CLIMATE *READY* TERRE HAUTE

SEPTEMBER 2024

CITY OF TERRE HAUTE INDIANA

GEOS INSTITUTE

INDIANA UNIVERSITY
ENVIRONMENTAL RESILIENCE INSTITUTE

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Welcome Letter

September 12, 2024

Dear Community,

Global climate change is a serious and immediate concern for our local environment, as well as our small-town character and way of life in Terre Haute. The impacts of climate change can greatly increase potential hazards, such as extreme heat and flooding, and adversely impact our local businesses and industries, our institutions and infrastructure, our personal health and the health of our natural systems, and more. We must act now to simultaneously reduce future greenhouse gas emissions and prepare for changes that are, in many cases, already underway.

As a city, we are committed to action, working collaboratively across all sectors to build partnerships and develop a roadmap for long-term resilience. This collaborative process has been underway for many months. It is with great pleasure that we introduce *Climate Ready Terre Haute*, our first climate resilience plan.

This plan describes how climate change is projected to impact Terre Haute and the vulnerabilities that we need to address. Bold strategies have been developed to protect our residents, infrastructure, economy, community culture, and environment. These strategies were created through extensive input by diverse community stakeholders to ensure Terre Haute maintains its unique character and quality of life.

This plan is a crucial first step in the process of preparing Terre Haute for the effects of climate change. The strategies identified here will serve as a launching point for policy adoption and implementation, while also complementing our greenhouse gas reduction and sustainability efforts.

We encourage you to dive into this plan and evaluate how you can contribute to each resilience measure. To create a climate-ready Terre Haute, we must all reduce our individual and collective carbon footprints and adapt to the cascading effects of a changing climate. Together, we can ensure that Terre Haute endures as a safe and vibrant community for years to come.

Sincerely,

Terre Haute Sustainability Commission

Acknowledgements

This report is the product of a year-long process led by the Terre Haute Sustainability Commission, a climate resilience Task Force of key stakeholders in the community, the Environmental Resilience Institute at Indiana University, and the Geos Institute's Climate Ready Communities Team. With appreciation and gratitude for their time and expertise, we expressly thank:

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Geos Institute

Executive Summary

Introduction

Terre Haute is already experiencing the impacts of climate change with more extreme heat, storms, and flooding. The Sustainability Commission is stepping up to the challenge by taking concrete action that protects and benefits people today as well as future generations.

Preparing for climate change is not an easy task — it requires action by every member of the community, as well as government, businesses, organizations and others. The threat of climate change also presents us with opportunities. Terre Haute is in position to harness its innovation, compassion, diversity, and strong community networks to make serious and systemic change. By prioritizing green jobs, living wages, clean technology, healthy parks and waterways, and social equity and justice, *Climate Ready Terre Haute* aims to benefit all community members and protect future generations.

Climate Ready Terre Haute is a plan to reduce climate-related risk to both people and nature. Strategies and actions presented in this plan are designed to protect the most vulnerable residents while building resilience across all people, businesses, and natural resources throughout the community.

Climate Ready Terre Haute is the culmination of an intensive and highly participatory, community-driven process. To ensure that *Climate Ready Terre Haute i*s based on local community values and reflects the expertise of residents, two stakeholder workshops and surveys provided community input and feedback throughout the process. A Task Force from diverse sectors of the community guided this process and ensured that all policies and actions were designed to conserve nature, advance equity, and protect those on the frontlines of climate change.

Terre Haute's Changing Climate

Climate change may be a global phenomenon, but the impacts are felt at the local level. Our region is expected to experience substantial impacts brought on by climate change. These impacts affect all sectors of our community, including human health, natural resources, infrastructure, emergency response, and the economy. Those who are already vulnerable in our community will be the people who are impacted the most.

Climate Trends Snapshot – Terre Haute

	HISTORICAL TRENDS (1976–2005)	MID-CENTURY PROJECTIONS (2035-2064)	LATE-CENTURY PROJECTIONS	LATE-CENTURY PROJECTIONS *with reduced emissions*
Average annual temperature	53.7° F	58.3° F to 59.8° F	59.7° F to 63.4° F	57.8° F to 59.2° F
Single maximum temperature	97.9° F	103° F to 104.3° F	102.8° F to 119.0° F	101.3° F to 111.8° F
Average annual minimum temperature	43.2° F	47.6° F to 49° F	49.3° F to 52.5° F	46.4° F to 48.4° F
Number of days per year above 90° F	26.4 days	61.1 days to 70.3 days	66.3 to 137.4 days	42.4 to 106.0 days
Number of days per year below freezing	25.2 days	13.3 days to 15.1 days	1.2 to 14.5 days	4.8 to 20.7 days
Change in annual precipitation (in)	N/A (Used as a reference for change)	5.5% to 5.9%	6.9% to 7.5%	4.6% to 4.9%
Number of days per year with precipitation over 1 inch	4 days	5.0 to 5.4 days	4.4 to 9.0 days	3.7 to 6.6 days
Drought stress OR days per year with no precipitation (dry days)	182.9 days	185.8 to 187.5 days	166.7 to 231.5 days	174.2 to 203.0 days

Climate Equity and Our Community

Climate change threatens our people, resources, and overall quality of life, including the features and values that define our vibrant community. Terre Haute is home to the most parks per capita in Indiana and has been a Sterling Tree USA city since 2014. It has unique arts and recreational amenities like the Vigo County History Center, Swope Art Museum, Terre Haute Symphony Orchestra, a large and well-maintained system of public parks, and the Indiana Theatre, which features the second largest indoor movie theater in the state. The presence of Indiana State University, Ivy Tech Community College, Rose-Hulman Institute of Technology, and Saint Mary-of-the-Woods College also makes the city a hub for higher education.

While climate change affects everyone in the community, it impacts some residents far more than others. Climate change exacerbates many existing stressors related to health, income, and housing

quality and availability. The strategies outlined in *Climate Ready Terre Haute* address climate impacts to the entire community, with a focus on the needs of those on the frontlines.

Climate Vulnerabilities

This plan examines climate vulnerabilities across five community systems: Health and Emergency Services, Natural Systems, Infrastructure, Business and Economy, and Community Culture. Some of Terre Haute's identified vulnerabilities include:

- Increased flooding risks
- Outdoor cultural activities impacted by poor air quality and extreme heat
- Degradation of mental health due to an increasingly extreme climate
- Loss of biodiversity
- Impacts to agriculture from extreme heat, decreased precipitation, and more extreme weather events

Climate Resilience Strategies

Terre Haute is actively working to prepare and build resilience in the face of accelerating climate impacts. Many of the strategies and actions within *Climate Ready Terre Haute* provide co-benefits, thereby strengthening the whole community by addressing not only climate change but many other community stressors.

The strategies presented in this report are organized into four themes that reflect our future vision of Terre Haute as the impacts of climate change worsen.

Resilience Education

Giving Hauteans agency and control over their own resilience is an effective way to foster community buy-in to climate change action and to educate residents on the importance of adaptation and mitigation efforts. Providing residents with resilience education will also take some burden off of overburdened local government and other stakeholders. Teaching the community how to plant their own trees, identify what a safe environment looks like, and access and grow food locally are just some of the ways resilience education can improve quality of life.

