



Maplewood



MINNESOTA

Climate Change Vulnerabilities Review

Prepared by:





Introduction

What is Climate Change Vulnerability?

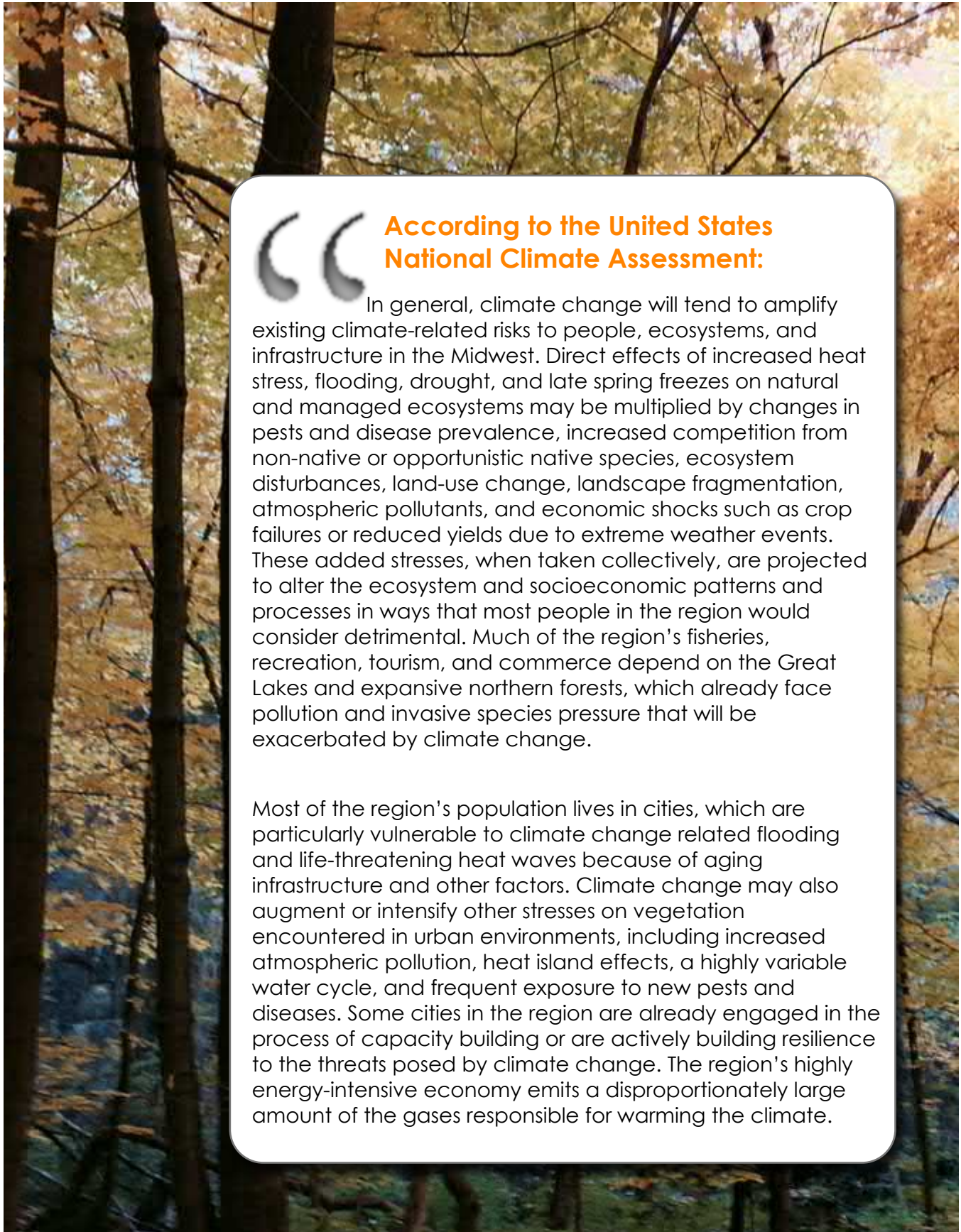
According to the Intergovernmental Panel on Climate Change (IPCC), vulnerability is “the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes”.

About This Document

This document is a review of the Climate Change risks facing the region and an identification of the risks most likely to impact the City of Maplewood. This report identifies the changes projected for Maplewood over the coming decades, as well as the environmental stresses those changes may create and an identification of the vulnerable populations within the City of Maplewood.

Next Steps

To fully understand the likely impacts, the ways these impacts will be felt, the sections of the City most likely to be impacted, and to determine the adaptation measures most likely to support the City's long-term climate resilience, we recommend that the City undertake a Climate Change Risk Assessment and Adaptation Planning effort.



According to the United States National Climate Assessment:

In general, climate change will tend to amplify existing climate-related risks to people, ecosystems, and infrastructure in the Midwest. Direct effects of increased heat stress, flooding, drought, and late spring freezes on natural and managed ecosystems may be multiplied by changes in pests and disease prevalence, increased competition from non-native or opportunistic native species, ecosystem disturbances, land-use change, landscape fragmentation, atmospheric pollutants, and economic shocks such as crop failures or reduced yields due to extreme weather events. These added stresses, when taken collectively, are projected to alter the ecosystem and socioeconomic patterns and processes in ways that most people in the region would consider detrimental. Much of the region's fisheries, recreation, tourism, and commerce depend on the Great Lakes and expansive northern forests, which already face pollution and invasive species pressure that will be exacerbated by climate change.

Most of the region's population lives in cities, which are particularly vulnerable to climate change related flooding and life-threatening heat waves because of aging infrastructure and other factors. Climate change may also augment or intensify other stresses on vegetation encountered in urban environments, including increased atmospheric pollution, heat island effects, a highly variable water cycle, and frequent exposure to new pests and diseases. Some cities in the region are already engaged in the process of capacity building or are actively building resilience to the threats posed by climate change. The region's highly energy-intensive economy emits a disproportionately large amount of the gases responsible for warming the climate.



Climate Risks in the Midwest

“

In the year 2065, on current trends, damage from climate change will exceed global GDP.

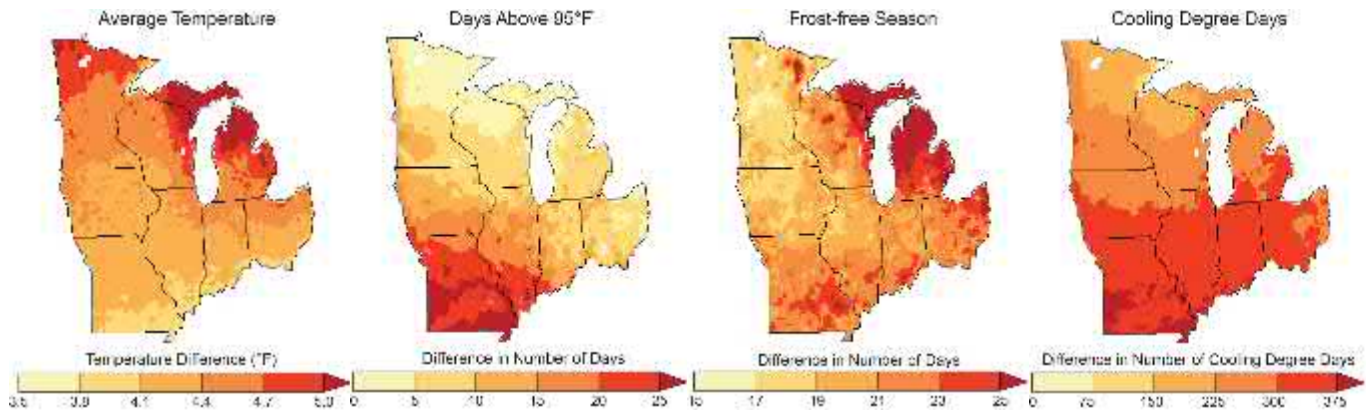
Andrew Dlugolecki, General Insurance Development

