the need to develop a community-based food system. The goal is to create a healthy system that reduces resource use, supports worker's rights, and protects the natural environment (JCFPC, 2018). Urban agriculture can help to support resilience within cities by providing additional food sources, increasing urban green spaces, and providing other ecosystem benefits (Demuzerea et al., 2014). There are four community gardens in Iowa City, as well as thirteen local growers. Some of the local growers include Urban Greens, Wilson's Orchard, and Wild Woods Farm. Urban Greens produces microgreens and micro-herbs year-round. Wilson's Orchard provides family fun, apple picking, and local cider. Wild Woods Farm provides sustainable vegetable for Iowa City and the surrounding area. More local urban producers are shown in the ArcMap(s) discussed below.

An additional resource for the City of Iowa City is an Iowa guidebook on municipal zoning for local foods created by Taylor and Vaage (2015a). Their work provides guidance and sample zoning code language designed to increase access to local food and to promote production and sales activities commonly associated with urban agriculture (Taylor & Vaage, 2015a). The guidebook has nine chapters from community gardens and compost to bees and hydroponics. Each chapter has an "Existing Regulations" section, highlighting the commonalities found among municipalities' codes. Depending on the activity, these may include the zoning districts where uses are commonly allowed, the types of operating standards and restrictions that are generally put into place and the accessory or incidental activities generally allowed with the use (Taylor & Vaage, 2015a).

Local Goods Redistribution and Resale Systems

The various goods Americans buy contribute to GHG emissions. Goods can include but are not limited to office supplies, reading materials, personal care and hygiene products, clothing, housewares, and entertainment. Jones and Kammen (2011) compared the carbon footprints of typical United States households in 28 different cities and found that GHG emissions from food (5-7 tCO₂e) and goods (6-8 tCO₂e) are quite consistent across cities.

Americans are increasingly accepting and utilizing secondhand or thrift stores. Norum (2015) found that the desire to donate is positively associated with giving to both charity and secondhand stores. However, one third of surveyed participants disposed of their extra clothing in the trash (Scarborough *et al.*, 2014). This study presented the need to reduce secondhand clothing being sent to the landfill if those goods can be redirected (Norum, 2015).

Today's sustainability defines the models necessary to slow or reverse pollution, conserve natural resources, and protect the environment. AeromatiCo (2018) defines seven R's of sustainability, expanding on the most famous three: reduce, reuse, and recycle. The seven R's consist of rethink, refuse, reduce, repurpose, reuse, recycle, and rot. For example, "refuse" requires a person to refuse single-use plastics and non-recyclable packaging. These principles allow people to continuously think about sustainability, from spring cleaning to grocery shopping.

Iowa City has twelve secondhand stores, including bookstores, antique stores, thrift stores, consignment stores, and other types of stores. People donate and purchase reused items at these stores. They can also shop secondhand at several local online selling platforms. Iowa City residents utilize these platforms:

- 1. <u>Freecycle.org lowa City</u>: a page for giving/receiving free items in a respective town and keeping items out of landfills
- <u>Iowa City Garage Sale Facebook</u>: a public Facebook group for buying/reselling items in Iowa City
- 3. Craigslist Iowa City



The seven R's of sustainability.

Recommended Solution: Local Foods and Goods Database

We created a database consisting of various businesses and establishments in Iowa City that sell locally produced foods and goods and that sell goods secondhand. We created this map in order to put information on businesses selling local food and goods in one place. It is our hope that by consolidating this data, it will be easier for community members to find places to shop that are sustainable and align with their values.

We researched local food and goods establishments in Iowa City through Google, Yelp, Little Village, and Field to Family. All store and business information were stored in a Microsoft Excel workbook. We added 68 stores and organizations to our database.

This database is publicly available through ArcMap Online, so everyone will be able to view it. To access the map, go to <u>https://arcg.is/0Obr0G</u>. Each pop-out box includes information

based on the different types of stores, organizations, or businesses. For example, a restaurant pop-out box includes the name, description, price range, address, website link, and latitude/longitude coordinates.

The database includes the business location, price range information (when available), and types of goods/foods sold. Local restaurants were taken from Field to Family, which has information on locallysourced restaurants in the Iowa City and Cedar Rapids areas. Price range information was taken from the Little Village Magazine, which has pricing information for restaurants in both Iowa City and Cedar Rapids. For businesses not listed in Little Village, Yelp reviews and personal experience were used.

The price index is as follows:

- \$ = \$10 and under
- \$\$ = \$10-\$20
- \$\$\$ = \$20-\$30
- \$\$\$\$ = \$30 and over

Local food in Iowa City can come from a range of sources. There are four community gardens with rental plots available, farmers markets that sell local produce between May and October, and twenty restaurants that sell locally produced food. The majority of locallysourcing restaurants price a typical meal between \$10 to \$20 (65%), followed by \$20 to \$30 (20%). They are mainly located in downtown lowa City, adjacent to the University of lowa.

Local Farms and Stores Data Summary				
Food Establishments				
Item Type	Total	Description		
Community Garden	4	City of Iowa City community garden plots available to the public		
Food Pantry	3	Includes food pantries in Iowa City, on university property, and pantry distributors		
Grocery Store	18	Includes all grocery stores and food co-ops		
Local Farms/Growers	11	Wilson's Orchard		
Restaurant	20	Only restaurants that source at least one menu item with local food or drink		
Goods Establishments				
Item Type	Total	Description		
Other	4	Includes bookstores, antique stores, etc., that source locally or secondhand		
Secondhand Store	8	Includes thrift and consignment stores		
Total	68			



Using the Local Foods and Goods database to get information on Mosley's Barbecue and Provisions.

Vulnerability Analysis

In addition to creating the spatial database, we analyzed spatial trends concerning vulnerability. We had additional concerns about vulnerable populations having access to these businesses, and maps showing where these places fall with respect to various vulnerability indices are shown and discussed below.

Food and goods establishments were mapped overtop both transportation (roads and infrastructure) and floodplain.–100-year and 500-year floods are displayed to analyze businesses that would be inaccessible in the event of a major flood. Five businesses are located within the 100- and 500-year floodplains: three of which are grocery stores and two of which are restaurants. Several businesses and farms were close to the floodplain boundaries.

We also explored these establishments overlaying the social vulnerability index (SoVI) described in Section 2, so we could see whether vulnerable populations have satisfactory access to local/secondhand foods and goods. Quite a bit of area within the city does not have easy access to these goods- most of the locally sourced/second hand businesses and restaurants cluster in the center of Iowa City along the River. Census blocks to the west, northeast, east, and southeast have very few local/secondhand businesses- three blocks only have one business, one block has three, and about seventeen blocks have no local/secondhand businesses. The more vulnerable blocks around the edges of the city often do not have any locally-sourced stores, restaurants, or secondhand stores. Most notably, the red blocks (denoting highest vulnerability to the east and southeast have only one business between them. Additionally, the highly vulnerable block to the west, which is also

surrounded by areas of median vulnerability, also have only one business.



These maps show all food related establishments in Iowa City: community gardens, grocery stores, restaurants that source food locally, food pantries, and local farms. The blue and purple floodplains show the 100-year and 500-year floods for Iowa City. The dark blue lines symbolize the street network.



This map shows all goods related establishments in Iowa City: thrift stores, consignment stores, and other secondhand businesses. The blue and purple floodplains show the 100-year and 500-year floods for Iowa City. The dark blue lines symbolize transport.



This map shows all Iowa City stores and farms overlaying the social vulnerability index—the choropleth color range. The blue and purple floodplains show the 100-year and 500-year floods for Iowa City. This map is zoomed in.

Future Research

<u>Climate conscious ranking system for all Iowa City restaurants and</u> <u>grocery stores</u>

Taking it a step further from recognizing businesses that sell local foods or secondhand goods, the city could create a ranking system for climate-conscious businesses. Climate consciousness is a mindset based on reducing your carbon footprint, greenhouse gas emissions, and waste, ultimately reducing your contribution to climate change. Local and environmental impacts must be accounted for, *e.g.*, sourcing choices, distance traveled by goods, embodied energy, low waste, health impacts, and pricing.



"Meet your milkers" signage and publicity for local farmers in HyVee.

Endorse better labelling to find local, healthy, organic foods in grocery stores

The City of Iowa City could better promote local producers and resources to find locally sourced foods in stores. While labeling systems do exist for local and organic food, it is not always consistent or clear for consumers. The City could urge grocery stores to use a common labelling system for healthy choices. Lastly, the City could promote a single resource for the different labelling systems in different stores. For example, HyVee has different signage and labelling for different events or types of items as shown in figure on the previous page.

Research and map distribution and supply data for establishments

Distribution and supply data would be valuable to show spatial trends throughout the city. Mapping distribution and supply flows could give further insight into where local goods are coming from and where they are ending up. Mapping these trends could also show inefficiencies in the distribution system that the city could address once exposed. In addition, having information on the sourcing of local goods would be a good addition for the informational pop-up in the current Local Foods and Goods database.