Robust Natural Systems

Green spaces and nature are critical for healthy neighborhoods. Parks, clean waterways, and healthy ecosystems provide connections to nature throughout the city. Healthy, intact natural systems also provide valuable ecological functions, such as filtering pollutants from the air and water, mitigating flood impacts, and reducing air temperatures.

Resilient Infrastructure

Climatic changes like increasing temperatures, more frequent and severe flooding, and drought can impact critical infrastructure. This built environment that we depend on includes our homes; commercial buildings; the energy distribution grid; water delivery, storm- and wastewater systems; floodwalls; roads, highways, bridges, and culverts; communication networks, and other structures.

Healthy and Safe Citizens

Maintaining and improving the physical and mental health of Terre Haute's residents is a top priority. As new climate-related impacts arise, greater investment in wellness, personal resilience, access to health care, and health care capacity will be needed.

Climate Resilience Strategies for Terre Haute

These climate resilience strategies were developed to address the specific climate vulnerabilities of Terre Haute. They are listed in priority order as determined by local stakeholders and community members.

Priority	Strategy	Theme
1	**Strategy RE-1: Develop Smart Parks**	Resilience Education
2	**Strategy NS-1: Connect Farmers to the Local Economy**	Robust Natural Systems
3	**Strategy RE-2: Build Capacity for Growing and Using Food**	Resilience Education
4	**Strategy RE-3: Establish a Homegrown National Park Program**	Resilience Education
4	**Strategy NS-2: Improve Natural Conservation of Water**	Robust Natural Systems

5	**Strategy RI-1: Create a More Resilient Power Grid**	Resilient Infrastructure
6	**Strategy HS-1: Build Community Resilience to Heat and Extreme Weather**	Healthy and Safe Citizens
7	**Strategy RI-2: Create More Safely Floodable Areas**	Resilient Infrastructure
8	**Strategy NS-3: Transition Existing Canopy to Trees Adapted to Warmth and Drought**	Robust Natural Systems
9	**Strategy RI-3: Update City and County Construction Policies**	Resilient Infrastructure
10	**Strategy HS-2: Ensure Preparedness of Healthcare Providers and First Responders**	Healthy and Safe Citizens
11	**Strategy NS-4: Create a Greenway Along Wabash Ave**	Robust Natural Systems
12	**Strategy RE-4: Create a Marketing Plan for Resilient Species to Plant**	Resilience Education
13	**Strategy HS-3: Provide Refuge Day and Night During Heat Emergencies**	Healthy and Safe Citizens
14	**Strategy RI-4: Use City Vacant Lots for Resilience Purposes**	Resilient Infrastructure
15	**Strategy RE-5: Improve Resilience on the Heritage Trail**	Resilience Education
16	**Strategy RI-5: Improve Access to Water**	Resilient Infrastructure
17	**Strategy HS-4: Support Persons Involved in Mandatory Outdoor Activities**	Healthy and Safe Citizens
18	**Strategy RI-6: Provide Housing to Unhoused Persons**	Resilient Infrastructure

Introduction

The city of Terre Haute is located in west-central Indiana and is the seat of Vigo County. With a population of over 58,000, it is the state's 15th largest city and lies at the important national intersection of Interstate 70 and US 41. Terre Haute is on the banks of the Wabash River, which is the second largest tributary to the Ohio River and the longest segment of free-flowing river east of the Mississippi River.

Terre Haute's history stems from a strong manufacturing base, and although it has struggled to retain manufacturing like other Midwestern cities, its ideal location has helped it to succeed on this front. We possess a variety of cultural and arts offerings and a resurgent downtown. Vigo County is home to a university and three colleges, making it one of Indiana's higher education hubs. Nonprofit organizations are highly revered in the community, particularly within the environmental sphere. As will be explored in this report, the residents of Terre Haute value its small-town feeling that is coupled with the resources of a larger city, as well as our excellent access to nature and public parks.

It is a well-documented reality that climate change is becoming a pressing issue for communities across the nation. Current projections paint a picture of long-term change centered around increasing heat, decreasing precipitation, and more extreme weather events. These projected changes will undeniably place stress on communities and create a new set of challenges for governments, businesses and residents to overcome. Developing resilience is one way to lessen the negative effects of climate change, as this report will outline.

Terre Haute is already experiencing the impacts of climate change with more extreme heat, storms, and flooding. Local government is stepping up to the challenge by taking concrete action that protects and benefits people today as well as future generations.

Reducing greenhouse gas emissions is critical to avoid locking-in more extreme climate impacts. Efforts to cut greenhouse gas emissions must go hand-in-hand with action to prepare for the changes that are already taking place. That is why Terre Haute launched *Climate Ready Terre Haute:* to determine the risks posed by climate change and outline steps that can be taken to increase community resilience.

A more resilient Terre Haute will be better able to withstand and bounce back from extreme events, such as more intense heat waves, bigger storms, flooding and drought. Climate action must also include the creation of thriving and resilient families, neighborhoods, businesses, cultural and faith communities, food systems, infrastructure and other key community components.

Climate change is already underway and must be addressed. Terre Haute is dedicated to investing in a vibrant future for all residents by protecting both people and nature from ongoing and future impacts and reducing emissions.

Preparing for climate change is not an easy task — it requires action by every member of the community, as well as government, businesses, organizations and others. The threat of climate change also presents us with opportunities. Terre Haute is in position to harness its innovation, compassion, diversity, and strong community networks to make serious and systemic change. By prioritizing green jobs, living wages, clean technology, healthy parks and waterways and social equity and justice, *Climate Ready Terre Haute* aims to benefit all community members and protect future generations.

Climate Ready Terre Haute is the culmination of an intensive and highly participatory process, which included extensive engagement by local stakeholders representing health care, neighborhood associations, transportation, business, government, emergency preparedness and response, non- profit organizations, conservation groups, industry, and others. A similarly diverse Task Force ensured that all strategies work to advance equity and protect those most at-risk from climate impacts.

Resilience is the ability of people and their communities to anticipate, accommodate and positively adapt to or thrive amidst changing climate conditions and hazard events. Resilient communities enjoy a high quality of life, reliable systems, economic vitality, and they conserve resources for present and future generations. (Urban Sustainability Directors' Network)

Climate Change Adaptation is anticipating the adverse effects of climate change and taking appropriate action to prevent or minimize the damage.

This plan is a combination of both concepts. We strive to anticipate adverse effects and utilize proven and new approaches that allow our community to spring back from disruptions. This plan presents an opportunity to do things in new ways, so that all members of our community can prosper and flourish, even if the future is very different from what we experience today.

Purpose of this Climate Resilience Plan

Climate Ready Terre Haute is more than a planning document. It is also an opportunity for our community to clarify our vision for the future and develop a pathway to realize that vision. The guiding

principles and vision statements below are the result of a highly collaborative effort with local government staff, the project Task Force, and community members. These statements represent

our best understanding of the challenges and opportunities that climate change presents our community today, but we recognize that these may shift over time.

Vision Statement

We envision our city as a vibrant, sustainable community prioritizing local business and agriculture through a resilient lens. We value the input and passion of our community members and nonprofit organizations, and recognize the importance of community involvement in achieving sustainable living. Our effort seeks to ensure that the people of Terre Haute benefit from walkable, enjoyable green space and a healthy, sustainable urban environment for work, play, and community gathering.