Climate Risks in the Midwest



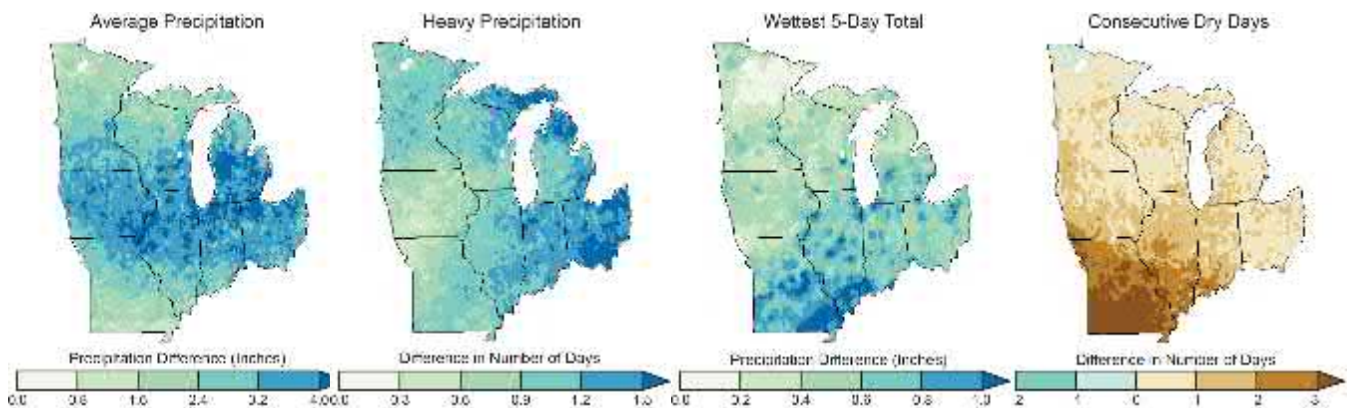
According to the US National Climate Assessment, based on current emissions trends, by mid-century (2040 - 2070) the Midwest region is projected to experience a climate that is...

Hotter...



...with more rain

...and drought



Primary Issues for Midwest

1: Impacts to Agriculture

Increases will continue in growing seasons, likely boosting some crop yields. Increases in extreme weather, number of very-hot days, flooding, and days without precipitation will likely decrease other yields. Overall, Midwest productivity is expected to decrease through the century.

2: Forest Composition

Rising air and soil temperatures, and variability in soil moisture will stress tree species. Forest compositions will change as habitats are driven Northward by as much as 300 miles. Due to these ecosystem disruptions, the region's forests may cease acting as a carbon sink, exacerbating greenhouse gas emission impacts.

3: Public Health Risks

Increases incident rate of days over 95 degrees, and humidity are anticipated to contribute to degradations in air and water quality. Each of these will increase public health risk, especially for at-risk populations.

4: Increased Rainfall and Flooding

The frequency and size of extreme rainfall events and flooding has increased over the last century. In addition, the number of days without precipitation have increased. These trends are expected to continue, causing erosion, declining water quality, and impacts on human health, and infrastructure.

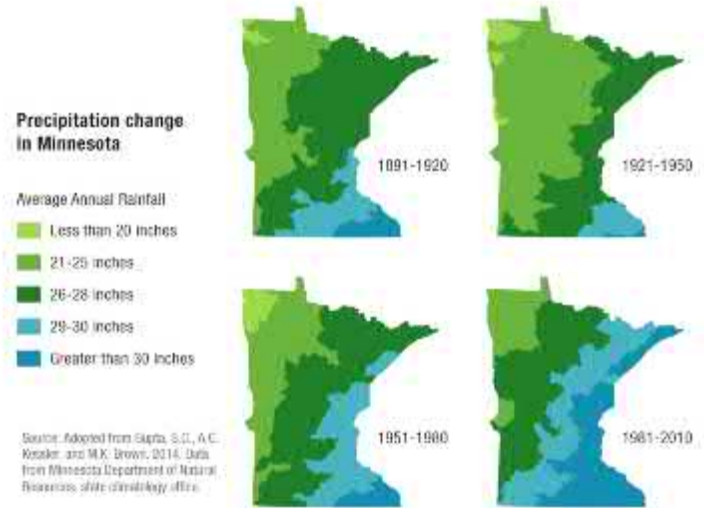


Climate Risks in Minnesota

Precipitation

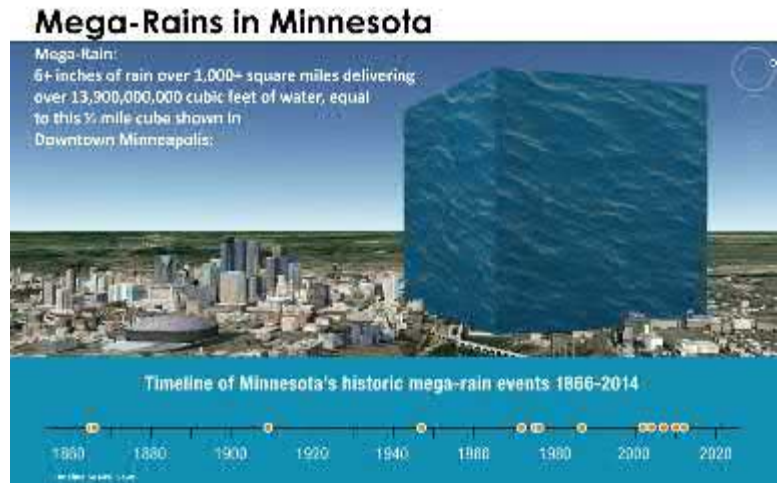
According to the State of Minnesota Climatology office, DNR and the National Climate Assessment, the majority of the State receives 5-15% more annual rainfall than a century ago.

(Graphic: Jaime Chrismar MPRnews.org)



Mega-Rains

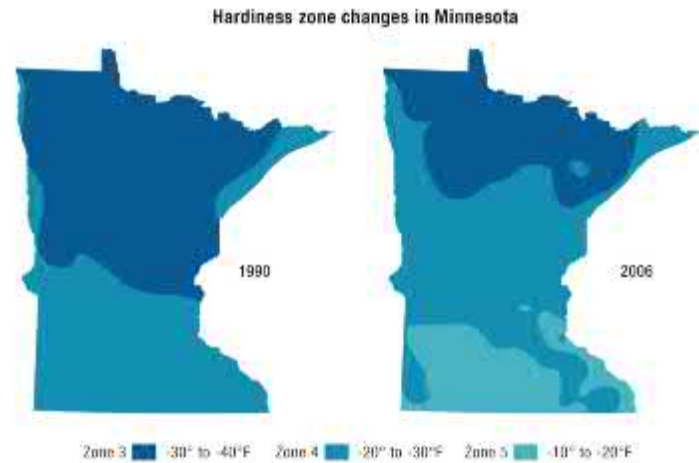
Since 1860 Minnesota has had 15 "Mega-rain" events: storms with 6+ of rain over 1,000 square miles or more. 5 of those storms have occurred since 2000, illustrating an increased rate of occurrence. Mega-Rain events represent a strain on stormwater infrastructure as they deliver a minimum of 13.9 billion cubic feet of rainwater in very short periods of time.



Changing USDA Zones

In addition to warmer weather, Minnesota is experiencing less spring snow cover in April resulting in more rapidly warming soil. The cumulative effects is a shift of USDA Hardiness zones to the North. In 1990 Maplewood was a Zone 4, today it is a Zone 5.