Recommendations: Local Foods Passport

A local foods passport would serve as a rewards program for consumers. It could be an application that offers information on businesses and restaurants that source locally, as well as maps that show where resources came from, and where to purchase local foods. Consumers that buy local goods would receive credits that could be exchanged for various rewards such as a free meal or a discount on future purchases. SNAP members could also get benefits and discounts through this passport.

Massachusetts has a plan like this known as HIP: The Healthy Incentives Program. It works by providing additional funds to SNAP participants who buy fruits and vegetables from participating farmers' markets, mobile markets, farm stands, or Community Supported Agriculture farm share programs. Depending on the size of the household, participants can earn between an additional \$40 and \$80 to their regular monthly benefits (CISA, 2019). A system put in place in Iowa City like this could go a long way in promoting healthy, local food to those who truly need it.

Both Seattle and Paris also have local food passport programs aimed at tourists. These programs are advertised as self-guided tours and include maps, tastings, and information about the food and the city. The Paris program ranges from 35 to 45 \in depending on if you purchase 6 or 12 tastings. In Iowa City, we propose a local food and good passport that could have similar levels of mapping and information available, but that serves as more of a rewards program than a tourism hook. Rather than selling tickets and telling consumers where to go, provide a map/list of choices of businesses that are participating in the program. If a consumer shops at one of these businesses they could receive several points, and after receiving a certain number the points can then be redeemed for some sort of incentive.

More research will need to be done exploring potential incentives and rewards that could be provided by the City to participating businesses, businesses that would like to opt in, and participating consumers. Potential participants in this type of program will need to be identified, and businesses will need to be contacted to collect their insights and assess their interest (*e.g.*, secondhand store managers and local co-op managers).

Vehicle Miles Traveled and Electric Vehicles

Alignment to the Iowa City Climate Action and Adaptation Plan

Targets

- Increase community-wide adoption of electric and alternative fuel vehicles.
- Identify vulnerable populations in Iowa City and develop communications and outreach approach.

Actions

- 2.2 Embrace Electric Vehicles, Alternative Fuel Vehicles. And Other Emerging Technologies
- 4.1 Conduct a Vulnerable Populations Asset Mapping Exercise

Background

Reducing greenhouse gas emissions can be achieved through reducing vehicle miles traveled (VMTs). One way to reduce VMTs is through up-zoning – increasing the density of a zone. The Iowa City Comprehensive Plan encourages mixed-use development which can encourage density and intermodal connections. Iowa City has allowed 'granny flats' or accessory units in the Peninsula neighborhood. These 'granny flats' double the density in otherwise single-family zones. Through Minneapolis 2040, Minneapolis' Comprehensive Plan, the City of Minneapolis, Minnesota has gotten rid of their single-family zoning, opting instead to up-zone – allowing up to three dwelling units per lot (also known as triplexes) to be built in residential neighborhoods and high-density buildings along transit corridors. This increases the housing choice and housing supply by allowing multifamily housing on select public transit routes with higher densities along high-frequency routes and near METRO stations. It is important to note that these triplexes are going to be implemented gradually as needed as the city grows. Intermodal connections are another way to reduce VMTs. Intermodal connections are when a person uses two or more modes of transportation to reach their final destination. For example, walking to the bus stop, taking a bus, and walking to your final destination. A small group of graduate students at the University of Iowa worked on shared mobility, electric shuttles and on demand service as a way to reduce VMTs for the Iowa City transportation plan.

The transportation sector makes up for a third of the nation's greenhouse gas emissions, with most of those emissions coming from privately owned vehicles. Specifically, Iowa City's transportation sector makes up for 15 percent of the community's emissions and accounts for the second largest source of the City's emissions, after energy consumption for buildings. According to the Iowa City Climate Action Plan, in order to effectively meet the GHG emissions goals, Iowa City would need to shift 50 percent of trips from conventional personal vehicles to other alternatives. Reducing the total amount of vehicle miles travelled (VMTs) and replacing gas-powered cars by electric vehicles would reduce emissions. However, the City will need to have plans and infrastructure in place to advocate and accommodate for this shift.



The transition to electric vehicles is well underway with more than 1 million electric vehicles operating in the United States as of October 2018[1]. An increasing amount of car manufacturers are responding to this demand and are developing more electric models that are increasingly competitive in cost to conventional combustion engines *(see Table below)*. As a result, the electric vehicle market is expected to see significant growth over the next few years as the vehicles continue to meet consumer needs, provide environmental benefits and support America's energy security. The Edison Electric Institute (EEI) and the Institute for Electric Innovation (IEI) developed a forecast of electric vehicles sales through 2030. The stock of electric vehicles is projected to reach 18.7 million in 2030 as seen in the figure to the right. However, if Iowa City wishes to encourage more electric vehicles, the City will need to have plans and infrastructure in place to properly accommodate and advocate for this increased shift.

Electric Vehicles Models (2017-2019)				
Model	Range (Miles)	Price (\$USD)		
2017				
2017 Mitsubishi i-MiEV	63	\$23,500		
2017 Smart Tortwo electric drive	70	\$25,750		
2017 Ford Focus Electric	76	\$29,120		
2017 Nissan Leaf	107	\$31,000		
2017 Kia Soul EV	93	\$32,250		
2017 FIAT 500e	84	\$32,995		
2017 Chevrolet Bolt	238	\$36,620		
2017 BMW i3	114	\$42,400		
Tesla S 70	234	\$72,700		
Tesla X 75D	238	\$85,500		
Tesla X 90D	257	\$93,500		
Tesla S 100D	360	\$97,500		
Tesla X P100D	289	\$145,000		
2019				
2019 Nissan Leaf	150 - 226	\$30,685		
2019 Hyundai Ioniq Electric	124	\$31,235		
2019 Hyundai Kona Electric	258	\$37,495		
2019 Chevrolet Bolt EV	238	\$37,495		
2019 Tesla Model 3	240 - 310	\$40,700		
2019 BMW i3	153	\$45,445		
2019 Tesla Model S	315 - 335	\$86,200		
2019 Tesla Model X	289 - 295	\$90,700		



Electric Vehicle Stock Forecast (2018-2030)

Current Conditions

Charging stations are needed to provide the convenience of charging for local residents and visitors alike at work, during meetings, running errands, or at a doctor appointment. These charging stations are particularly useful and necessary for people who do not have athome charging stations: students, renters, and visitors.

Electric vehicles do not emit emissions while driving, but they need to be charged which requires a great deal of electricity which is generated from a power plant and if that plant runs on coal and electric vehicle could be just as damaging as a conventional combustion engine. However, the energy companies which serve lowa City have invested in utilizing renewable resources to generate energy to be more environmentally friendly. MidAmerican Energy Company provides rates that are 37 percent below the national average and as of 2016 the company has 48 percent of its energy generation come from wind. Alliant Energy is transitioning to a cleaner mix of energy courses and expanding use of renewable resources.

There are three general levels of charging infrastructure that are commercially available: Level 1 is the cheapest and provides 2 to 5 miles of range per 1 hour of charging time. Level 2 is the most common and provides 10 to 20 miles of range per 1 hour of charging time. Finally, Direct Current (DC) Fast Chargers or Level 3 provides 60 to 80 miles of range per 20 minutes of charging time. Level 3 is the most expensive charging station to purchase.

lowa City currently has 25 Level 2 charging stations around the City. 12 of which are in different municipal parking garages which are available 24 hours, 2 are located at car dealerships and 11 are located at private businesses which some offer 24/7 charging access while other are only available during business hours. Almost all charging stations available to the public are free because non-utility

companies cannot legally charge for the direct sale of electricity, but revenue can potentially be recuperated from parking fees.



Charging stations in Iowa City.



Charging stations in Iowa City (Plug-Share).

<u>Https://www.plugshare.com</u> and <u>https://www.chargepoint.com/</u> are websites that show the location of electric vehicle charging stations, hours of operation, cost, and availability.



Charging stations in Iowa (Charge Point).

Key Barriers for Adoption of Electric Vehicles

Despite the long-term financial benefits that electric vehicles can provide, the assumption of higher upfront price represents a barrier because consumers often do not consider the total cost of ownership when making a vehicle purchase. Electric vehicles provide clear cost savings when it comes to gas, but they also provide an increase in savings for overall ownership. Electric vehicles only contain one moving part while the conventional combustion engine contains dozens and do not need to replace items like fan belts, air filters and cylinder heads and therefore electric vehicle owners avoid many repeated costs associated with combustion engine upkeep. Electric vehicle largest maintenance expense would be replacing the battery because over time batteries degrade and hold less range time. While rare, battery replacements can be costly, but many manufacturers such as Nissan, Chevrolet, and Tesla will over the replacement if the vehicle is under a battery warranty.

There is also concern over at home charging stations and the added cost of not only installation but also added electricity usage they bring for both single- family residential and multi-family residential areas. Charging stations can range in prices dependent on the brand, level of charge, and length of charging cord but most range from \$200 to \$600 plus installation.