Guiding Principles

A community survey sent to Terre Haute residents in August 2023 offers insight into what citizens value most about the city. Fifty percent of respondents identified features of a small, tight-knit community, such as family, friends, home, and quality of life, as their favorite aspect of Terre Haute. Parks and nature were also highlighted as a source of great enjoyment at 22 percent. Understanding community values is crucial when developing climate resilience because leaders of these efforts will be better able to steer the work in a direction that aligns with the values of the people being served.

An activity during the October 2023 vulnerability assessment workshop asked participants to identify one resource that Terre Haute already possesses to promote resilience. The overwhelming answer was passionate people, especially youth. EARTHlings, a youth climate activism group in Terre Haute, provided speakers at the event and had a powerful impact on participants. Terre Haute has a strong foundation for grassroots, community-led change, starting with its youth.

Scope of Plan

The scope of *Climate Ready Terre Haute* encompasses the municipal boundaries of Terre Haute. However, many of those who call Terre Haute home live outside of those boundaries in unincorporated Vigo County. Data from Vigo County is used throughout this plan (as many projections and historical metrics are at a county scale), but its primary focus is the City of Terre Haute.

Whole Community Resilience

Climate change affects everyone and everything in our community at the same time. As people start to make changes to adapt to climate change, some of these changes can have unintended consequences. Close coordination and communication are needed to prevent redundancy or conflicting actions. People will need to work together to ensure all sectors and populations of Terre Haute are protected.

Climate action in Terre Haute advances:

*Green jobs and living wages
*Neighborhood networks and support
*Cross-cultural, interracial understanding
*Investment in underserved areas
*Opportunities to be active and healthy
*More efficient and healthier homes
*Preparedness for extreme events
*Cleaner air, waterways, and parks
*Improved ecosystem health
*Greater biological diversity
*Environmental and social awareness

The Planning Process

Climate Ready Terre Haute is the culmination of an intensive and highly participatory, community-driven process. A diverse Task Force guided the process and ensured that all policies and actions were designed to conserve nature, advance equity, and protect the most vulnerable populations from climate impacts. (See Appendix 6: Community and Stakeholder Outreach)

To ensure that *Climate Ready Terre Haute* is based on local values and reflects the expertise of residents, stakeholder workshops and surveys provided community input and feedback throughout the process.

Figure 2. Timeline of major milestones in the Climate Ready Terre Haute planning process.

Stakeholder Workshops

Subject matter experts from throughout Vigo County came together on two occasions to guide this planning process. In the first workshop, participants reviewed future climate change projections and then identified and prioritized climate impacts across five community systems: Built, Natural, Economic, Cultural, and Social. This information was combined with broad public input collected via surveys and listening sessions to develop the Vulnerability Assessment portion of this plan.

Three months later in January 2024 the same stakeholders met again to identify cross-sector and collaborative strategies to address the vulnerabilities identified in the earlier workshop. These strategies, along with input from the broader public, form the foundation of this adaptation plan.

Community Surveys

Surveys were distributed digitally through formal channels (i.e. the City of Terre Haute's Facebook page and via email). We received 206 responses from community members. Of the respondents, 84% were White. 69% were generally "extremely concerned" about climate change. The most concerning climate impact for residents was impacts to the agricultural sector, followed by the effects of extreme heat. See Appendix 6: Community and Stakeholder Outreach.

> *"I am concerned about extreme heat and more intense storms. Also the change in season of precipitation is bad for agriculture."*
> – Community Resident

How to Use This Report

This report provides information on the past and future climate trends of Terre Haute, information about the climate vulnerabilities across all sectors of the community, and the specific goals, strategies, and actions Terre Haute will use to address those vulnerabilities. It is important to note that this report represents an understanding of Terre Haute at one point in time. The information in this report should be used as a starting point for building climate resilience, with regular updates and revisions.

Climate Ready Terre Haute is divided into four primary sections:

1. Climate Trends
2. Community Trends
3. Climate Vulnerabilities
4. Resilience Strategies

Each section builds on the information from the previous one, ensuring that the resulting strategies are based on the best available information and address local priorities (see Figure 3). This robust list of strategies and actions was developed in collaboration with the community. These ranked options are directly tied to the identified climate vulnerabilities for Terre Haute and they provide clear and prioritized steps to building greater climate resilience.

This report has been designed so that each section acts as a summary and may be used independently, with additional details and supporting information provided in the appendices.

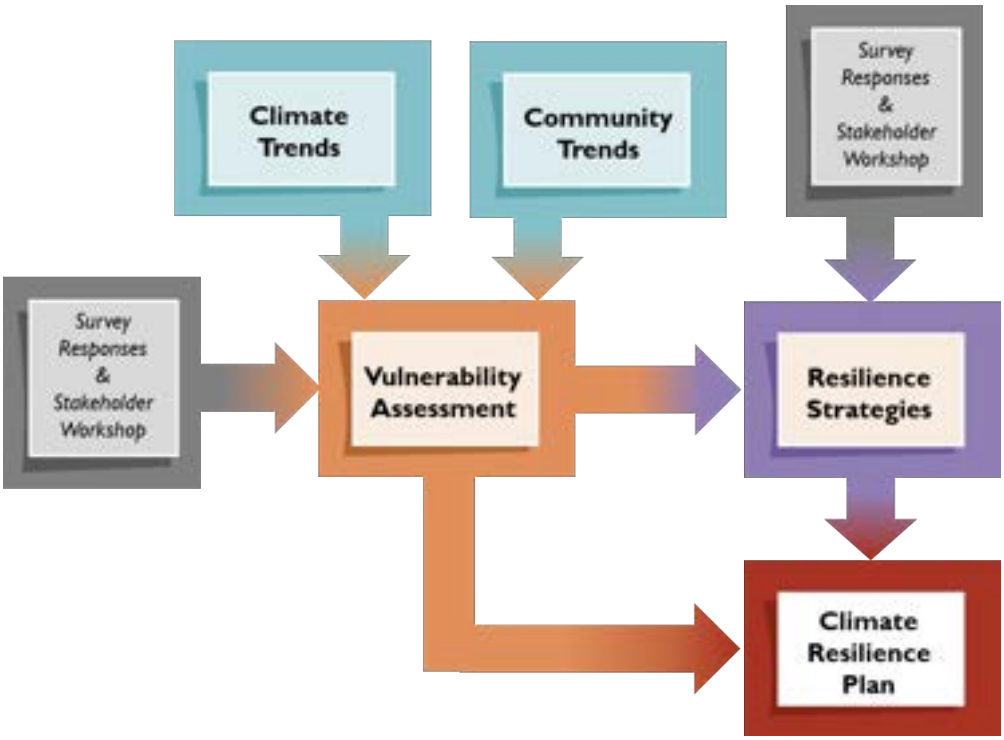

Figure 3. The components that comprise this Climate Ready Terre Haute Plan.

Connecting Past and Present

Climate Ready Terre Haute builds upon our efforts to date. As we look to the future, climate change will need to be considered in all decisions. Herein lies the opportunity to plan for climate impacts in ways that make our community more equitable for people of different income levels and backgrounds.