(Graphic: Jaime Chrismar MPRnews.org)

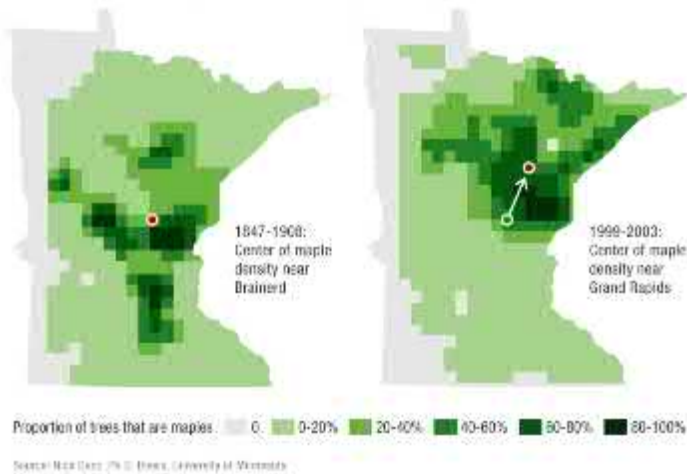


Source: U.S. Department of Agriculture

Climate Risks in Minnesota



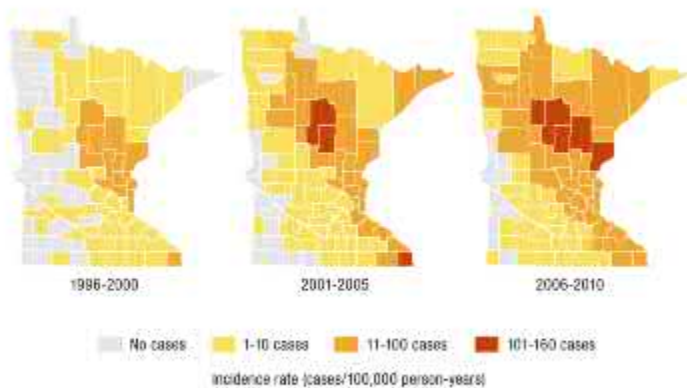
Density of Minnesota's maples moving north and east



Change in ragweed pollen season, 1995-2013



Distribution of Lyme disease cases by county of residence



Impacts of Climate Changes

In the natural world, changes in climate, of course, can change the favorability of a region towards plant, animal, and insect species. These species impacts, then can have impacts on human health and economy, such as:

Trees Moving North

Maple forests, among other species, are moving northward, with the densest forests now occurring in the "arrowhead" section of the State rather than central region. Beyond the impacts on the ecosystem, this shift is expected to impact Minnesota's Maple syrup production in the coming years. (Graphic: Jaime Chrismar MPRnews.org)

Human Allergies

With the shift in hardiness zones and increasing growing season, increases in pollen quantity and duration have been experienced and projected to continue. Beyond inflammation and irritation associated with allergic reactions, some studies indicate pollen can affect the cardiovascular and pulmonary system. (Graphic: Jaime Chrismar MPRnews.org)

Vector Borne Disease

Vector borne diseases are spread through insects and are highly sensitive to climatic factors. Warmer weather influences survival and reproduction rates of vectors, in turn influencing the intensity of vector activity throughout the year. The increase in Lyme disease cases are an illustration of the impacts of a warming Minnesota climate will have on vector borne disease intensity. (Graphic: Jaime Chrismar MPRnews.org)



Maplewood Climate

Maplewood Climate History

Since 1951, Maplewood has experienced:

Increase in annual average temperature: **3.2°F**

Increase in annual precipitation: **21%**

Increase in heavy precipitation events:
(Highest 5 flood stages from the Mississippi River
have occurred in the last twenty years) **58%**

Increase in growing season: **16days**

Maplewood Climate

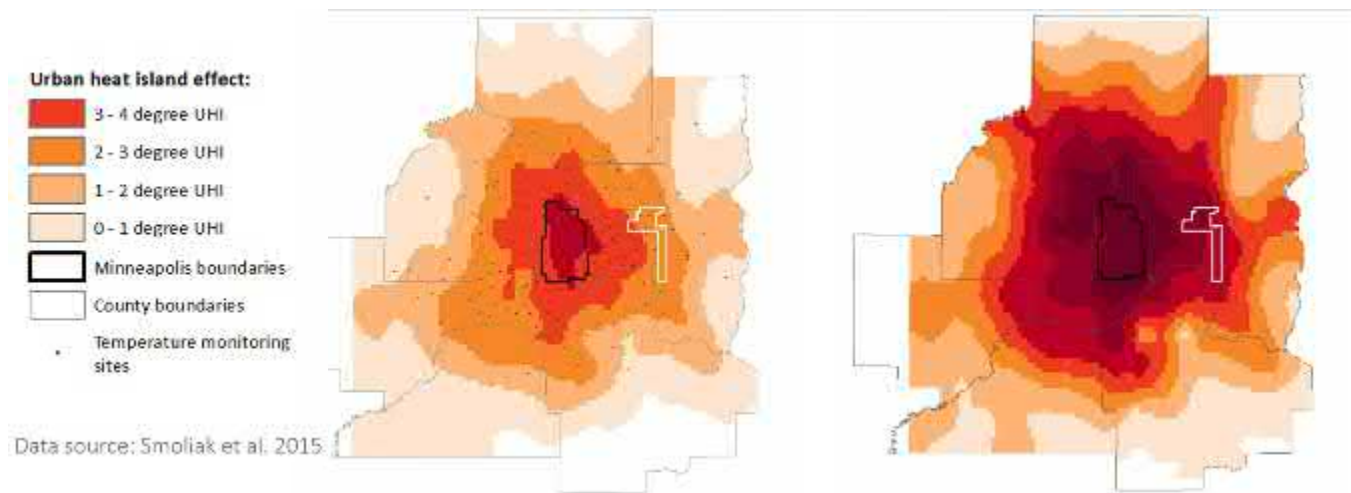


Urban Heat Island

Urban dwellers are more at risk for heat-related illnesses than rural dwellers. Due to the “urban heat island effect,” urban areas are usually hotter and cool off less at night than rural areas. Urban heat islands can increase health risks from extreme heat by increasing the potential maximum temperatures residents are exposed to and the length of time that they are exposed to elevated temperatures. The level of the urban heat island effect of a region is largely driven by the amount of impervious surface (pavement and buildings). This heat island effect serves to increase the impact of climate change effects in urban areas.

A study funded by the Institute on the Environment found:

- Temperatures in the urban core average 2 °F higher in summer than in surrounding areas
- The differential spiked as much as 9 °F higher during a heat wave in July 2012
- Urban heat island effect is stronger at night in summer and during the day in winter
- In urban areas when snow cover is less pervasive, daytime urban winter temperatures are higher than rural areas by an average of 2 °F.



Above is a graphic showing the measured metro heat island effect on July 2, 2012. The graphic on the left shows the day-long average temperature variation and on the right shows night-time difference. The City of Maplewood is outlined in white.

Impervious Surface Area

Total impervious area	1.88%
...State Wide:	11.25%
...Metro area:	27.6%
...Ramsey County:	27.8%
...Maplewood:	27.8%



Maplewood Climate

Maplewood on The Move

Projected changes in annual average temperatures and growing seasons will result in a change in the overall climate of Maplewood. Summertime conditions for mid-twenty first century in Maplewood are projected to be similar to the conditions currently felt 300 miles or further to the South.

According to the University of Michigan Climate Center, by 2040 summertime conditions in Maplewood are anticipated to be similar to those today in Marion Iowa, Muncie Indiana, Columbus Ohio, and Wilkesboro North Carolina. On the map to the right, all areas shaded in blue represent Climate Peers whose current summer conditions match Maplewood's projected summer conditions by mid-century (2040-2070).

(Source: University of Michigan Climate Center)

10
miles Distance southward the
City of Maplewood's
Climate moves every year.

Which is equal to moving **145**
feet every day.