One of the most significant barriers to widespread electric vehicle adoption is consumers' "range anxiety." Range anxiety is the concern that during use, the electric vehicle will run out of power before reaching the destination or a suitable charging station. Even with enough charging stations, it may still be challenging for electric vehicle drivers to find a place to charge up because stations can be difficult to locate while driving and not being able look at an app. They can be poorly designed because electric vehicles charging stations need more space around the car in order to provide sufficient space for a person to stand by the charging equipment and operate it which is typically a 3-foot by 3-foot space. Then finally, lack of enforcement for electric vehicle only parking spaces, people are less aware of parking requirements when it comes to charging only spaces verses a handicapped parking spot which is nationally regulated, and more are aware of the penalties associated with parking in one without reason.

The lack of available charging stations in many places and the increase time it takes to recharge an electric vehicle compared to filling a tank of gas is a drawback for many consumers. It is faster and more efficient to pump one gallon of gasoline (about one minute) to go an average of 20-25 miles versus one hour of charging using a Level 2 charger to have 10 - 20 miles of range. Some drivers may not want to take the extra time to charge an electric vehicle or charge more often, instead preferring to use a traditional combustion engine (gasoline-powered) vehicle.

Solutions to Overcome the Key Barriers

A way to offset the high upfront costs and encourage more people to see electric vehicles as a realistic option over a conventional combustion engine is to offer incentives for buying an electric vehicle. The federal government offers a tax credit for purchasing a new electric vehicle. The minimum tax credit ranges from \$2,500 to \$7,500 depending on the battery capacity and vehicle weight. The credit is time-sensitive and will be phased out for each manufacturer when a minimum of 200,000 electric vehicles have been sold in the United States.

States offer a variety of incentives and rebates to encourage electric vehicles and/or electric vehicle charging stations. However, Iowa does not provide any incentives or rebates for electric vehicle

purchase or for installing charging stations. Most of the incentives offered are from private companies such as MidAmerican Energy Company and Alliant Energy which periodically offer incentives or discounts to reduce the cost of purchasing or leasing electric vehicles. ChargePoint, which operates the most open electric vehicle charging stations, periodically provides incentives and discounts for installing charging stations at home. Charging stations are becoming available not only single-family residential homes but also to multi-family residential units. Alliant Energy provides rebates for communities, business and multi-family locations for installing level 2 chargers. ChargePoint also works with property managers to provide charging stations for multi-family residential units for various types of parking situations whether it is assigned parking or shared parking.

A way to minimize range anxiety and improve access to charging infrastructure is through increased development of charging sites and better designs. The key considerations for appropriate design are knowing the number of charging stations needed, where the stations should be and the desired level of power. A way for Iowa City to determine the need is through The Department of Energy which broadly estimates the number of charging stations needed and what level based on the potential number of electric vehicles and the current infrastructure in place. While Iowa City has enough charging stations to meet the current demand of electric vehicles, they are all level 2 and none are DC fast chargers. According to the Department of Energy, planners should prioritize fast charging infrastructure first to establish a fast charging network and then level 2 stations second. DC Chargers should be prioritized to establish a fast charging network to enables charging safety nets and provide charging for drivers without home charging stations which is critical to support all electric vehicles who have no other alternative for quickly extending their driving range.

Signage for electric vehicle charging stations is an important consideration to signal electric vehicle charging stations. Increased or improved signage helps to optimize the use of the charging stations and provide information on regulations on time limits which facilitate enforcement of these spaces. This also promotes awareness and visibility among the public by helping to make prospective electric vehicle drivers aware of available charging infrastructure.



Examples of various electric charging station signage across Iowa City.

City already. Possible locations for the DC Fast Charger could include in downtown lowa City or at an already-established gas station less than one mile from the interstate. This would provide easy access to users and existing signage for the gas station could be utilized to advertise the charger.

Increase the signage around the charging station parking spot but also indicate charging stations outside of the parking garages. Drivers should be able to easily see where charging stations are and an increase similar signs will be easy indicators.

There should be a way for drivers to reserve electric vehicle chargers. ChargePoint already provides this service – a person can reserve a spot at an electric vehicle charger. This site also lets users pay with a ChargePass card. Rates vary, and reservations can be cancelled.

Recommendations

Per the Department of Energy's general recommendation based on electric vehicle volume, Iowa City needs one DC Fast Charger. This will be a draw for visitors to the City, those just passing through, and for local residents. Visitors and locals can get a quick vehicle charge while at an appointment, meeting, or sporting event and people just passing through the City can stop off to get a quick charge before heading back out onto the interstate. Iowa City can advertise itself as an 'EV Fast-Charge Stop'. Since it is the most expensive, the City should investigate funding options or potentially partner with ChargePoint since the company has multiple stations throughout the

Glossary

Climate Change – The process in which the Earth is growing warmer due the release of carbon dioxide associated with human activity. A warmer climate means that there will be more high temperature days in Iowa City.

Climate Conscious – A mindset based on reducing your carbon footprint, greenhouse gas emissions, and waste, ultimately reducing your contribution to climate change.

GIS (Geographic Information Systems) – Software used by planners, engineers, geographers, and other professions to identify characteristics and patterns as they occur across space.

Polar Vertex (pl. Vertices) – The phenomenon in which due to overall warmer temperatures, the Jet Stream is drastically weakened. This means that frigid polar can travel further south than historically precedented.

Proxy – When data for a desired variable is not obtainable, another variable expected to follow the same patterns is used in its place.

Social Vulnerability Index (SoVI) - A multifaceted index that computes susceptibility to hazards based on factors including race, gender, income, age, and other factors that may increase or decrease the ability of an individual or population to cope with external pressures.

Thermal Radiation – A type of radiation, or emission of electromagnetic wave, due to heat from a given material. Special instruments are used to measure thermal radiation, allowing temperature variations to be calculated.

Urban Heat Island Effect – The phenomenon in which the temperature in urbanized areas is higher than areas with less intense development. This means that in a city's downtown area, the temperature is higher than in its suburbs and exurbs. This is because surfaces such as pavement absorb heat and do not allow rainwater to penetrate.

Vulnerable Population – Senior citizens, minority populations, single-parent households, special needs populations, immigrants, and low-income populations.

Appendices

Appendix: Approaches to Assessing Climate Change Vulnerability

Academic Approach: Social Vulnerability Index (SoVI)

In "Social Vulnerability to Environmental Hazards", Cutter, et al. developed a Social Vulnerability Index (SoVI) for the United States calculated from county-level socioeconomic and demographic data (Cutter, Boruff, & Shirley, 2003). Eleven factors of social vulnerability to environmental hazards were determined from factor analytic analysis (Cutter, Boruff, & Shirley, 2003):

- Personal wealth
 - Measured through per capita income
- Age
 - Measured through median age
- Density of the built environment
 - Measured by the number of commercial establishments per square mile
- Single-sector economic dependence
 - Measured by the percentage of employment in extractive industries
- Housing stock and tenancy
 - Measured by the percentage of housing units that are mobile homes
- Race African American
 - Measured by the percentage of African American
- Ethnicity Hispanic
 - Measured by the percentage of Hispanic
- Ethnicity Native American
 - o Measured by the percentage of Native American
- Race Asian
 - o Measured by the percentage of Asian
- Occupation
 - \circ $\;$ Measured by percentage of employment in service occupations
- Infrastructure dependence
 - Measured by the percentage of employment in transportation, communication, and public utilities

Municipal Approach: The City of Minneapolis Climate Change Vulnerability Assessment

Through the Public Health Institute (PHI) Climate Learning Collaborative Grant from the Center for Climate Change & Health, the City of Minneapolis developed a project in October 2015 to address climate change (City of Minneapolis, 2018). The project was executed according to the following three phases (City of Minneapolis, 2018):

- 1. A Climate Change Vulnerability Assessment was conducted to identify neighborhoods vulnerable to climate change
- 2. Based on the Climate Change Vulnerability Assessment, three neighborhoods were selected for community outreach and engagement with partnering community organizations
- 3. The community outreach and engagement events were evaluated, and neighborhood-specific climate resiliency recommendations were prepared for policy makers

The City of Minneapolis Office of Sustainability collaborated with University of Minnesota School of Public Affairs Urban and Regional Planning graduate students to complete the Climate Change Vulnerability Assessment (City of Minneapolis, 2018). Their Assessment identified both social and built environment vulnerability to climate change events, such as extreme heat and flooding, and provided the data for an online mapping tool, Neighborhoods at Risk (The University of Minnesota Humphrey School of Public Affairs). The Climate Change Vulnerability Assessment performed included the following social vulnerability metrics at the U.S. Census tract level (The University of Minnesota Humphrey School of Public Affairs):

- Poverty
- People of Color
- Disability
- Limited English Proficiency
- Older Population
- Young Children
- Renters
- No Vehicle Access
- Air Conditioning



The City of Minneapolis' "Neighborhoods at Risk" online mapping tool

Comparing the Academic and Municipal Approaches

To perform a climate change vulnerability assessment for lowa City, the municipal approach with the work completed by the City of Minneapolis was referenced as it is more suitable in terms of geographic compatibility and technical practicality than the academic approach. Cutter, et al. provided the foundations for assessing vulnerabilities at a county-level but it is uncertain whether the factors can also be applied at the city, or more specifically at the neighborhood, level. Additionally, several of Cutter, et al.'s factors are difficult to obtain at the city or neighborhood level, such as single-sector economic dependence, occupation, and infrastructure dependence. Unlike Cutter, et al.'s approach, the indicators used by the Minneapolis Climate Change Vulnerability Assessment not only parallel those of a 2014 Minnesota Department of Health climate vulnerability assessment but were also adapted for the geographic scale of the City of Minneapolis and reviewed by various City of Minneapolis staff (The University of Minneapolis Climate Change Vulnerability Assessment was used as a reference for the lowa City climate change vulnerability assessment.