Terre Haute's young people face a climatic future very different from that enjoyed by their parents and grandparents because of warmer temperatures, new precipitation patterns, and a faster rate of change. We have a responsibility to prepare for this future by building resilience across all parts of the community to allow people and nature to respond and adapt in positive ways.

In 2020, a group of young activists called EARTHlings formed; "EARTH" stands for "Earth Activists for a Resilient Terre Haute." Their mission was to call attention to climate change and sustainability through formal channels, and they began to push for a climate change resolution adopted by the City Council. This resolution passed in August of 2021. Terre Haute formally acknowledged the existence and threat of climate change and formed the Sustainability Commission to create this climate action plan. Terre Haute currently partners with the Indiana University Environmental Resilience Institute for technical assistance in this endeavor (Bhattacharyya, 2022). EARTHlings, Earth Charter Indiana, and reTHINK are all local activist groups that have been critical in pushing for sustainability and climate resilience. In 2022, the City's first greenhouse gas emissions inventory was completed.

Advancing Climate Equity

Climate change does not affect all residents evenly. Many people experience more severe impacts than others. Those who are most impacted often contributed the least to the problem. Climate inequities stem from the existing unequal distribution of social, political, and economic power.

Preparing Terre Haute for the impacts of climate change requires significant investment of time and resources across all components of the community, including business, health, education, infrastructure, community culture, and natural resources. Investments in climate solutions need to support and empower those who are most at risk. Unless climate equity is prioritized from the beginning, and power disparities are recognized throughout the process, climate planning will likely default to existing inequitable and exclusionary patterns and approaches and prevent real progress.

What is Climate Equity?

Climate equity is a framework, a goal, and a process. It asks that the diversity of histories, abilities, and needs across community members be accounted for in the design and implementation of climate change solutions. Residents of Terre Haute have differing levels of ability to protect themselves from impacts. As climate change progresses, important work on social and environmental justice will increasingly need to focus on climate impacts.

Many residents of Terre Haute are disadvantaged due to lower income, race, language, gender, LGBTQ+ status, mobility, disability, housing status, health condition, age, etc. By engaging and empowering disadvantaged residents to take on leadership roles and become the recipients of much of the investment in climate resilience, existing inequities can begin to be corrected. All residents of Terre Haute benefit when those who are most vulnerable become more resilient and empowered.

Terre Haute has a history of redlining. Source: Larimer, 2022

Reference

Larimer, M. (2020, September 6). *Redlining up close: A local case of systemic racism.* Slow Worm. https://slow-worm.com/2020/06/09/redlining-up-close-a-local-case-of-systemic-racism/

Climate Change Trends

Climate change may be a global phenomenon, but the impacts are felt at the local level here and all around the world. These impacts affect all sectors of our community, including human health, natural resources, infrastructure, emergency response, and the economy. Those who are already vulnerable will be impacted the most.

Terre Haute's Climate is Already Changing

The average annual temperature in Indiana has already increased 1.8° F from 1960 to 2020 (Widhalm et al). Precipitation from more extreme storms has increased by 5.6 inches since 1895 (Cherkauer et al). Over 3,000 homes are at risk of severe flooding in the next 20 years (Risk Factor).

Image of the 2008 Vigo County 100-year flood. The Wabash River neared record-high crests. Source: Tribune-Star

Future Climate Change in Terre Haute

Atmospheric scientists have created models that help us predict future climate. These Global Climate Models (GCMs) were adjusted to the local scale and help us understand how Terre Haute will be affected. Terre Haute's climate is expected to continue to change. If greenhouse gas emissions are reduced, this change is expected to level off mid-century. Table 1 highlights the expected changes for continued business-as-usual emissions and reduced emissions.

Table 1. Projected changes in key climate indicators for Terre Haute. (Sources: data and projections from CMRA, Climate Explorer, and Climate Toolbox).

Climate Trends Snapshot – Terre Haute

	HISTORICAL TRENDS (1976–2005)	MID-CENTURY PROJECTIONS (2035-2064)	LATE-CENTURY PROJECTIONS	LATE-CENTURY PROJECTIONS *with reduced emissions*
Average annual temperature	53.7° F	58.3° F to 59.8° F	59.7° F to 63.4° F	57.8° F to 59.2° F
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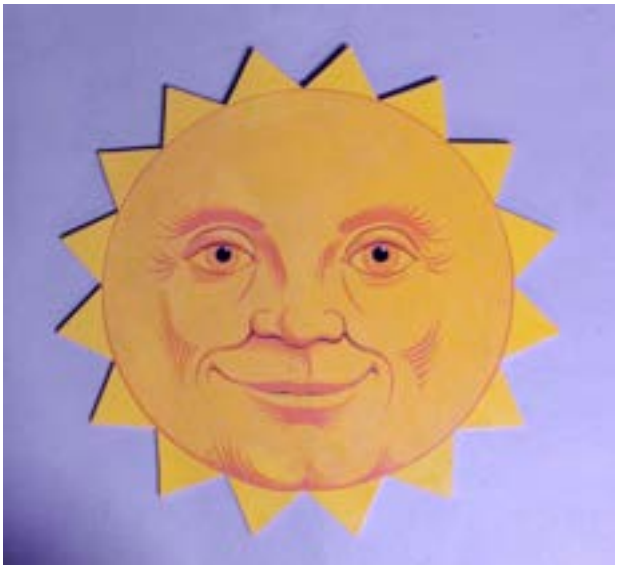
Average annual minimum temperature	43.2° F	47.6° F to 49° F	49.3° F to 52.5° F	46.4° F to 48.4° F
Number of days per year above 90° F	26.4 days	61.1 days to 70.3 days	66.3 to 137.4 days	42.4 to 106.0 days
Number of days per year below freezing	25.2 days	13.3 days to 15.1 days	1.2 to 14.5 days	4.8 to 20.7 days
Change in annual precipitation (in)	N/A (Used as a reference for change)	5.5% to 5.9%	6.9% to 7.5%	4.6% to 4.9%
Number of days per year with precipitation over 1 inch	4 days	5.0 to 5.4 days	4.4 to 9.0 days	3.7 to 6.6 days
Drought stress OR days per year with no precipitation (dry days)	182.9 days	185.8 to 187.5 days	166.7 to 231.5 days	174.2 to 203.0 days

More details about climate change trends and projections for Terre Haute can be found in Appendix 1: Climate Change Trends Primer.

Like the rest of Indiana, the climate of Terre Haute has already changed over the past several decades. At the current rate of greenhouse gas emissions, these trends are expected to continue. The primary changes to climate characteristics for Terre Haute include:

- Warmer annual average temperatures and more significant warming in winter months.
- Decrease in the number of days below 32 degrees Fahrenheit).
- Increase in extreme heat days (days above 95 degrees Fahrenheit).
- Increase in heavy rainfall events, with an increase in flood potential.
- Increase in time between precipitation with an increase in drought potential.
- Greater variability in temperature and precipitation trends.