Maplewood Climate



Maplewood Vulnerabilities



Urban Tree Canopy Vulnerability

Trees have a degree of vulnerability to changes in temperature ranges, precipitation patterns, soil temperature and moisture levels, and changes to winter processes and growing season length. According to the US Forest service, urban forests are very susceptible to a number of climate change factors including species invasion, and insect and pathogen attack. Species projected to have negative stressors in the Maplewood region include Aspen, Birch, Ash, Balsam, and Spruce. Extended drought conditions may also negatively impact other species such as Sugar Maple, Red Maple, and Basswood. Finally, increased growing seasons will result in taller trees which may be more susceptible to damage in extreme weather events. The map above shows the woodland, forest, and general tree cover of Maplewood. (Source: Minnesota DNR)



Flood Vulnerability

According to the US National Climate Assessment, the ten rainiest days can contribute up to 40% of the annual precipitation in our region. The Maplewood area can anticipate an increase of 10-20% in the total annual precipitation, while the amount of precipitation in summer months may actually decline. Under this scenario, it is likely that certain periods of the year, like spring, may be significantly wetter with storms producing heavier rains. In anticipation of that, it is appropriate to review the areas of the City with flood risk and to review current stormwater management capacity against future extreme rainfall event projections. The map above shows the flood risk areas throughout the City. (Source: National Flood Services)



Maplewood Vulnerabilities

Understanding Risks

Some of the risks associated with the projected climate change impacts for the Maplewood region include:

Warmer summers

Pollution control risks:

Wildfires may lead to soil erosion

Habitat risks

Greater evaporation
lower groundwater tables
Switching public water supply between surface and groundwater sources may affect the integrity of water bodies

Fish Wildlife and Plant risks:

Species that won't tolerate warmer summers may die/migrate
Biota at the southern limit of their range may disappear from ecosystems
Species may be weakened by heat and become out-competed
Essential food sources may die off or disappear, affecting the food web
Species may need to consume more water as temperature rises

Recreation and Public Water Supply Risks

More people using water for recreation may raise the potential for pathogen exposure
Warmer temperatures may drive greater water demand
Evaporation losses from reservoirs and groundwater may increase

Warmer winters

Pollution Control risks:

Increased fertilizer and pesticide use due to longer growing season.
Reduced winter snow and spring flow volume resulting in raised pollutant concentration in receiving waters.

Habitat risks:

Less snow, more rain may change the runoff/infiltration balance; base flow in streams may change
Changing spring runoff with varying snow.

Fish Wildlife and Plant risks:

Species that used to migrate away may stay all winter and species that once migrated through may stop and stay
Pests may survive winters that used to kill them and Invasive species may move into places that used to be too cold
Some plants need a "setting" cold temperature and may not receive it consistently
A longer growing season may lead to an extra reproductive cycle
Food supplies and bird migrations may be mistimed

Recreation and Public Water Supply Risks

Summer water supplies that depend on winter snow pack may be reduced or disappear
Cold places may see more freeze/thaw cycles that can affect infrastructure

Warmer water

Pollution Control risks:

Temperature criteria for discharges may be exceeded (thermal pollution)
Warmer temperatures may increase toxicity of pollutants
Higher solubility may lead to higher concentration of pollutants
Water may hold less dissolved oxygen
Higher surface temperatures may lead to stratification
Greater algae growth may occur
Parasites, bacteria may have greater survival or transmission

Habitat risks:

Warmer water may lead to greater likelihood of stratification
Desired fish may no longer be present
Warmer water may promote invasive species or disease

Fish Wildlife and Plant risks:

Newly invasive species may appear
Habitat may become unsuitably warm, for a species or its food
Heat may stress immobile biota
Oxygen capacity of water may drop



Some fish reproduction may require cold temperatures; other reproductive cycles are tied to water temperature
Parasites and diseases are enhanced by warmer water

Recreation and Public Water Supply Risks
Harmful algal blooms may be more likely
Fishing seasons and fish may become misaligned
Desired recreational fish may no longer be present
Invasive plants may clog creeks and waterways
Changes in treatment processes may be required
Increased growth of algae and microbes may affect drinking water quality

Increased drought

Pollution Control risks:

Critical-low-flow criteria for discharging may not be met
Pollutant concentrations may increase if sources stay the same and flow diminishes
Pollution sources may build up on land, followed by high-intensity flushes

Habitat risks:

Groundwater tables may drop
Base flow in streams may decrease
Stream water may become warmer
Increased human use of groundwater during drought may reduce stream baseflow
New water supply reservoirs may affect the integrity of freshwater streams

Fish Wildlife and Plant risks:

Species may not tolerate a new drought regime (birch family)
Native habitat may be affected if freshwater flow in streams is diminished or eliminated

Recreation and Public Water Supply Risks

Freshwater flows in streams may not support recreational uses
Groundwater tables may drop
Maintaining passing flows at diversions may be difficult

Increased storminess

Pollution Control risks:

Combined sewer overflows may increase
Treatment plants may go offline during intense floods
Streams may see greater erosion and scour
Urban areas may be subject to more floods
Flood control facilities (e.g., detention basins, manure management) may be inadequate
High rainfall may cause septic systems to fail

Habitat risks:

The number of storms reaching an intensity that causes problems may increase
Stronger storms may cause more intense flooding and runoff
Turbidity of surface waters may increase
Increased intensity of precipitation may yield less infiltration
Stream erosion may lead to high turbidity and greater sedimentation
Lower pH from NPS pollution may affect target species

Fish Wildlife and Plant risks:

Greater soil erosion may increase turbidity and decrease water clarity
Greater soil erosion may increase sediment deposition in estuaries, with consequences for benthic species

Recreation and Public Water Supply Risks

More frequent or more intense storms may decrease recreational opportunities
Greater nonpoint source pollution may impair recreation
Water infrastructure may be vulnerable to flooding
Flood waters may raise downstream turbidity and affect water quality

(Source: USEPA "Being Prepared for Climate Change A Workbook for Developing Risk-Based Adaptation Plans")



Maplewood Vulnerabilities

Vulnerable Populations in Maplewood

According to the Minnesota Department of Health, some populations are especially vulnerable to climate health risks due to particular sensitivities, high likelihood of exposure, low adaptive capacity, or combinations of these factors. To assist a City in identifying adaptive measures to support their community in the impacts of climate change, it is important to understand and identify the most vulnerable populations within the community.

The graphs to the right indicate the percentage of population for some of the most vulnerable groups in Minnesota., Metro Twin Cities, and the City of Maplewood. Groups of particular concern for the City are seniors, seniors living alone, lower income families/individuals, and families/individuals without a vehicle.

(Source: State of Minnesota Department of Health)

Maplewood Vulnerabilities

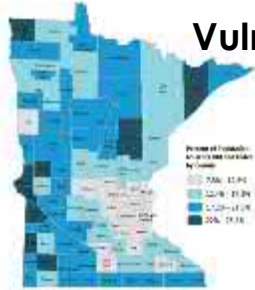


Vulnerable Populations:

...In Minnesota

...Twin City Metro

...City of Maplewood



12.6%
65 Years and Older

11.9%

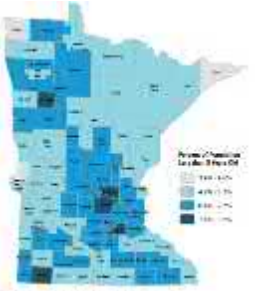
16.3%



9.4%
Seniors Living Alone

9.7%

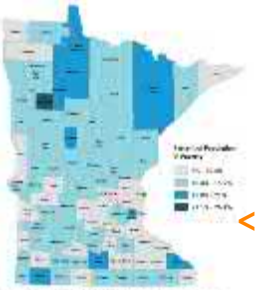
11.6%



6.7%
Under 5 Years

6.8%

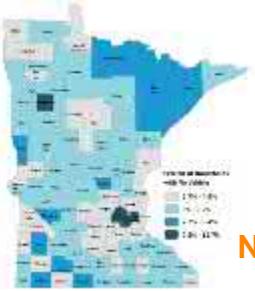
6.2%



25.5%
<200% Poverty

32.4%

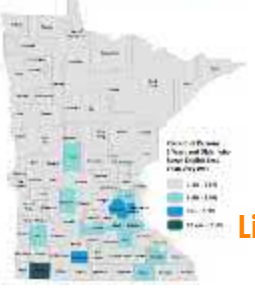
26.0%



7.9%
No Vehicle

8.2%

9.4%



4.2%
Limited English

6.3%

7.6%



Maplewood Vulnerabilities

Age and Disabilities

Children

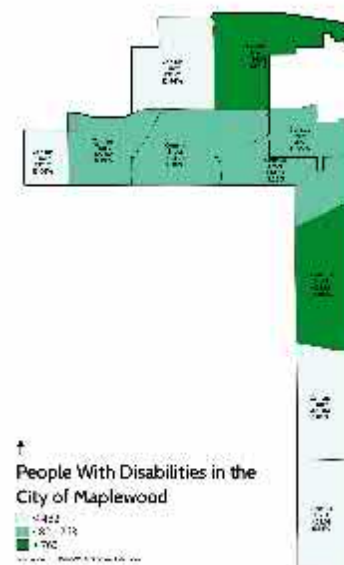
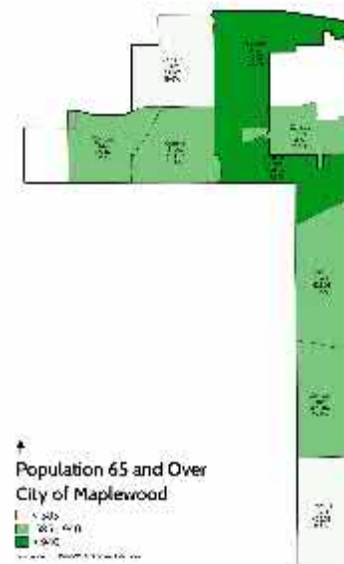
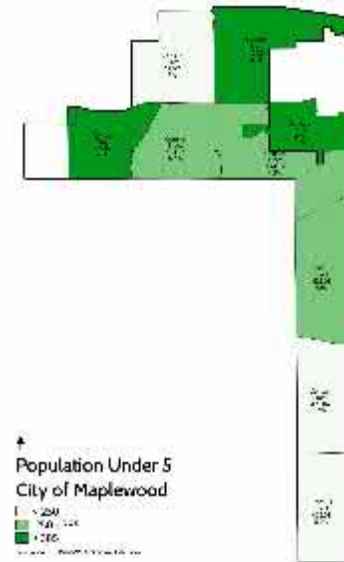
According to the US Global Change Research Program “Children are vulnerable to adverse health effects associated with environmental exposures due to factors related to their immature physiology and metabolism, their unique exposure pathways, their biological sensitivities, and limits to their adaptive capacity. Children have a proportionately higher intake of air, food, and water relative to their body weight compared to adults. They also share unique behaviors and interactions with their environment that may increase their exposure to environmental contaminants such as dust and other contaminants, such as pesticides, mold spores, and allergens.”

Older Adults

Older adults are also vulnerable to the health impacts associated with climate change and weather extremes. Vulnerabilities within older adults are not uniform due to the fact that this demographic is a diverse group with distinct subpopulations that can be identified not only by age but also by race, educational attainment, socioeconomic status, social support networks, overall physical and mental health, and disability status. According to the US Global Change Research Program “the potential climate change related health impacts for older adults include rising temperatures and heat waves; increased risk of more intense floods, droughts, and wildfires; degraded air quality; exposure to infectious diseases; and other climate-related hazards.”

Individuals with Disabilities

People with disabilities experience disproportionately higher rates of social risk factors, such as poverty and lower educational attainment, that contribute to poorer health outcomes during extreme events or climate-related emergencies. These factors compound the risks posed by functional impairments and disrupt planning and emergency response. Of the climate-related health risks experienced by people with disabilities, perhaps the most fundamental is their “invisibility” to decision-makers and planners. Disability refers to any condition or impairment of the body or mind that limits a person’s ability to do certain activities or restricts a person’s participation in normal life activities, such as school, work, or recreation.

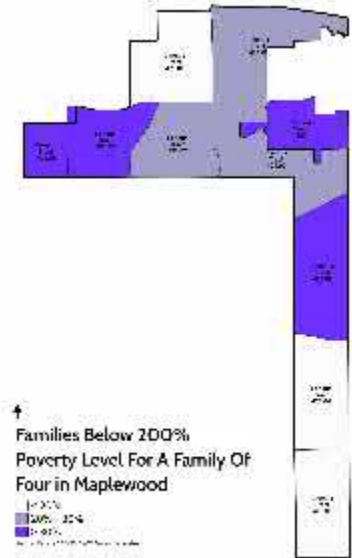
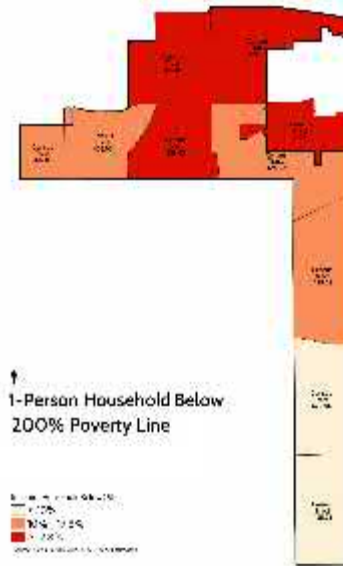


Maplewood Vulnerabilities



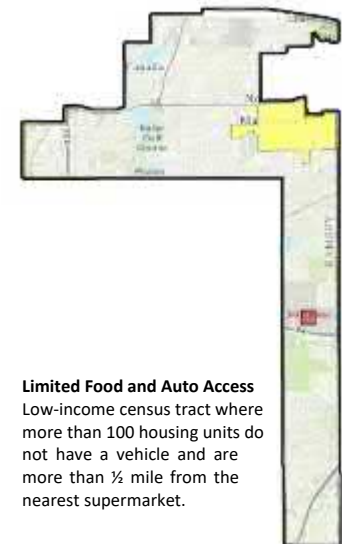
Economic Stress

People who live in poverty may have a difficult time coping with changes. This portion of our population have limited financial resources to cope with heat, relocate or evacuate, or respond to increases in the cost of food. In addition, they frequently have limitations to health care. In Minnesota, food insecurity effects 10.6% of all households, while an average of 24.5% of Ramsey County's population has limited access to grocery stores according to the USDA.



Food Insecurity

According to U.S. agriculture secretary Tom Vilsack, climate change is likely to destabilize cropping systems, interrupt transportation networks and trigger food shortages and spikes in food cost. According to the US National Climate Assessment for the Midwestern states: "In the next few decades, longer growing seasons and rising carbon dioxide levels will increase yields of some crops, though those benefits will be progressively offset by extreme weather events. Though adaptation options can reduce some of the detrimental effects, in the long term, the combined stresses associated with climate change are expected to decrease agricultural productivity." These effects can be anticipated regionally as well as worldwide to become more pronounced by mid-century. As the food distribution system becomes more stressed, individuals with less readily available access are more likely to be negatively impacted.