Appendix: Iowa City Climate Change Vulnerability Assessment Methodology

The following data sources and methodology were adapted from "Technical Report: Minneapolis Climate Change Vulnerability Assessment" (The University of Minnesota Humphrey School of Public Affairs). The Geographic Information System (GIS) tool used for the vulnerability assessment is ESRI ArcMap.

TIGER/Line with Selected Demographic and Economic Data census block group geodatabase from the U.S. Census served as the main source of data. The geodatabase contains the 2016 TIGER/Line shapefiles of Johnson County, Iowa block groups and census data from the 2012-2016 American Community Survey (ACS) 5-year estimates. The download is available at https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-data.html.

Vulnerability	2012-2016	2012-2016 ACS 5-year estimates Code	Calculation Performed to Develop the Vulnerability
Indicator	ACS 5-year	Description	Indicator
	estimates		
	Code		
Rent-Burden	B25071e1	Median Gross Rent As A Percentage Of	No Additional Calculations Were Performed As The Data
		Household Income In The Past 12 Months	Were In Percentages.
		(Dollars): Total: Renter-Occupied Housing	
		Units Paying Cash Rent (Estimate)	
No Vehicle	B25044e1	Tenure By Vehicles Available: Total:	(B25044e3 + B25044e10) /
Access		Occupied Housing Units (Estimate)	B25044e1
			Tenure By Vehicles Available: Owner Occupied: No Vehicle Availa-
			bie: Occupied Housing Units (Estimate) + Tenure By Venicles
			Available: Renter Occupied: No Venicle Available: Occupied Hous-
			ing Units (Estimate) / Tenure By Vehicles Available: Total: Occu-
			pied Housing Units (Estimate)
Limited	C16002e1	Household Language By Household Limited	(C16002e4 +
English		English Speaking Status: Total: Households	C16002e7 +
Speakers		(Estimate)	C16002e10 +
		\/	C16002e13) /

Eight of the nine vulnerability indicators were constructed from the following 2012-2016 ACS 5-year estimates:

			C16002e1
			Household Language By Household Limited English Speaking Sta- tus: Spanish: Limited English Speaking Household: Households (Estimate) + Household Language By Household Limited English Speaking Status: Other Indo-European Languages: Limited English Speaking Household: Households (Estimate) + Household Language By Household Limited English Speaking Sta- tus: Asian And Pacific Island Languages: Limited English Speaking Household: Households (Estimate) + Household Language By Household: Households (Estimate) + Household Language By Household Limited English Speaking Status: Other Languages: Lim- ited English Speaking Household: Households (Estimate) / Household Language By Household Limited English Speaking Status: Total: Households (Estimate)
Poverty	B17021e1	Poverty Status Of Individuals In The Past 12 Months By Living Arrangement: Total: Population For Whom Poverty Status Is Determined (Esti- mate)	B17021e2 / B17021e1 Poverty Status Of Individuals In The Past 12 Months By Living Ar- rangement: Income In The Past 12 Months Below Poverty Level: Population For Whom Poverty Status Is Determined (Estimate) / Poverty Status Of Individuals In The Past 12 Months By Living Ar- rangement: Total: Population For Whom Poverty Status Is Deter- mined (Estimate)
Race	B02008e1, B02009e1, B02010e1, B02011e1, B02012e1	White Alone Or In Combination With One Or More Other Races: Total: White Alone Or In Combination With One Or More Other Races (Estimate) Black Or African American Alone Or In Combina- tion With One Or More Other Races: Total: Black Or African American Alone Or In Combination With One Or More Other Races (Estimate) American Indian And Alaska Native Alone Or In Combination With One Or More Other Races: To- tal: People Who Are American Indian Or Alaska	B02009e1 + B02010e1 + B02011e1 + B02012e1 / (B02008e1 + B02009e1 + B02010e1 + B02011e1 + B02012e1) (Black Or African American Alone Or In Combination With One Or More Other Races: Total: Black Or African American Alone Or In Combination With One Or More Other Races (Estimate) + American Indian And Alaska Native Alone Or In Combination With One Or More Other Races: Total: People Who Are American Indian Or Alaska Native Alone Or In Combination With One Or More Other Races (Estimate) +

		Native Alone Or In Combination With One Or More Other Races (Estimate) Asian Alone Or In Combination With One Or More Other Races: Total: Asian Alone Or In Com- bination With One Or More Other Races (Esti- mate) Native Hawaiian And Other Pacific Islander Alone Or In Combination With One Or More Other Races: Total: Native Hawaiian And Other Pacific Islander Alone Or In Combination With One Or More Other Races (Estimate)	Asian Alone Or In Combination With One Or More Other Races: To- tal: Asian Alone Or In Combination With One Or More Other Races (Estimate) + Native Hawaiian And Other Pacific Islander Alone Or In Combina- tion With One Or More Other Races: Total: Native Hawaiian And Other Pacific Islander Alone Or In Combination With One Or More Other Races (Estimate)) / (White Alone Or In Combination With One Or More Other Races: Total: White Alone Or In Combination With One Or More Other Races (Estimate) + Black Or African American Alone Or In Combination With One Or More Other Races: Total: Black Or African American Alone Or In Combination With One Or More Other Races (Estimate) + American Indian And Alaska Native Alone Or In Combination With One Or More Other Races: Total: People Who Are American Indian Or Alaska Native Alone Or In Combination With One Or More Other Races (Estimate) + Asian Alone Or In Combination With One Or More Other Races: To- tal: Asian Alone Or In Combination With One Or More Other Races (Estimate) + Native Hawaiian And Other Pacific Islander Alone Or In Combina- tion With One Or More Other Races: Total: Native Hawaiian And Other Pacific Islander Alone Or In Combination With One Or More Other Races (Estimate)
Under 5	B01001e1 B01001e3 B01001e27	SEX BY AGE: Total: Total population (Estimate) SEX BY AGE: Male: Under 5 years: Total popula- tion (Estimate) SEX BY AGE: Female: Under 5 years: Total popu- lation (Estimate)	(B01001e3 + B01001e27) / B01001e1

Elderly Over 65B01001e1SEX BY AGE: Total: Total population (Estimate)65B01001e20 B01001e21 B01001e22 B01001e23 B01001e24 B01001e25SEX BY AGE: Male: 65 and 66 years: Total population (Estimate) SEX BY AGE: Male: 67 to 69 years: Total population (Estimate)801001e24 B01001e25SEX BY AGE: Male: 70 to 74 years: Total population (Estimate)801001e44 B01001e45SEX BY AGE: Male: 70 to 74 years: Total population (Estimate)801001e45 B01001e46SEX BY AGE: Male: 75 to 79 years: Total population (Estimate)801001e47 B01001e48 B01001e49SEX BY AGE: Male: 80 to 84 years: Total population (Estimate)SEX BY AGE: Female: 65 and 66 years: Total population (Estimate)SEX BY AGE: Female: 67 to 69 years: Total population (Estimate)SEX BY AGE: Female: 67 to 69 years: Total population (Estimate)SEX BY AGE: Female: 70 to 74 years: Total population (Estimate)SEX BY AGE: Female: 75 to 79 years: Total population (Estimate)SEX BY AGE: Female: 75 to 79 years: Total population (Estimate)SEX BY AGE: Female: 75 to 79 years: Total population (Estimate)SEX BY AGE: Female: 75 to 79 years: Total population (Estimate)SEX BY AGE: Female: 80 to 84 years: Total population (Estimate)SEX BY AGE: Female: 85 years and over: Total population (Estimate)SEX BY AGE: Female: 85 years and over: Total population (Estimate)	((B01001e20 + B01001e21 + B01001e22 + B01001e23 + B01001e24 + B01001e44 + B01001e45 + B01001e45 + B01001e47 + B01001e48 + B01001e49)) / B01001e1 ((SEX BY AGE: Male: 65 and 66 years: Total population (Estimate) + SEX BY AGE: Male: 70 to 74 years: Total population (Estimate) + SEX BY AGE: Male: 75 to 79 years: Total population (Estimate) + SEX BY AGE: Male: 80 to 84 years: Total population (Estimate) + SEX BY AGE: Male: 85 years and over: Total population (Estimate) + SEX BY AGE: Male: 85 years and over: Total population (Estimate) + SEX BY AGE: Female: 65 and 66 years: Total population (Estimate) + SEX BY AGE: Female: 65 and 66 years: Total population (Estimate) +