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Community Trends Summary

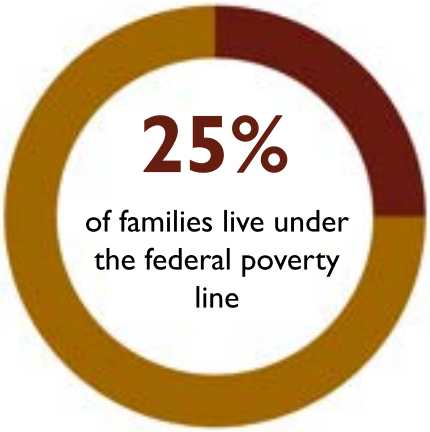
Climate change threatens our people, resources, and overall quality of life. As Terre Haute works to develop a plan that will ensure long term climate resilience, it is important to identify the features and values that create our vibrant quality of life.

This overview of basic community systems in Terre Haute provides a snapshot of how the city and its surrounding area function at the time this report is written. It is intended to support the climate change vulnerability assessment workshop process, and lead to robust strategies.

More information about these community trends can be found in Appendix 2: Community Trends.

People and the Economy

- Terre Haute has a population of approximately 58,000 (U.S. Census Bureau).
- 80.6% of the population identifies as White, and 11.4% identifies as Black or African American (U.S. Census Bureau).
- The largest employment sector is management and business, followed by service occupations (U.S. Census Bureau).
- Terre Haute's unemployment rate is 4.4%, higher than the national average (U.S. Census Bureau).
- Important anchor institutions include Indiana State University, Rose-Hulman Institute of Technology, St. Mary-of-the-Woods College, Ivy Tech Community College and Union Health.
- 25% of people are under the federal poverty line (U.S. Census Bureau).
- 3000 homes are located within a FEMA flood zone (RiskFactor).
- Disadvantaged populations in Terre Haute include low-income neighborhoods, non-English speakers, people with disabilities, people without health care, and others.



Nature and the Environment

- Terre Haute lies on Indiana's state river, the Wabash River
- The Terre Haute Parks Department owns over 1,000 acres of dedicated land, including community parks, neighborhood parks, block parks, two golf courses, as well as trails, greenways and boulevards.
- The community takes pride in its 28.32% tree canopy, which is higher than the national average (iTree and DeepRoot).
- Terre Haute has received the Tree City USA designation for the past 18 years from the National Arbor Day Foundation and in 2014 received the prestigious Sterling Tree City USA status.

Infrastructure

- Terre Haute receives its municipal water from four wells near the Wabash River; it is then treated and distributed by the Indiana-American Water Company (City of Terre Haute).
- Duke Energy provides electricity and CenterPoint Energy provides natural gas.
- Major transportation routes include U.S. Routes 40 and 41, I-70, S.R. 46 and Wabash Avenue.

Cultural Resources

- Before white settlement in Terre Haute during the early 19th century, the land was primarily home to the Wea tribe, a faction of the larger Miami tribe that spread across Indiana and the Midwest. Now the Native American population here is 2%, according to the U.S. Census Bureau.
- Terre Haute is an arts, service, educational, and healthcare hub for West Central Indiana and East Central Illinois.
- In 2010, Terre Haute was named the Indiana Chamber of Commerce's Community of the Year.
- In 2018, the Indiana Arts Commission formally recognized the 41|40 Arts and Cultural District in Terre Haute. Radiating from the Crossroads of America intersection at 7th and Wabash, the district encompasses Downtown, the Brewery District, and much of Indiana State University's campus

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Climate Change Vulnerabilities

Climate impacts affect every person, structure, business, natural resource, and organization in Terre Haute. And yet, some will be impacted far more than others. Vulnerability depends on many factors, including ongoing stressors, potential climate impacts, and existing adaptive capacity.

This plan examines vulnerabilities across the following five community systems:

Social Systems - this includes the health care system, education and schools, law enforcement, emergency response services, and under-represented populations such as communities of color, people with disabilities, youth, elders, low-income workers, and those experiencing homelessness.

Natural Systems – this includes all aquatic, terrestrial, and marine ecosystems in the community. These may be public lands or privately owned, including urban greenways such as parks, tree rows, and residential yards.

Built Systems – this includes all the built elements in the community such as stormwater, wastewater, and drinking water systems; transportation networks like roads and railways; energy production and distribution infrastructure; communication towers; as well as homes, businesses and other buildings.

Economic Systems – this includes community economic drivers such as small businesses , large industry, agriculture, commercial spaces, recreation resources, and tourism.

Cultural Systems – this includes offerings that make a community special and feel like home to its residents, such as faith communities, civic organizations, local cultural groups, festivals, and events. This also includes specific cultural practices or needs of indigenous people or immigrant populations.

Climate Change Vulnerabilities in Terre Haute

Local experts from diverse sectors of the community created the list of vulnerabilities and prioritized them across all five systems. For more information and details on this process, see Appendix 3: Climate Vulnerability Assessment.

Table 2. The following populations and resources were identified as vulnerable to climate change.

Climate hazards - The specific climate trend or projection that is already causing or is expected to cause the impact.

 **Severe Heat** – There could be 32-57 more days/year above 90° F

 **Larger Storms** - The amount of precipitation in the largest storms could increase 5-30%

 **Drought** - Drought stress could increase by 44-78%

 **Flooding** – More homes and businesses at risk of flooding

Timeframe

When the impact is expected to occur
Near-term = current to 2030s
Mid-term = 2040s to 2060s
Long-term = 2070s to 2090s and beyond

Sensitivity

How much of a response or how great of an impact is expected (e.g. how disruptive it is, how serious the consequences are, and how much overall change is expected)
High, Medium, or Low

Adaptive Capacity

Whether there are already existing resources, programs, or policies in place to protect people or to respond to the changes with little disruption
High, Medium,or Low

Rank	Sector(s)	Vulnerability	Climate Hazard(s)	Time frame	Sensi-tivity	Adaptive Capacity
1	Built	Increased flooding risks due to more extreme weather		Near term	High	Low
2	Cultural	Outdoor activities limited by poor air quality		Near term	High	Low
3	Cultural	Greenways affected by weather severity		Near term	High	Low

4	Social	Increased mental health challenges worsened by climate change		Near term	High	Med
5	Natural	Impact on trees from increased heat, decreased precipitation, and invasives		Near term	High	Med
6	Natural	Decreased biodiversity due to extreme heat and weather events		Near term	High	Med
7	Economic	Impacts on agriculture from increased heat and change in growing season		Near term	High	Med
8	Economic	Healthcare industry affected by flooding, increased heat exposure, and poor air quality		Mid term	High	Med
9	Cultural	Blueways/rivers affected by weather severity		Near term	High	Med
10	Social	Increased frequency of power outages due to extreme weather		Near term	High	Med
11	Social	Decreased ability to grow produce due to changing water patterns		Near term	High	Med
12	Cultural	Cultural facilities limited by adaptive costs		Near term	High	Med
13	Social	Decreased water supply due to changing precipitation patterns		Near term	Med	Low
14	Economic	Increased insurance costs due to extreme weather		Mid term	Med	Low
15	Social	Greater risk of respiratory issues due to poor air quality		Near term	Med	Low
16	Built	Increased demand for cooling due to higher heat		Near term	Med	Low

17	Natural	Impacts to the Wabash River and watershed due to flooding and drought		Mid term	High	High
18	Social	Increased health risks from vector-borne diseases due to high heat		Mid term	Med	Med / High
19	Built	Increased strain on drinking water due to drought and increased heat		Long term	Med	Med / High
20	Cultural	Outdoor activities limited by high heat		Near term	Med	Med / High
21	Social	More severe fires due to drought and extreme heat		Mid term	Med	High
22	Economic	Impacts to the tourism sector affected by increased heat and extreme weather		Near term	Med	High

Strategies to Prepare for Change

The following sections provide an overview of the ways that Terre Haute will prepare and build resilience in the face of accelerating climate impacts. Many of the goals, strategies, and actions within *Climate Ready Terre Haute* provide co-benefits, thereby strengthening the whole community by addressing not only climate change but many other stressors.