Maplewood Vulnerabilities

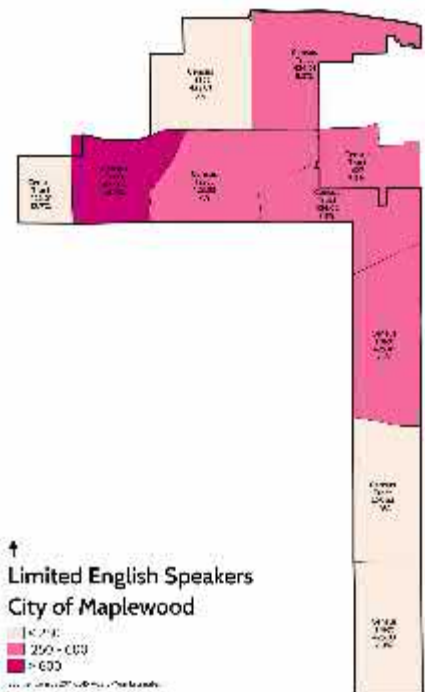
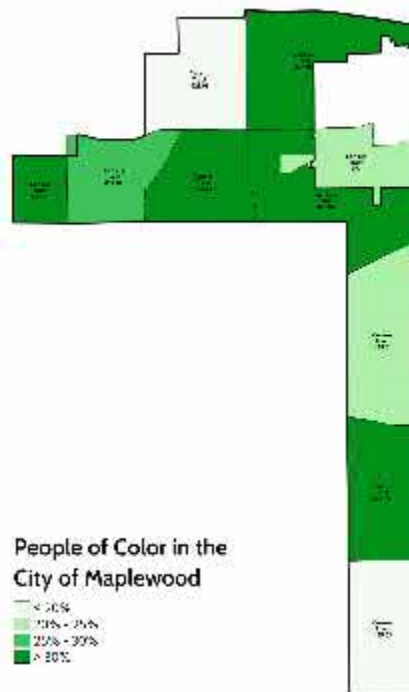
People of Color and Limited English Populations

“These populations are at increased risk of exposure given their higher likelihood of living in risk-prone areas, areas with older or poorly maintained infrastructure, or areas with an increased burden of air pollution.” In addition, according to the Center for Disease Control and the National Health Interview Survey these portions of our population also experience higher incidence of chronic medical conditions which can be exacerbated by climate change impacts. These populations may also be impeded from preparing, responding, and coping with climate related health risks due to socioeconomic and education factors, limited transportation, limited access to health education, and social isolation related to language barriers.



**Composite Map:
People of Color + Limited English**

★ City Owned Facility



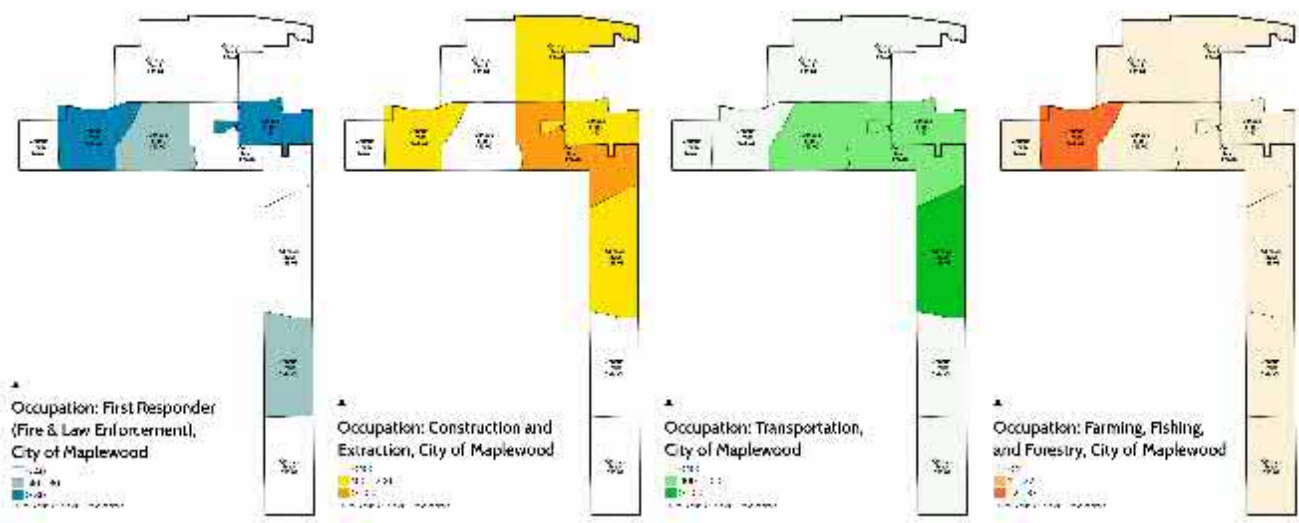
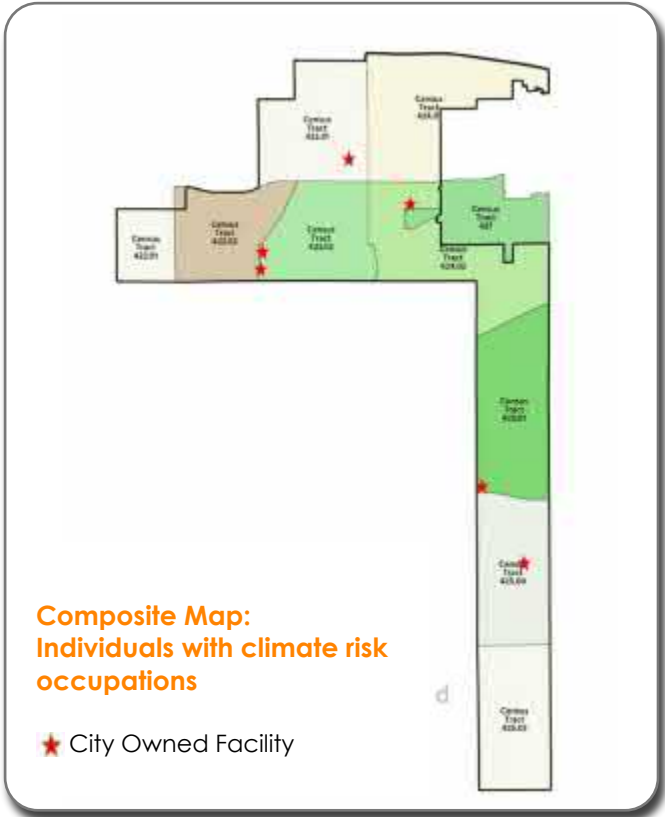
Maplewood Vulnerabilities



At-Risk Occupations

Climate change will increase the prevalence and severity of occupational hazards related to environmental exposure. As our climate changes, we may also experience the emergence of new work related risks. Climate change can be expected to affect the health of outdoor workers through increases in ambient temperature, more prevalent and longer-lasting heat waves, degraded air quality, extreme weather, vector-borne diseases, industrial exposures, and changes in the built environment. Workers affected by climate change include farmers, ranchers, and other agricultural workers; laborers exposed to hot indoor work environments; construction workers; paramedics, firefighters and other first responders; and transportation workers.

For individuals employed in climate vulnerable jobs who also fall within other vulnerable population categories, the health effects of climate change can be cumulative. For these individuals, the risks experienced in their work can be exacerbated by exposures associated with poorly insulated housing and lack of air conditioning. Workers may also be exposed to adverse occupational and climate-related conditions that the general public may altogether avoid, such as direct exposure to wildfires.





Maplewood Recommended Adaptation Goals



Recommended Adaptation Goals

The following are recommended overall goals for increasing the climate resilience for the City of Maplewood. In the following pages a menu of specific strategies for each goal is provided. Many of these goals and strategies have some existing City, County, and State policies already underway which relate to them. A detailed review of all existing policies against these specific goals and the strategies should be conducted and policy modification recommendations should be developed. Other goals may require new policy or program development.

In prioritizing the implementation of the goals and strategies which follow, the City of Maplewood should:

- Consider available resources and opportunities to leverage new resources.
- Consider the associated carbon emission reduction opportunities and other co-benefits of strategies.
- Study the anticipated equity impacts of strategies
- Consider the urgency and window of opportunity
- Identify departments and staff capable of taking lead for strategy implementation
- Integrate implementation plans into routine working plan that is reviewed and revised regularly (every 2 to 5 years recommended)

Climate Adaptation Goals

Hotter Summers with Increased Heat Wave Incidence

- 1 Decrease the urban heat island effect, especially in areas with populations most vulnerable to heat.
- 2 Minimize health issues caused by extreme heat days, especially for populations most vulnerable to heat.
- 3 Increase the resilience Maplewood's water supply in drier summers.
- 4 Increase food security for Maplewood residents, especially those most vulnerable to food environment.