			SEX BY AGE: Female: 70 to 74 years: Total population (Estimate) + SEX BY AGE: Female: 75 to 79 years: Total population (Estimate) + SEX BY AGE: Female: 80 to 84 years: Total population (Estimate) + SEX BY AGE: Female: 85 years and over: Total population (Estimate))) / SEX BY AGE: Total: Total population (Estimate)
Disability	B23024e3 B23024e18 B23024e2	Poverty Status In The Past 12 Months By Disabil- ity Status By Employment Status For The Popula- tion 20 To 64 Years: Income In The Past 12 Months Below Poverty Level: With A Disability: Population 20 To 64 Years For Whom Poverty Status Is Determined (Estimate) Poverty Status In The Past 12 Months By Disabil- ity Status By Employment Status For The Popula- tion 20 To 64 Years: Income In The Past 12 Months At Or Above Poverty Level: With A Disa- bility: Population 20 To 64 Years For Whom Pov- erty Status Is Determined (Estimate) Poverty Status In The Past 12 Months By Disabil- ity Status By Employment Status For The Popula- tion 20 To 64 Years: Income In The Past 12 Months By Employment Status For The Popula- tion 20 To 64 Years: Income In The Past 12 Months Below Poverty Level: Population 20 To 64 Years For Whom Poverty Status Is Determined (Estimate)	(B23024e3 + B23024e18) / B23024e2 (Poverty Status In The Past 12 Months By Disability Status By Em- ployment Status For The Population 20 To 64 Years: Income In The Past 12 Months Below Poverty Level: With A Disability: Population 20 To 64 Years For Whom Poverty Status Is Determined (Esti- mate) + Poverty Status In The Past 12 Months By Disability Status By Em- ployment Status For The Population 20 To 64 Years: Income In The Past 12 Months At Or Above Poverty Level: With A Disability: Pop- ulation 20 To 64 Years For Whom Poverty Status Is Determined (Estimate)) / Poverty Status In The Past 12 Months By Disability Status By Em- ployment Status For The Population 20 To 64 Years: Income In The Past 12 Months Below Poverty Level: Population 20 To 64 Years For Whom Poverty Status Is Determined (Estimate)

Central air conditioning data in an Excel spreadsheet format were obtained from the City of Iowa City's Assessor Office. Non-residential properties, such as commercial or industrial, were removed. The spreadsheet contains the property parcel number and whether the property has main air conditioning (coded 0 for no and 1 for yes), among other characteristics. Properties with more than one building unit, such as an apartment

complex, are recorded multiple times in the spreadsheet. For example, 100 Main Street Apt. 1 and 100 Main Street Apt. 2 are separate entries with the same property parcel number were consolidated so that only one record exists for each property parcel number. This process of removing duplicates is to ensure that each property entry in the spreadsheet can be joined in ArcMap to a shapefile of Johnson County parcels with the corresponding property parcel number. The Johnson County property parcels were obtained from the University of Iowa shared GIS repository. Using ArcMap, after the Excel spreadsheet was joined to the Johnson County property parcels shapefile was spatially joined to the Iowa City census block groups. Two fields were created during the spatial join process: one was the count of the property parcels with air conditioning and the other was the sum of the property parcels without central air conditioning, first divide the sum field by the count field and then subtract one.

The Z scores for each of the nine vulnerability indicators per Iowa City census block group were then calculated using the following equation:

$$Z \ score = \frac{(X-\mu)}{\sigma},$$

where X is the value of a vulnerability indictor of a census block group, μ is the citywide mean of a vulnerability indicator, and σ is the citywide standard deviation of a vulnerability indicator. Transforming the vulnerability indicators into a Z score standardizes the values for visualizations and calculations, where one standard deviation is equal to 1, two standard deviations is equal to 2, etc. (The University of Minnesota Humphrey School of Public Affairs)

For visualization purposes, the following Python code can be used in the Field Calculator in ArcMap to classify the calculated Z scores for each census block group into 6 categories. Each of the nine vulnerabilities can then be symbolized on the same standard scale.

Z-Score	Classification
Z Score >= 2	"> 2 SD Above Mean"
Z Score >= 1 AND Z Score < 2	"1-2 SD Above Mean"
Z Score >= 0 AND Z Score < 1	"< 1 SD Above Mean"
Z Score >= -1 AND Z Score < 0	"< 1 SD Below Mean"
Z Score >= -2 AND Z Score < -1	"1-2 SB Below Mean"
Z Score < -2	"> 2 SD Below Mean"

1.	det Reclass(input):
2.	if (input >= 2):
3.	return "Greater Than 2 SD Above Mean"
4.	<pre>elif (input < 2 and input >= 1):</pre>
5.	return "1 - 2 SD Above Mean"
6.	<pre>elif (input >= 0 and input < 1):</pre>
7.	return "Less Than 1 SD Above Mean"
8.	<pre>elif (input >= -1 and input < 0):</pre>
9.	<pre>return "Less Than 1 SD Below Mean"</pre>
10.	<pre>elif (input >= -2 and input <= -1):</pre>
11.	<pre>return "1 - 2 SD Below Mean"</pre>
12.	<pre>elif (input < -2):</pre>
13.	return "Greater Than 2 SD Below Mean"
14.	else:
15.	return "No Classification"

To compute the final climate change vulnerability score, the Z scores of each vulnerability indicator per census block group were reclassified along a 1 to 6 scale with the following Python code using the Field Calculator in ArcMap. A score of 6 indicates the highest vulnerability and a score of 1 indicates the lowest vulnerability. After the reassignment, the Field Calculator was used to sum each of reclassified census block group score into a final climate change vulnerability score.

Z-Score	Classification
Z Score >= 2	6
Z Score >= 1 AND Z Score < 2	5
Z Score >= 0 AND Z Score < 1	4
Z Score >= -1 AND Z Score < 0	3
Z Score >= -2 AND Z Score < -1	2
Z Score < -2	1

- 1. def Reclass(input):
 2. if (input >= 2):
 3. return 6
 4. elif (input < 2 and input >= 1):
- 5. return 5
- 6. elif (input >= 0 and input < 1):</pre>
- 7. return 4

```
8. elif (input >= -1 and input < 0):
9. return 3
10. elif (input >= -2 and input <= -1):
11. return 2
12. elif (input < -2):
13. return 1
14. else:
15. return 0
```

There are limitations of the data sources and the methodology used to compute Iowa City's climate change vulnerability. First, the U.S. Census block groups do not fit neatly within the boundaries of the City of Iowa City and so they were clipped to be contained within Iowa City boundaries. Doing so results in small portions of larger block groups that are maintained within Iowa City and they misrepresent data when symbolized as the smaller remnants do not proportionately represent their larger whole. Second, the 2012-2016 ACS 5-year estimates contain margins of error which were not analyzed or incorporated and could potentially affect the calculation of the vulnerability scores. Third, the air conditioning data from the Iowa City Assessor is not complete as there are properties that may not be included or assessed for central air conditioning. Fourth, the choice of variables from the 2012-2016 ACS 5-year estimates may not be the most accurate representation of the social vulnerability indicator at the census block group level; additional 2012-2016 ACS 5-year estimate variables may be considered for future use. Fifthly, there is risk of double counting certain vulnerable populations and indicators as well as confounding among correlated variables which was not teased out by principal component analysis (The University of Minnesota Humphrey School of Public Affairs).
Appendix: Climate Change Communication and Outreach and Engagement Resources

Suggested climate change communications training materials for the Neighborhood Climate Partners and the City-wide Climate Coordinator before conducting climate change community engagement and outreach include the following:

- "Communicating Materials on Climate Change, Health, and Populations of Concern: Summary Points from the U.S. Climate and Health Assessment" (U.S. EPA)
 - 8 vulnerable populations
 - Children
 - Communities with Environmental Justice Concerns
 - Indigenous Peoples
 - Occupational Groups
 - Older Adults
 - People with Disabilities
 - People with Existing Health Conditions
 - Pregnant Women
- "ICLEI Resource Guide: Outreach and Communications" (ICLEI Local Governments for Sustainability, 2009)
- "Let's Talk Climate: Messages to Motivate Americans" (Krygsman, Speiser, & Perkowitz, 2015)
 - Especially the sections on how to communicate to minority populations, such as African Americans and Hispanic/Latino Americans
- "Let's Talk Communities & Climate: Communication Guidance for City and Community Leaders" (Krygsman & Speiser, 2016)

Neighborhood Climate Partners, in addition to city-wide community organizations and Neighborhood Associations, are suggested to reference "Ready, Set, Go! Community-Based Organizations Emergency Preparedness Toolkit" (Ahmed, et al.).