Effective strategies and actions will address climate vulnerabilities by either *reducing the potential impact* and/or *increasing the adaptive capacity* for the population or resource affected. Actions that reduce the potential impact may reduce the exposure to the climate hazard, or the sensitivity of the population or resource, or both. Actions that address the adaptive capacity can increase existing or develop new adaptive capacity.

Areas where Terre Haute can lead through direct governmental action are highlighted throughout the plan. To achieve success, however, actions must also be supported and implemented by residents, businesses, neighborhoods, nonprofit organizations, faith communities, schools and others.

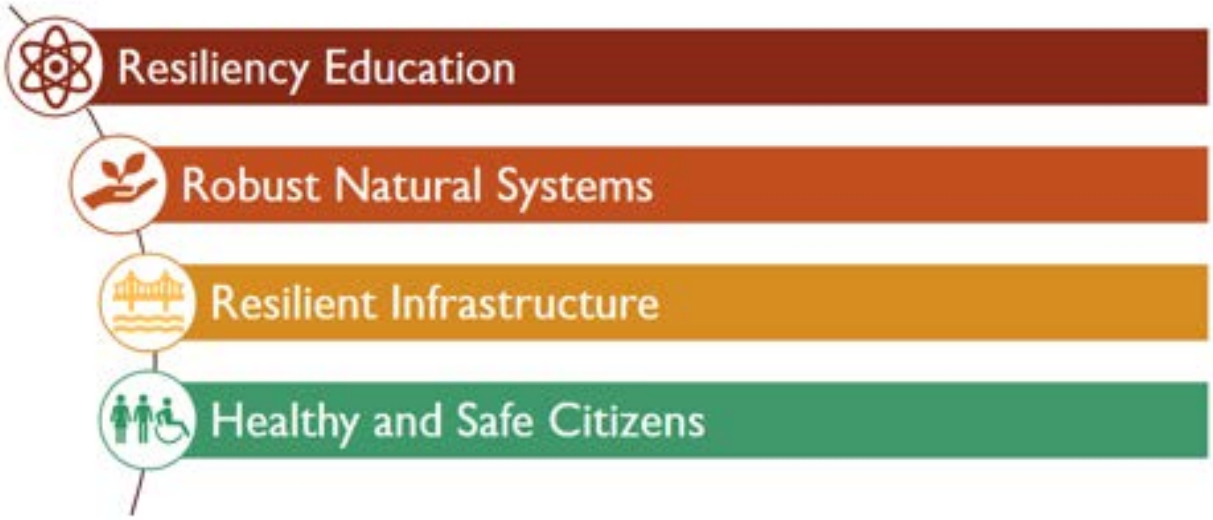
Symbols used in this plan

- Enhances environmental health and biological diversity
- Helps to build equity for historically marginalized groups
- Terre Haute leads through direct governmental action
- Supports efforts to reduce greenhouse gas emissions (mitigation)
- Cross-sector strategy addresses multiple needs across the community
- Indicates a high priority item

How to Read This Plan

Climate Ready Terre Haute is organized into four themes that reflect the future of Terre Haute as climate change progresses. Within each theme are key goals, and a suite of strategies to address those goals. Strategies which help to address other important community values such as equity, nature, and mitigation are highlighted throughout the plan.

Climate Ready Terre Haute Themes



Resiliency Education

While government action promoting resilience is a good and useful strategy, building resilience should not just be a top-down effort. Teaching citizens about resilience strategies and practices they can carry out on their own not only builds community strength and knowledge, but can potentially reduce the burden on government and organizational systems.

Education can occur in every sphere of life in Terre Haute. It can happen in schools, teaching the next generation about resilience that they can carry into adulthood, or it can happen through local government and organizations. Adults also have the capacity to learn strategies and practices to become resilient and self-reliant in the face of climate change.

These strategies are often labor intensive and can be costly up front, but the payoff is clear. By giving Hauteans the tools they need to build their own resilience in their homes, schools, and organizations, local government can more effectively focus on the strategies that only they can accomplish, as well as mitigation. Organizations like the White Violet Center for Eco-Justice and ReTHINK already do some of this work locally, and drawing examples of education from their practices is another strong way to build community resilience.

Strategies to foster resiliency education:

Strategy RE-1: Develop Smart Parks

Strategy RE-2: Build Capacity for Growing and Using Local Food

Strategy RE-3: Establish a Home Grown National Park program

Strategy RE-4: Create a Marketing Plan for Species to Plant

Strategy RE-5: Improve Resilience on the National Road Heritage Trail

Theme: Resiliency Education

Strategy RE-1: Develop Smart Parks

Terre Haute is known for and proud of its many parks and outdoor amenities. However, residents' ability to enjoy these parks will most likely be inhibited by climate change, specifically by extreme heat and poor air quality during the summer months. Since Terre Haute and Vigo County have parks with varying tree cover, shade infrastructure, and proximity to pollution emitting manufacturing centers, those who frequent parks with a higher climate change impact may be affected disproportionately.

A Smart Parks initiative would have a two-pronged approach. Signage would be developed and established at each park in the city signaling the day's air quality index and temperature and whether or not that park is safe to enjoy that day, much like fire risk signs in state and national parks. This information would also be available on a city website through the parks department. That website would point residents toward parks with the least amount of risk so that they could still enjoy the outdoors.

This strategy could also assist cultural programming, like festivals, after-school programs, etc., allowing for more effective and safely planned outdoor events. Tracking park attendance through this program could highlight which parks are the most at risk, signaling to the city focus areas for improvement like increasing tree canopy.

Addresses Risks
2, 4, 12, 20, 22

Lead* & Implementing Partner(s)
City Parks Department*; City Engineering, Urban Forester, City Signage Department

Effectiveness

Evaluation Metrics
- Website traffic
- Park attendance

Upfront Costs

Ongoing Costs

Potential Actions
1. Park signage program signaling air quality and temperature
2. Air quality and temperature monitoring website

Theme: Resiliency Education

Strategy RE-2: Build Capacity for Growing and Using Local Food

The current American food system brings in products from all over the country and the world—places with vastly different climates and susceptibility to climate change. Food systems throughout the world will be disrupted by climate change, thereby affecting the supply chain to grocery stores in Terre Haute. Foods we take for granted will become more scarce, expensive, or poorer in quality. This

system gap is an excellent place to teach Hauteans the value of locally-grown food and how to produce it ourselves.