Increased variability of rain with extended time frames between precipitation combined with more intense rainfall events

- 5 Increase the resilience of natural and built systems to adapt to increased timeframes between precipitation and increased drought conditions.
- 6 Increase the resilience of the natural and built environment to more intense rain event and associated flooding.
- 7 Manage the increased risk of disease due to changes in vector populations.

Build community capacity to prepare for and respond to climate change

- 8 Strengthen emergency management capacity to respond to weather-related emergencies.
- 9 Institutionalize climate change preparation planning and best practices.
- 10 Improve the capacity of the community, especially populations most vulnerable to climate change risks, to understand, prepare for and respond to climate impacts.



Maplewood Adaptation Strategies

1

Strategy Menu - Goal 1 Decrease Urban Heat Island Effect

- 1.1 Decrease impervious areas and increase the total ecoroof acreage in the city (green roof, cool roof, etc) in public and private development.
- 1.2 Evaluate the impact of the City's tree codes.
- 1.3 Identify vulnerable urban tree canopy and street tree sections and develop policies to incentivize, encourage, or require strategic tree planting for heat island mitigation.
- 1.4 Develop policies and programs which decrease impervious surfaces, especially in neighborhoods of increased vulnerable populations.
- 1.5 Research, evaluate and pilot porous paving, de-paving, vegetation and/or more reflective surfaces in parking areas to reduce and cool impervious surfaces, particularly in urban heat island areas with populations most vulnerable to heat.
- 1.6 Consider populations most vulnerable to heat and living in urban heat islands when making decisions about tree planting, protection and maintenance, green infrastructure placement, and access to vegetated open spaces and natural areas.
- 1.7 Add or modify park plantings in under-served areas, and increase maintenance to sustain mature tree canopy, decrease tree hazards and delay tree replacement needs.
- 1.8 Apply the latest climate and forestry science to develop a climate adaptive ready tree species list for use in City plantings/replacements as well as for communication to residents, building owners, and developers.
- 1.9 Apply the latest climate science in revision of urban tree canopy goals for the City and address tree canopy disparities in neighborhoods where populations most vulnerable to heat live.

2

Strategy Menu - Goal 2 Minimize Health Issues of Extreme Heat

- 2.1 Create a Heat Response Plan based on Minnesota Department of Health Extreme Heat Toolkit.
- 2.2 Strengthen City's Heat Response Plan through collaboration with community stakeholders and populations most vulnerable to heat.
- 2.3 Work with health care and social services providers to ensure their ability to provide appropriate services during extreme heat events.
- 2.4 Partner with community-based organizations and local service providers to seniors and people with disabilities to assess the need for and coordinate the operation of cooling environments, including extended hours of Senior Center Operations, that are culturally appropriate and readily accessible.
- 2.5 Improve the energy efficiency of homes, apartments and commercial buildings to keep interiors cool, improving the comfort and safety of occupants and reducing the need for summer air conditioning. Encourage the planting of trees and vegetation on the south and west sides of homes and buildings to reduce summer heat gain.
- 2.6 Expand the capacity to educate health care providers to recognize and report patterns of heat-related illnesses and injuries, and to inform the public about preventive actions.
- 2.7 Ensure public safety staff is properly trained to recognize and respond to physical and behavioral signs of heatrelated illness.

Maplewood Adaptation Strategies



3 Strategy Menu - Goal 3 Increase Maplewood's Water Resilience in Drier Summers

- 3.1 Develop and implement water conservation education and outreach programs in residential and commercial sectors.
- 3.2 Support incentivized, encouraged, and regulatory efficiency programs.
- 3.3 Support incentivized, encouraged, and regulatory gray water and water recycling systems for lawn irrigation systems.
- 3.4 Change design and management methods to minimize water use and waste in publicly owned or managed properties while still maintaining thriving vegetation. Replace potable water lawn irrigation systems with gray/recycled water systems at city-owned facilities where practicable.

4 Strategy Menu - Goal 4 Increase Food Security in Maplewood

- 4.1 Expand the prevalence of community gardens and family gardens through the continued development, improvement, and communication of the City's urban agriculture policies and ordinances.
- 4.2 Develop policies and ordinances which promote, encourage, or require permaculture landscaping in lieu of "traditional" lawn oriented landscaping.
- 4.3 Develop permaculture landscape zones for city-controlled properties and street boulevard zones where practicable.
- 4.4 Continue to support, collaborate, and implement invasive species control programs.
- 4.5 Develop pollinator friendly policies including promotion of pollinator habitats on public and private land as well as policies which restrict and eliminate neonicotinoid pesticides.
- 4.6 Attract and promote grocery store and food market investment in food desert sections of the City. Collaborate with neighboring communities to maximize coverage.

5 Strategy Menu - Goal 5 Increase Resilience of Natural and Built Systems for Increased Drought Conditions

- 5.2 Identify habitat diversity and connectivity needs (e.g., links to and among existing natural areas, anchor locations) and prioritize habitat corridors for protection and enhancement, including through acquisition, restoration, regulations and innovative techniques such as vegetated streets, to create an interconnected network of terrestrial and aquatic habitats.
- 5.3 Review city codes and drainage rules to evaluate their ability to protect and improve stream flows, seeps, springs, wetland function, water quality including temperature, vegetation and habitat, and stormwater management during hotter summers with longer time frames between precipitation.
- 5.4 Explore new and support expansion of voluntary programs promoting increased native, drought tolerant vegetation and reduced hardscape on private property
- 5.5 Focus acquisition, restoration and management of the City's natural areas inventory to ensure species of concern and overall biodiversity is retained.



Maplewood Adaptation Strategies

6 Strategy Menu - Goal 6 Increase Resilience of Natural and Built Systems for Periods of Heavier Rain

- 6.1 Work with FEMA (Federal Emergency Management Agency) to update the floodplain mapping program to reflect potential changes due to climate change variability in the 100-year floodplain maps.
- 6.2 Address floodplain hazards through the Comprehensive Plan update and provide guidance to regulate or manage development in the floodplain.
- 6.3 Determine stormwater volume requirements meeting anticipated future storm levels and identify stormwater management systems and infrastructure not capable of meeting projected needs. Prioritize upgrades required and implement.
- 6.4 Review city codes, drainage rules, and surface waterways to evaluate their ability to protect and improve stream flows, seeps, springs, wetland function, water quality including temperature, vegetation and habitat, and stormwater management during periods of extreme heavy rain. Use the Natural Resource Inventory and other data to track gains and losses, and propose revisions as necessary.
- 6.5 Explore new and support expansion of voluntary programs promoting increased on-site storm water management (rain gardens, impervious surfaces, et)

7 Strategy Menu - Goal 7 Manage Increased Risk of Vector Borne Disease

- 7.1 Develop and distribute culturally appropriate and accessible materials about vector-borne disease prevention.
- 7.2 Expand the capacity to educate health care providers to recognize and report patterns of vector-borne disease illnesses and injuries, and to inform the public about preventive actions.
- 7.3 Create and maintain a Response Plan for emerging vector-borne diseases, including increased capacity for health services that are triggered by certain case thresholds.

8 Strategy Menu - Goal 8 Strengthen Emergency Capacity for Response to Weather Related Emergencies

- 8.1 Develop, test, train, and update emergency response plans that address hazards likely to become more frequent or intense as the climate changes, including flood and extreme heat. Plan for projected increases in weather-related emergencies, especially high-heat days, and the resulting potential for increased violence, mental illness, chemical dependency and addiction.
- 8.2 Promote equity in hazard mitigation, and emergency response and recovery activities, and consider populations most vulnerable to weather-related emergencies in all plans and exercises.
- 8.3 After weather-related emergency events, assess response to identify effectiveness, deficiencies and resources needed to build future resilience.