Neighborhood Climate Ambassadors are suggested to review the following materials on general climate change information, climate change communication, and latest city government climate change actions and to adapt the resources for their specific community and neighborhood for use in community outreach and engagement:

- General Climate Change Information
 - "Ready & Resilient: A Guide to Extreme Weather for Saint Paul Residents" (Burlager & Sanders-Reed, 2014)
- Climate Change Communication
 - "Let's Talk Climate: Messages to Motivate Americans" (Krygsman, Speiser, & Perkowitz, 2015)
 - Especially the sections on how to communicate to minority populations, such as African Americans and Hispanic/Latino Americans
- Local Government Climate Action Updates
 - Reviews of City Council resolutions, climate projections, climate action updates, and community greenhouse gas inventories (City of Austin)

Suggested climate change community engagement and outreach events and activities for Neighborhood Climate Partners and the City-wide Climate Coordinator include the following:

- o Events
 - City of Cleveland, Ohio "Cleveland Climate Fairs" (Cleveland Neighborhood Progress; City of Cleveland, Mayor's Office of Sustainability; Cleveland Urban Design Collaborative; University at Buffalo; Kent State University, 2015)
 - An event with interactions with climate action program coordinators, opportunities to join the leadership development program and green jobs training, and trainings on emergency response, urban agriculture, and home weatherization. Free childcare, free transportation, and free lunch are provided.
 - City of Baltimore, Maryland "Make a Plan. Build a Kit. Help Each Other" campaign launch (Baja, 2014)
 - The campaign focused on preparing families and individuals for natural hazards and climate change events in the Mid-Atlantic and Northeast regions. The launch of the campaign was held at the Commission on Sustainability's annual Town Hall event in a community vulnerable to extreme heat. Advertisement for the event was through neighborhood group leaders, the City website, social media, and flyers around the community. Residents walked to the meeting or were provided with free public transportation. There were three interactive components for participants: emergency plan development, emergency kit making (hand-crank radios, flashlights with batteries, water bladders, emergency whistles, first aid kits), and community asset and shortcomings identification. Additional features include a "Help/Safe Card", a piece of cardboard with the word "Help" painted in orange on one side and "Safe" painted in green on the other side, to place in windows during emergencies to communicate safety status. Four questions were asked before and after the event to measure the success of the event: "Do you know what natural hazards are most likely to occur in your neighborhood?", "Do you have an emergency plan?", "Do you have an emergency kit?", "Have you taken action to help your community prepare?". Event participants indicated their gained knowledge through placing dots in a "yes" or "no" category for the four questions and many left the event with an emergency plan and a kit. Health, safety, savings, and comfort were that residents were able to connect with the most. After the initial campaign event, five more events were scheduled, and additional events were planned.
- o Mobile Events
 - City of Escondido, California "The Mobile Community Workshop" (Ascent Environmental, Inc., 2018)
 - A table display with flyers and brochures, posters, and an interactive survey. City staff may also develop a 10 to 15 minutes workshop for small groups at community events.
 - City of Cleveland, Ohio "Cleveland Green Party Crasher Program" (Cleveland Neighborhood Progress; City of Cleveland, Mayor's Office of Sustainability; Cleveland Urban Design Collaborative; University at Buffalo; Kent State University, 2015)
 - Climate ambassadors attend neighborhood celebrations and events to inform on climate change and community resilience in a "fun and accessible way".

- City of Philadelphia, Pennsylvania "Kits for Loan from the Franklin Institute" (Climate & Urban Systems Parternship)
 - Mobile activity kits to simulate heavy rainfall with "Ready Row Home: Preparing for a Wetter Philadelphia" and hotter days with "Ready Row Home: Preparing for a Hotter Philadelphia".

The American Planning Association (APA) awarded the North Jersey Transportation Authority (NJTPA) the 2018 National Planning Achievement Award for Public Outreach Silver award for their "Engage!" public involvement database (American Planning Association). NJTPA spent two years to research outreach activities in planning organizations and recorded over 400 public engagement activities. The online database allows users to filter outreach activities based on audience (such as low income, minorities, immigrants and limited English persons, children and teens, senior citizens, and people with special needs), scope (from neighborhood to state), and timeframe (from less than one month to ongoing.

Appendix: Examples of Projects for Climate Action Fund

In the City of St. Paul, funding from the Great Lakes Integrated Sciences + Assessments (GLISA), an organization between the University of Michigan and Michigan State University, supported the development of climate adaptation projects from low income and historically marginalized communities such as the following (McLaughlin, 2015):

- community networks to support those vulnerable to heat waves
- emergency kits for children and the elderly that include first aid supplies, face masks, wet wipes, hand sanitizers, flashlights, and coloring books and markers for children
- a green newspaper to report on climate change heroes and actions to help neighbors
- vermicomposting system
- interactive displays instructing how to create emergency kits
- listening sessions with elders on their experiences with extreme weather events
- climate change adaptation curriculum at a juvenile detention center
- towers to provide habitats for chimney swifts, a bird to east mosquitos to prevent vector diseases

References

Climate Change Vulnerability Assessment

AAhmed, H., Brodsky, L., Drews, M., Gieseke, J., Henslee, K., Kafumbe, N., . . . Schweizer, M. (n.d.). Ready, Set, Go! Community-Based Organizations Emergency Preparedness Toolkit. Minneapolis-St. Paul Metropolitan Medical Response System (MMRS); Bloomington Public Health. Retrieved from https://www.bloomingtonmn.gov/sites/default/files/media/cover_acknowledgments_toc_preface.pdf

American Planning Association. (n.d.). National Planning Achievement Awards 2018. Retrieved from American Planning Association: https://www.planning.org/awards/2018/achievement/

Ascent Environmental, Inc. (2018). Community Outreach Plan for the Climate Action Plan Update. City of Escondido. Retrieved from https://www.escondido.org/Data/Sites/1/media/PDFs/Planning/ClimateActionPlan/CAPUpdate/EscondidoCAP_CommunityOutreachPlan_FINAL .pdf

Baja, K. (2014, August 07). Building community conversations around preparedness in Baltimore. Retrieved from Climate Access: https://climateaccess.org/blog/building-community-conversations-around-preparedness-baltimore

Burlager, S., & Sanders-Reed, A. (2014). Ready & Resilient: A Guide to Extreme Weather for Saint Paul Residents. Macalester College, the Science Museum of Minnesota, City of St. Paul. Retrieved from https://www.macalester.edu/readyandresilient/resources/ReadyandResilientPrimer.pdf

City of Cleveland. (n.d.). Neighborhood Climate Action Toolkit: An Assets-Based Approach to Building Thriving and Healthy Neighborhoods in Cleveland. Retrieved from

https://d3n8a8pro7vhmx.cloudfront.net/sustainablecleveland/pages/149/attachments/original/1462888931/NEIGHBORHOOD_CLIMATE_ACTIO N_TOOLKIT-FINAL.pdf?1462888931

City of Minneapolis. (2018, October 23). Climate Change Resiliency. Retrieved from Minneapolismn: http://www.ci.minneapolis.mn.us/health/preparedness/climate

City of Minneapolis. (2018, December 31). Climate Change Vulnerability Assessment & Resilience. Retrieved from Minneapolismn: http://www.ci.minneapolis.mn.us/sustainability/climate-prep/vulnerability-assessment

Cleveland Neighborhood Progress; City of Cleveland, Mayor's Office of Sustainability; Cleveland Urban Design Collaborative; University at Buffalo; Kent State University. (2015). Cleveland Climate Resilience & Urban Opportunity Plan. Retrieved from http://www.clevelandnp.org/wp-content/uploads/2018/09/Final-Implementation-Plan_CNP2.pdf

Climate & Urban Systems Parternship. (n.d.). Philadelphia. Retrieved from Climate & Urban Systems Parternship: http://www.cuspproject.org/cities/philadelphia#.XMjGG-hKhPZ

Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social Vulnerability to Environmental Hazards. Social Science Quarterly, 84(2), 242-261. Retrieved from https://doi-org.proxy.lib.uiowa.edu/10.1111/1540-6237.8402002

ICLEI - Local Governments for Sustainability. (2009). Outreach and Communications. ICLEI Resource Guide, ICLEI - Local Governments for Sustainability USA. Retrieved from https://climate-adapt.eea.europa.eu/metadata/tools/climate-change-outreach-and-communication-guide/04_iclei-cap-outreach-communications-guide_0.pdf

Institute for Local Government; California Air Resources Board. (2010). How to Harness the Power of Your Community to Address Climate Change: A Local Official's Guide. Retrieved from https://www.ca-ilg.org/sites/main/files/file-attachments/cc_and_public_participation.pdf

Krygsman, K., & Speiser, M. (2016). Let's Talk Communities & Climate: Communication Guidance for City and Community Leaders. Path to Positive Communities. Washington, D.C.: ecoAmerica. Retrieved from https://www.nlc.org/sites/default/files/2017-08/ecoAmerica%20Lets%20Talk%20Communities%20and%20Climate%20NLC%208.2.pdf

Krygsman, K., Speiser, M., & Perkowitz, R. (2015). Let's Talk Climate: Messages to Motivate Americans. Washington, D.C.: ecoAmerica. Retrieved from http://nlc.org/sites/default/files/2017-08/ecoAmerica%20Lets%20Talk%20Climate%20NLC%20new%20v2%20%281%29.pdf

McLaughlin, A. (2015, September 7). Climate Change & the City. Retrieved from https://www.macalester.edu/news/2015/09/climate-change-the-city/