Locally grown foods are an important part of resilience. Not only do community members get to take control of some of their own food supply, but foods that are grown on a smaller scale in-season are more likely to be of good quality even with climate change. Hauteans can learn about what foods Indiana grows and how to use them in place of foods that are shipped from other parts of the world. Using local food also reduces the greenhouse gas emissions created when transporting food from other parts of the world.

Building awareness of the resources already in place for local foods is one place to start. Terre Foods, a cooperative market, is a new initiative in the city that supplies local foods. The Vigo County Purdue Extension has a Nutrition Education program that could be expanded with more local buy-in. These are just some places where the community could start building resilience in this capacity.

Addresses Risks
6, 7, 11

Lead* & Implementing Partner(s)
Sustainability Commission*, Purdue Extension, USDA, Vigo County Health Department, Union Health, Terre Haute Farmers Market, Terre Foods, Indiana State University, Colleges, Vigo County School Corporation

Effectiveness

Evaluation Metrics
- Establishment of a local food usage program
- Number of vendors at Terre Foods market
- Number of vendors at Terre Haute Farmers Markets

Upfront Costs

Ongoing Costs

Potential Actions
1. Convene group to develop plan to increase education and awareness
2. Incentivize using and growing food locally

Theme: Resiliency Education

Strategy RE-3: Establish a Homegrown National Park program

The Homegrown National Park program aims to give private persons the ability to combat biodiversity loss in their own spaces. The initiative's goal is to plant 20 million acres of native plants across the country (Homegrown National Park). It connects individuals with local resources and instructions on how to grow and maintain native plants. Terre Haute can help supplement this by encouraging the program through official channels. The City could also establish a demonstration plot on city property to show residents what a Homegrown National Park plot could look like.

This program could also lead the city to become a Bee City. Like a Tree City USA, a Bee City must meet a number of requirements demonstrating support for their bee population. ISU is a Bee Campus, and collaborating with the school would be useful. In order to garner community support for bees, educational resources would need to be available demonstrating the importance and necessity of bees for ecosystem health and maintenance of biodiversity.

Addresses Risks
4, 6, 8

Lead* & Implementing Partner(s)
Sustainability Commission*, Master Gardeners, ISU, Purdue Extension, Parks Department, Vigo County Soil and Water Conservation District, Homeowners

Effectiveness

Evaluation Metrics
- Establishment of a demonstration plot
- Number of homeowners enrolled in Homegrown National Park

Upfront Costs

Ongoing Costs

Potential Actions
1. Establish a Homegrown National Park demonstration plot
2. Pursue Bee City USA designation
3. Pledge to prioritize biodiversity through policy and planning

Theme: Resiliency Education

Strategy RE-4: Create a Marketing Plan for Resilient Species to Plant

Plant Hardiness Zones detail what plants and trees are best suited to survive in different regions of our country. As average annual temperatures rise, these hardiness zones are shifting northward, meaning that some trees and other plants that were once suited to Terre Haute's climate will no longer be so. In order for the City's tree canopy to be resilient to climate change, proactive measures should be taken to ensure the correct trees grow into maturity in the coming years.

This can be a City-led effort, but citizens should also be involved so that community knowledge on new "native" species can be built. Information about what trees should and shouldn't be planted is already available, but it needs to be more effectively communicated to the public. By sharing this information in a purposeful and strategic way, Hauteans will not only be more informed about what trees to plant, but they may be more motivated to plant trees overall. Public trees are only one part of a holistic tree canopy, and encouraging tree planting on private property will assist in making the tree canopy resilient and while also mitigating emissions.

Addresses Risks
1, 5, 6, 16

Lead* & Implementing Partner(s)
City Forester*, TREES, Inc., Purdue Extension, Master Gardeners

Effectiveness

Evaluation Metrics

- Amount of new resilient tree species planted
- Events held by the city where species information is shared

Upfront Costs

Ongoing Costs

Potential Actions

1. Compile existing resources about tree planting in Terre Haute
2. Begin a program to help residents plant and maintain their own trees
3. Hold more city-led tree planting and maintenance events for education and awareness

Theme: Resiliency Education

Strategy RE-5: Improve Resilience on the National Road Heritage Trail

The National Road Heritage Trail is an important mode of transportation and outdoor enjoyment in Terre Haute. Spanning 6.5 miles, it connects Indiana State University and Rose Hulman Institute of Technology and runs through the center of the city parallel to Wabash Avenue. This trail is the most prominent in the city and would be an ideal starting point for making the trails in Terre Haute resilient. This, in part, entails providing walkers and cyclists adequate shade either through tree cover or shade infrastructure. The trail can also be a place to provide education on climate change and how it will affect beloved native plants and animal species. This strategy proposes a native plant mile marker program on the trail, marking every half mile with a plant, flower, or tree native to Indiana or the Midwest and an accompanying placard describing it and how it could be potentially impacted by climate change. Because this information could be upsetting, the placards would not need to be on the trail year-round; the month of April would be a good place for this to start, as part of Earth Day. However, in order to promote grassroots, citizen-led resilience, Hauteans must be presented with the negative impacts of climate change so that we are motivated to take action.

Addresses Risks

3, 4, 6, 22

Lead* & Implementing Partner(s)

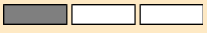
City Engineering*; Parks Department, Sustainability Commission, Master Gardeners, Purdue Extension, ISU and colleges, local businesses

Effectiveness

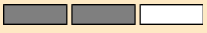
Evaluation Metrics

- Completion of a vulnerability assessment
- Traffic on the Heritage Trail
- Number of new plants planted on the Trail

Upfront Costs



Ongoing Costs



Potential Actions

1. Assess the Heritage Trail's climate vulnerability and prioritize those vulnerabilities
2. Create a native plant mile marker program to increase education about how climate change may affect native species

Robust Natural Systems

Green spaces and nature are critical for healthy neighborhoods. Parks, clean waterways, and healthy ecosystems provide connections to nature throughout the city. They improve property values, provide recreational opportunities such as walking, hiking, and biking, improve physical and mental health, and support wildlife and biodiversity. Healthy, intact natural systems can also provide valuable ecological functions, such as filtering pollutants from the air and water, reducing flood impacts, and reducing air temperatures. Parks and open spaces contribute to social cohesion by serving as social gathering spaces for sports, education, art, and volunteer work.

Natural systems are not limited to parks and protected areas, though. Yards, grounds, open lots, gardens, and other vegetated areas can provide critical habitat for native insects and birds, stopover areas for migrating species, and connections between more substantial blocks of habitat. As wilderness and natural areas become stressed and/or degraded, maintaining biological diversity within cities and other inhabited areas becomes increasingly vital to the persistence of native species throughout the region.

Wetlands, riparian areas, meadows, and cold-water fisheries are highly vulnerable to climate impacts. Native trees are susceptible to drought, wildfire, disease, and pests. The Wabash River and Wabashiki Fish and Wildlife Area are unique to Terre Haute, as are the many parks in the city and county. The recently updated RiverScape plan guides development, recreation and conservation of the Wabash River as it passes through Terre Haute.