Maplewood Adaptation Strategies



8 Strategy Menu - Goal 8 Strengthen Emergency Capacity for Response to Weather Related Emergencies (Continued)

8.4 Through training, educational materials and other resources, strengthen capabilities of individuals and organizations that assist in disaster response as well as community/cultural groups to prepare for potential climate change impacts, including disproportionate impacts on populations most vulnerable to climate change risks.

9 Strategy Menu - Goal 9 Institutionalize Climate Change Preparation Planning and Best Practices

9.1 Establish a multi-jurisdiction/multi-department adaptive management coordination team to: review emerging climate research, trends and regulations at least once a year.

9.2 Utilize an equity framework or lens to ensure preparation actions are implemented in ways that deliver more equitable outcomes and prioritize populations most vulnerable to climate change impacts.

9.3 As appropriate, coordinate with or require health and safety service providers to support recommendations of this Climate Vulnerability Assessment (e.g., provide education and resources about climate risks to populations most vulnerable to climate change impacts and development of continuity of operations plans).

9.4 Continue to pursue energy efficiency opportunities to minimize impacts from rising energy costs and increased cooling demands in City and County owned and operated facilities.

10 Strategy Menu - Goal 10 Improve Capacity of Community

10.1 Provide education and resources about climate risks to the public, especially those most vulnerable to potential impacts like high-heat and flooding.

10.2 Develop and distribute culturally appropriate and accessible materials about extreme heat and related respiratory-illness, especially to populations most vulnerable to those impacts.

10.3 Link low-income populations, communities of color, older adults and people with disabilities to services that help reduce safety, health and financial risks associated with climate change impacts.

10.4 Build capacity and leadership within communities most vulnerable to climate change impacts by promoting, supporting and leveraging community-specific strategies, projects and events.

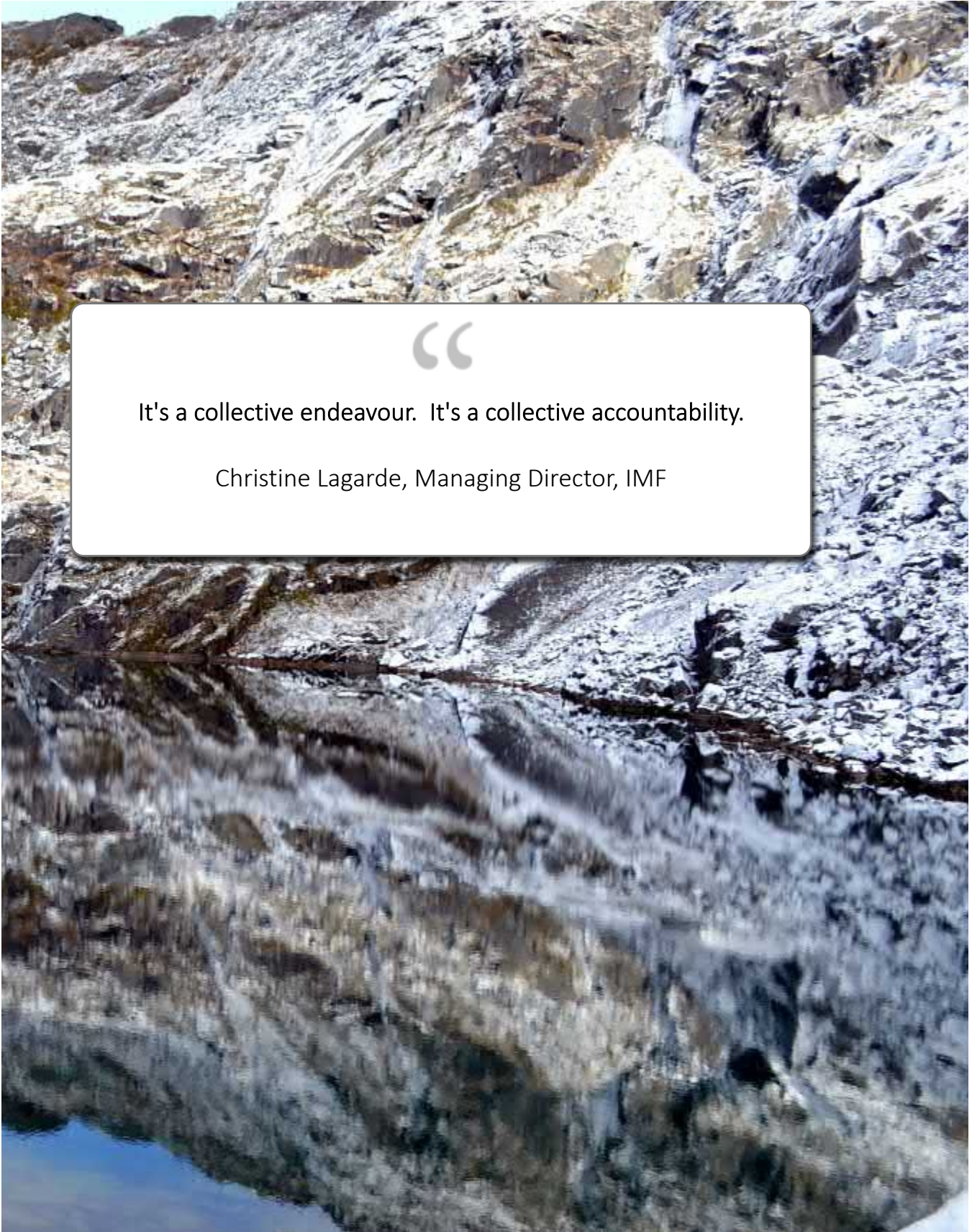


Conclusions

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It's a collective endeavour. It's a collective accountability.

Christine Lagarde, Managing Director, IMF



Conclusions



The City of Maplewood has already seen climate changes. The projections for the City's climate by the middle of this century indicate continued increases in temperatures. Additionally, precipitation patterns are anticipated to change, providing an increase in the overall rainfall as well as an increase in the number of days without rain - exacerbating both flooding and drought potential. The City's location as a "first ring" suburb is prone to heat island effects which act as a multiplier on the overall region's climate extremes.

The projected changes to Maplewood climate represent stressors for both the environment and people. Urban tree canopies as well as urban populations have unique vulnerabilities associated with the projected climate changes for the City of Maplewood.

Risks to Maplewood's Environment

The risks to the City of Maplewood's physical environment include:

- Stresses on the City's Urban Tree Canopy, and subsequent increase in heat island effect exacerbating the effects of temperature extremes.
- Stresses on the City's lakes, streams, and wetlands including threats to aquatic species and water quality
- Stresses on the City's storm water management infrastructure with increased flood risk potential.

Risks to Maplewood's Residents

Climate impacts also represent potential health risks to vulnerable sectors of the City of Maplewood's residents. Some of these population sectors, in fact, represent a higher portion of the City's population, and therefore risk potential, than that of the metro area or even the State as a whole, including:

- Individuals 65 and older (137% of the metro-wide portion of population)
- Seniors living alone (123% of the State average portion of population)
- Individuals living at or below 2x "poverty income"
- Individuals without vehicle access (115% metro wide average)
- Individuals with limited English proficiency (180% of State average, and 121 of metro-wide average)

Next Steps

We recommend that the City of Maplewood conduct a develop a Climate Adaptation Plan. This effort should focus on refining and applying the adaptation strategies included in this report to the specific geographic features, habitats, city infrastructure, and city neighborhoods with higher concentrations of the demographic sectors most vulnerable to the projected climate change risks.

Once developed, this Climate Adaptation Plan should include an implementation plan with a clear delineation of the individuals and departments responsible for the implementation, monitoring, and refinement of each of the strategies included in this report..



paleBLUEdot llc

2515 White Bear Ave, A8
Suite 177
Maplewood, MN 55109