Phadke, R., & Manning, C. (2017). Minneapolis Ready and Resilient Evaluation Summary Report. Retrieved from http://www.minneapolismn.gov/www/groups/public/@health/documents/webcontent/wcmsp-212754.pdf

The University of Minnesota Humphrey School of Public Affairs. (n.d.). Technical Report: Minneapolis Climate Change Vulnerability Assessment. Retrieved from http://www.ci.minneapolis.mn.us/www/groups/public/@citycoordinator/documents/webcontent/wcmsp-180497.pdf

U.S. EPA. (n.d.). Communication Materials on Climate Change, Health, and Populations of Concern: Summary Points from the U.S. Climate and Health Assessment. Retrieved from https://19january2017snapshot.epa.gov/sites/production/files/2016-10/populationsofconcern_communications_materials.docx

hmed, H., Brodsky, L., Drews, M., Gieseke, J., Henslee, K., Kafumbe, N., . . . Schweizer, M. (n.d.). Ready, Set, Go! Community-Based Organizations Emergency Preparedness Toolkit. Minneapolis-St. Paul Metropolitan Medical Response System (MMRS); Bloomington Public Health. Retrieved from https://www.bloomingtonmn.gov/sites/default/files/media/cover_acknowledgments_toc_preface.pdf

American Planning Association. (n.d.). National Planning Achievement Awards 2018. Retrieved from American Planning Association: https://www.planning.org/awards/2018/achievement/

Ascent Environmental, Inc. (2018). Community Outreach Plan for the Climate Action Plan Update. City of Escondido. Retrieved from https://www.escondido.org/Data/Sites/1/media/PDFs/Planning/ClimateActionPlan/CAPUpdate/EscondidoCAP_CommunityOutreachPlan_FINAL .pdf

Baja, K. (2014, August 07). Building community conversations around preparedness in Baltimore. Retrieved from Climate Access: https://climateaccess.org/blog/building-community-conversations-around-preparedness-baltimore

Burlager, S., & Sanders-Reed, A. (2014). Ready & Resilient: A Guide to Extreme Weather for Saint Paul Residents. Macalester College, the Science Museum of Minnesota, City of St. Paul. Retrieved from https://www.macalester.edu/readyandresilient/resources/ReadyandResilientPrimer.pdf

City of Cleveland. (n.d.). Neighborhood Climate Action Toolkit: An Assets-Based Approach to Building Thriving and Healthy Neighborhoods in Cleveland. Retrieved from

https://d3n8a8pro7vhmx.cloudfront.net/sustainablecleveland/pages/149/attachments/original/1462888931/NEIGHBORHOOD_CLIMATE_ACTIO N_TOOLKIT-FINAL.pdf?1462888931

City of Minneapolis. (2018, October 23). Climate Change Resiliency. Retrieved from Minneapolismn: http://www.ci.minneapolis.mn.us/health/preparedness/climate

City of Minneapolis. (2018, December 31). Climate Change Vulnerability Assessment & Resilience. Retrieved from Minneapolismn: http://www.ci.minneapolis.mn.us/sustainability/climate-prep/vulnerability-assessment

Cleveland Neighborhood Progress; City of Cleveland, Mayor's Office of Sustainability; Cleveland Urban Design Collaborative; University at Buffalo; Kent State University. (2015). Cleveland Climate Resilience & Urban Opportunity Plan. Retrieved from http://www.clevelandnp.org/wp-content/uploads/2018/09/Final-Implementation-Plan_CNP2.pdf

Climate & Urban Systems Parternship. (n.d.). Philadelphia. Retrieved from Climate & Urban Systems Parternship: http://www.cuspproject.org/cities/philadelphia#.XMjGG-hKhPZ

Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social Vulnerability to Environmental Hazards. Social Science Quarterly, 84(2), 242-261. Retrieved from https://doi-org.proxy.lib.uiowa.edu/10.1111/1540-6237.8402002

ICLEI - Local Governments for Sustainability. (2009). Outreach and Communications. ICLEI Resource Guide, ICLEI - Local Governments for Sustainability USA. Retrieved from https://climate-adapt.eea.europa.eu/metadata/tools/climate-change-outreach-and-communication-guide/04_iclei-cap-outreach-communications-guide_0.pdf

Institute for Local Government; California Air Resources Board. (2010). How to Harness the Power of Your Community to Address Climate Change: A Local Official's Guide. Retrieved from https://www.ca-ilg.org/sites/main/files/file-attachments/cc_and_public_participation.pdf

Krygsman, K., & Speiser, M. (2016). Let's Talk Communities & Climate: Communication Guidance for City and Community Leaders. Path to Positive Communities. Washington, D.C.: ecoAmerica. Retrieved from https://www.nlc.org/sites/default/files/2017-08/ecoAmerica%20Lets%20Talk%20Communities%20and%20Climate%20NLC%208.2.pdf

Krygsman, K., Speiser, M., & Perkowitz, R. (2015). Let's Talk Climate: Messages to Motivate Americans. Washington, D.C.: ecoAmerica. Retrieved from http://nlc.org/sites/default/files/2017-08/ecoAmerica%20Lets%20Talk%20Climate%20NLC%20new%20v2%20%281%29.pdf

McLaughlin, A. (2015, September 7). Climate Change & the City. Retrieved from https://www.macalester.edu/news/2015/09/climate-change-the-city/

Phadke, R., & Manning, C. (2017). Minneapolis Ready and Resilient Evaluation Summary Report. Retrieved from http://www.minneapolismn.gov/www/groups/public/@health/documents/webcontent/wcmsp-212754.pdf

The University of Minnesota Humphrey School of Public Affairs. (n.d.). Technical Report: Minneapolis Climate Change Vulnerability Assessment. Retrieved from http://www.ci.minneapolis.mn.us/www/groups/public/@citycoordinator/documents/webcontent/wcmsp-180497.pdf

U.S. EPA. (n.d.). Communication Materials on Climate Change, Health, and Populations of Concern: Summary Points from the U.S. Climate and Health Assessment. Retrieved from https://19january2017snapshot.epa.gov/sites/production/files/2016-10/populationsofconcern_communications_materials.docx

Social Vulnerability to Flooding Events at the City Level

Tate, E., Strong, A., Kraus, T. et al. Nat Hazards (2016) 80: 2055. https://doi.org/10.1007/s11069-015-2060-8

Heat Events

Antonia, K., P, K. G., & D, F. A. (2018). The Impact of Heat Waves on Mortality among the Elderly: A Mini Systematic Review. *Journal of Geriatric Medicine and Gerontology*, 4(3). doi:10.23937/2469-5858/1510053

Iowa Utility Board. (2019, March 21). Winter Heating Moratorium Ends April 1. Retrieved from https://iub.iowa.gov/press-release/2019-03-21/winter-heating-moratorium-ends-april-1

National Oceanic and Atmospheric Administration. (n.d.). [XLXS]. Washington DC: National Oceanic and Atmospheric Administration.

Order and download data from including daily maximal and hourly observations from the Iowa City Airport from 2015-2018.

National Safety Council. (2018, June 27). Responding to heat stroke, heat exhaustion. Retrieved from https://www.safetyandhealthmagazine.com/articles/14528-responding-to-heat-stroke-heat-exhaustion

Pascal, M., Laaidi, K., Ledrans, M., Baffert, E., Caserio-Schönemann, C., Tertre, A. L., . . . Empereur-Bissonnet, P. (2005). France's heat health watch warning system. International Journal of Biometeorology, 50(3), 144-153. doi:10.1007/s00484-005-0003-x

Rosenthal, J. K., Kinney, P. L., & Metzger, K. B. (2014). Intra-urban vulnerability to heat-related mortality in New York City, 1997–2006. *Health & Place, 30*, 45-60. doi:10.1016/j.healthplace.2014.07.014

Sheridan, S. C. (2006). A survey of public perception and response to heat warnings across four North American cities: An evaluation of municipal effectiveness. *International Journal of Biometeorology*, *52*(1), 3-15. doi:10.1007/s00484-006-0052-9

The Local. (2017, June 20). Paris: Authorities trigger emergency heatwave plan as capital continues to sizzle. Retrieved from https://www.thelocal.fr/20170620/paris-authorities-trigger-heatwave-plan-as-alert-is-extended

US Department of Commerce, National Oceanic and Atmospheric Administration, & National Weather Service. (2018, September 26). Wind Chill Chart. Retrieved from https://www.weather.gov/safety/cold-wind-chill-chart

US Department of Commerce, National Oceanic and Atmospheric Administration, & National Weather Service. (2018, April 10). Heat Index. Retrieved from https://www.weather.gov/safety/heat-index

Vandentorren, S., Bretin, P., Zeghnoun, A., Mandereau-Bruno, L., Croisier, A., Cochet, C., . . . Ledrans, M. (2006). August 2003 Heat Wave in France: Risk Factors for Death of Elderly People Living at Home. European Journal of Public Health, 16(6), 583-591. doi:10.1093/eurpub/ckl063

Extreme Weather Preparedness: Shelter

Beharie, Nisha et al. "Assessing the Relationship Between the Perceived Shelter Environment and Mental Health Among Homeless Caregivers." *Behavioral medicine (Washington, D.C.)* vol. 41,3 (2015): 107-14. doi:10.1080/08964289.2015.1046415

Chad. Iowa City Animal Care and Adoption Center. (April 11, 2019). Personal Interview

City of Iowa City. Climate Action and Adaptation Plan. (Figure 2) https://www8.iowacity.org/weblink/0/edoc/1803121/Climate%20Action%20Plan.pdf

City of Iowa City. Sustainability. https://www.icgov.org/project/iowa-city-climate-action-and-adaptation-plan

Department of Homeland Security. Lessons Learned Information Sharing. https://www.ready.gov/sites/default/files/documents/files/FEMAPetShelteringbestpractices2007.pdf

Government of San Francisco, Department of Homelessness and Supportive Housing. *Inclement Weather*. http://hsh.sfgov.org/services/inclement-weather/

Iowa Voluntary Organizations Active in Disaster. https://iavoad.communityos.org/cms/

Johnson County Iowa. Emergency Preparedness Information. https://www.johnson-county.com/dept_emergency.aspx?id=7912

Johnson County, Iowa. Local Emergency Planning Committee. https://www.johnson-county.com/dept_emergency.aspx?id=13584

National Oceanic and Atmospheric Administration. NWS Weather Fatalities of 2018. https://www.nws.noaa.gov/om/hazstats.shtml

Pets of the Homeless. (Map 1) https://www.petsofthehomeless.org/get-help/find-locations/#latitude=41.6611277&longitude=-91.53016830000001&zoom=9&types%255B%255D=shelters

Rettner, Rachael. How Does a Person Freeze to Death? LiveScience.com. January 30, 2019 https://www.livescience.com/6008-person-freeze-death.html

Robinson, Alicia. *RIVERSIDE: Homeless shelter now has place for pets*, Press-Enterprise, The Orange County Register. May 20, 2011. https://www.pe.com/2011/05/20/riverside-homeless-shelter-now-has-place-for-pets/

Sertterh, M. Iowa City Shelter House. (April 25, 2019). Personal Interview.

ShelterList.com. Pet Friendly Homeless Shelters. (Image 1) https://www.shelterlist.com/page/shelters_for_pets

States at Risk, America's Preparedness Report Card. (Figure 1) http://reportcard.statesatrisk.org/

Summer heat brings in more families to eastern lowa shelter. Brea Love. KCRG-TV9. Jul 30, 2018. https://shelterhouseiowa.org/news/summer-heat-brings-in-more-families-to-eastern-iowa-shelter/

University of Iowa Hospitals and Clinics. Crisis Stabilization Unit. https://uihc.org/crisis-stabilization-unit-csu Flood Events

Building and Energy Efficiency

Air Sealing Your Home. (n.d.). Retrieved from https://www.energy.gov/energysaver/weatherize/air-sealing-your-home

Emrath, P., & Fei Liu, H. (2007, April 3). Residential Greenhouse Gas Emissions. Retrieved from http://www.nahbclassic.org/generic.aspx?genericContentID=75563

Energy & Community. (n.d.). Retrieved from https://www.greeniowaamericorps.org/energy-community

Energy Conservation. (n.d.). Retrieved from http://www.hacap.org/what-we-do/energy-conservation/

Iowa City. (n.d.). Iowa City Climate Action and Adaptation Plan. Retrieved from https://www8.iowa-city.org/weblink/0/edoc/1803121/Climate Action Plan.pdf

Piccirilli Dorsey, Inc. (n.d.). Buildings and Climate Change. Retrieved from https://www.eesi.org/

Update or Replace Windows. (n.d.). Retrieved from https://www.energy.gov/energysaver/design/windows-doors-and-skylights/update-or-replace-windows

US Department of Energy. (n.d.). Weatherization Works. Retrieved from https://www.energy.gov/sites/prod/files/2018/06/f52/EERE_WAP_Fact Sheet-v2.pdf

US Department of Energy, W. (n.d.). Midwest Weatherization Best Practices Field Guide. Retrieved May, 2007, from https://www.energy.gov/sites/prod/files/2016/06/f32/Midwest_Wx_Best_Practices_May_2007.pdf

Why Energy Efficiency Upgrades. (n.d.). Retrieved from https://www.energy.gov/eere/why-energy-efficiency-upgrades

Sustainable Lifestyles

AeromatiCo. (2018). The 7 R's of Sustainability. Retrieved from https://www.aeromatico.com/the-7-rs-of-sustainability/

Cotton Dean, J. (2012). The Iowa Food Policy Council: a case study (Iowa State University). Retrieved from https://lib.dr.iastate.edu/etd/12827

Demuzerea, M., Orru, K., Heidrich, O., Olazabal, E., Geneletti, D., Orru, H., Bhave, A. G., Mittal, N., Feliu, E., Faehnle, M. (2014). Mitigating and adapting to climate change: Multi-functional and multi-scale assessment of green urban infrastructure. Journal of Environmental Management. 146 107-115.

Harper, A., Shattuck, A., Holt- Giménez, E., Alkon, A., Lambrick, F. (2009). Food Policy Councils: Lessons Learned. Food First Institute for Food and Development Policy. https://foodfirst.org/publication/food-policy-councils-lessons-learned/

Healthy Incentives Program. Community Involved in Sustaining Agriculture (CISA). (2019). https://www.buylocalfood.org/buy-local/use-snapebt-for-local-food/healthy-incentives-program/

Johnson County Food Policy Council (JCFPC). (2018). Food policy council recommendations for the 2018 comprehensive plan. Johnson County Iowa. Retrieved from https://www.johnson-county.com/dept_supervisors.aspx?id=10645

Jones, C. M., & Kammen, D. M. (2011). Quantifying Carbon Footprint Reduction Opportunities for U.S. Households and Communities. Environmental Science & Technology, 45(9), 4088–4095. https://doi.org/10.1021/es102221h

Norum, P. S. (2015). Trash, Charity, and Secondhand Stores: An Empirical Analysis of Clothing Disposition. Family and Consumer Sciences Research Journal, 44(1), 21–36. https://doi.org/10.1111/f

Taylor, G., & Vaage, A. (2015a). Reducing local regulatory barriers to local foods: Municipal Zoning for Local Foods in Iowa Guidebook. Retrieved from http://lib.dr.iastate.edu/leopold_grantreports

Taylor, G., & Vaage, A. (2015b). Municipal Zoning for Local Foods in Iowa: A Guidebook for Reducing Local Regulatory Barriers to Local Foods. Retrieved from https://blogs.extension.iastate.edu/planningBLUZ/files/2012/01/ZONING-FOR-LOCAL-FOODS-GUIDEBOOK.pdf

The First Self-Guided Paris Food Tour. Le Food Trip. (2017). https://www.le-food-trip.com/en/food-passport/paris

Scarborough, P., Appleby, P. N., Mizdrak, A., Briggs, A. D. M., Travis, R. C., Bradbury, K. E., & Key, T. J. (2014). Dietary greenhouse gas emissions of meat-eaters, fish-eaters, vegetarians and vegans in the UK. Climatic Change, 125(2), 179–192. https://doi.org/10.1007/s10584-014-1169-1

Seattle Food Passport. Savor Seattle Food Tours. (2018). https://www.savorseattletours.com/foodpassport

Vehicles Miles Traveled and Electric Vehicles

I. (2016). Advancing Iowa's Electric Vehicle Market (pp. 1-88, Rep.). Iowa Clean Cities Coalition.

W. K. (2019, April 16). Best Electric Cars: Top-Rated Electric Vehicles for 2019. Retrieved from https://www.edmunds.com/electric-car/articles/best-electric-cars/

utm_medium=sem&utm_source=bing&utm_account=nonbrand_tier_1&utm_campaign=top_generic_tier_1&utm_adgroup=electric_cars&utm_term=electric_vehicles&utm_content=77240776715634&utm_device=c&utm_matchtype=bb&msclkid=1bf564e475df10578fcc3835dcb2ac88

Cooper, A., & Schefter, K. (2018). *Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030* (pp. 1-18, Rep.). Washington, D.C.

Electric Vehicle Infrastructure Projection Tool (EVI-Pro) Lite. (n.d.). Retrieved from https://afdc.energy.gov/evi-pro-lite

EVSE | Electric Vehicle (EV) Charging Stations. (n.d.). Retrieved from https://www.chargepoint.com/

Heater, B. (2016, July 14). ChargePoint lets you reserve electric charging stations, cuts down on alternative fueling fistfights. Retrieved from https://www.engadget.com/2011/04/25/chargepoint-lets-you-reserve-electric-charging-stations-cuts-do/

C. (2017). Iowa City Community-wide Greenhouse Gas Emissions (pp. 1-37, Rep.). Iowa City, IA.

Mayfield, D. (2012). Site Design for Electric Vehicle Charging Stations. *Sustainable Transportation Strategies*, 1-35.

Staff, F. (2018, February 28). 2017 Battery Electric Cars Reported Range Comparison. Retrieved from https://www.fleetcarma.com/2017-battery-electric-cars-reported-range-comparison/