Strategies for robust natural systems:

Strategy NS-1: Connect Farmers to the Local Economy

Strategy NS-2: Improve Natural Conservation of Water

Strategy NS-3: Transition Existing Canopy to Trees Adapted to Warmth and Drought

Strategy NS-4: Create a Greenway Along Wabash Avenue

Theme: Robust Natural Systems

Strategy NS-1: Connect Farmers to the Local Economy

Like Strategy RE-2, this strategy targets the problems that climate change will present within the global food economy. Local food will become a more highly-sought commodity as food supply chains are disrupted by extreme weather and changing growing seasons, and local farmers and food-growers do not yet have the capacity to bring their food to Terre Haute citizens on the scale that will be demanded of them. Many local farmers are suppliers to larger agribusinesses like Bayer because they are able to

make a better living. By incentivizing and subsidizing local food-growers to provide food to their own community, resilience of both the food system and the livelihood of an entire economic sector will be strengthened.

Unlike the previously mentioned strategy, this strategy targets those who are already growing food locally and giving them the ability to sell their produce on a larger scale. This means expanding on the Terre Haute Farmers Market and the work that Terre Foods does, working with grocery stores to put local food on their shelves, and creating programs for local farmers to provide food in places with food deserts like the 12 Points neighborhood.

Addresses Risks
4, 7, 11

Lead* & Implementing Partner(s)
Terre Foods*; West Central Indiana Small Business Development Center, Terre Haute Farmers Market, locally owned grocery stores

Effectiveness

Evaluation Metrics

- Amount of local food being sold at grocery stores
- Size of food deserts
- Number of produce vendors at the Terre Haute Farmers Market

Upfront Costs

Ongoing Costs

Potential Actions

1. Support and help expand Terre Foods in their endeavors
2. Help farmers scale up to distribute food

Theme: Robust Natural Systems

Strategy NS-2: Improve Natural Conservation of Water

Drought and extreme heat will make water more difficult to come by, and extreme weather events may disrupt utility systems that provide water to homes and businesses. However, a positive tradeoff is that those same extreme weather events like storms provide an opportunity to collect and conserve water naturally. Strategy RI-5 targets water conservation at an infrastructure level, but it is also possible to conserve water through natural efforts. Schools and other public locations can start water catchment systems that collect rainwater. Residential filtration systems can localize water conservation and put it in the hands of the community. A gray water recycling plan could reduce water waste. These are only a few actions that could increase natural water conservation.

Addresses Risks
12, 13, 19

Lead* & Implementing Partner(s)
Sustainability Commision*; Vigo County School Corporation, City Planner, Vigo Soil and Water Conservation District, Vigo Area Planning, City Engineering, ISU, Union Health

Effectiveness

Evaluation Metrics

- Ascertain rainwater collection by water catchment systems
- Track amount of land dedicated to retention ponds

Upfront Costs

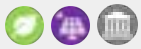
Ongoing Costs

Potential Actions

1. Create a water catchment system for public locations like schools and government buildings
2. Create a residential filtration system for collected water
3. Establish a gray water recycling plan

Theme: Robust Natural Systems

Strategy NS-3: Transition Existing Canopy to Trees Adapted to Warmth and Drought



This strategy, like RE-3, targets the Plant Hardiness Zones problem, but from a government perspective. As hardiness zones shift northward, mature public trees will have difficulty surviving, and the city should be proactive in ensuring unhealthy trees are removed and replaced with the correct species. Terre Haute is a Sterling Tree City USA, which requires it to have a public tree care ordinance. This ordinance should include requirements for maintaining public tree resiliency.

As mature trees are removed and new, young trees are planted, the city will need to allocate time and money for the maintenance and care of those trees so that they can grow into maturity and provide the same benefits as their predecessors. Tree care is expensive, but it is most expensive when it is reactive instead of proactive. It is already a reality in Indiana that beloved trees like the sugar maple will not be suited to a warmer climate, and a city like Terre Haute that has so much community support for trees has the opportunity to continue to strengthen its canopy despite climate change.

Addresses Risks

5, 6

Lead* & Implementing Partner(s)

City Forester*; TREES Inc., City Planner, City Council, Mayor's Office

Effectiveness

Evaluation Metrics

- Creation of a planting plan
- Number of new trees planted

Upfront Costs

Ongoing Costs

Potential Actions

1. Create a city plan for replacing trees and maintaining healthy trees
2. Assign city budget to young tree maintenance

Theme: Robust Natural Systems

Strategy NS-4: Create a Greenway Along Wabash Avenue

Destination Wabash Avenue is a plan in the works for the city that aims to revitalize the thoroughfare from 3rd to 9th St. Wabash Avenue is a major street, and emphasizing greenery here could potentially be a jumping off point for greening the rest of the city. Greenery does not just belong in parks and "natural" settings; greening heavily urban areas can bring the many benefits of nature to the city in a purposeful way. By planting more street trees along Wabash Avenue, pedestrians will also be better protected from extreme heat.

However, greenways do not just have to consist of trees. Greenery can come in the form of bushes, flowers, and other native plants. Rain gardens or bioswales are another type of greenery that has multiple benefits. Not only are rain gardens home to beautiful plants, their main goal is to soak up water that impervious surfaces like roads, sidewalks and rooftops cannot. By implementing rain gardens on Wabash Avenue, flooding risk would be reduced while also beautifying the road. By committing to climate resilience in the Destination Wabash plan, the city can begin committing to integrating strategies in initiatives across the board.

Addresses Risks

1, 3, 6

Lead* & Implementing Partner(s)

Chamber of Commerce/Downtown Terre Haute*; City Forester, Mayor's Office, City Engineering, Redevelopment Commission, local businesses

Effectiveness

Upfront Costs

Ongoing Costs

Evaluation Metrics

- Foot traffic on Wabash Ave
- How long rain garden program lasts
- Flood mitigation
- Number of trees planted

Potential Actions

1. Integrate resilience strategy into Destination Wabash Avenue
2. Establish a rain garden program along Wabash Avenue
3. Plant more street trees throughout Downtown Terre Haute

Resilient Infrastructure

Infrastructure includes buildings; energy distribution systems; water delivery, storm- and wastewater management systems; culverts and floodwalls; roads, highways, and bridges; communications networks; and many other basic structures found throughout the region. Terre Haute's infrastructure varies significantly in age and condition and improving its efficiency, resilience, functionality, and health is a top priority.

"See You in Terre Haute 2025" is just one of the strategies Terre Haute is employing to improve infrastructure and ensure that the community is "thriving and prosperous" (Terre Haute Chamber of Commerce). The development of the Terre Haute Convention Center was part of this plan, and this construction has set a precedent for new and modern infrastructure that serves the community.

Terre Haute's Department of Redevelopment is another city initiative to assist with infrastructure problems, specifically for low-income residents. It provides housing and repairs important infrastructure so that poor neighborhoods are more livable, primarily using federal funds distributed to the City.

Some of Terre Haute's most at-risk infrastructure includes aging sewer systems, flood-prone neighborhoods, the above ground energy grid, and flood-prone roads and highways.

Strategies to support resilient infrastructure

Strategy RI-1: Create a More Resilient Power Grid

Strategy RI-2: Create More Safely Floodable Areas

Strategy RI-3: Update City and County Construction Policies

Strategy RI-4: Use City Vacant Lots for Resilient Purposes

Strategy RI-5: Improve Access to Water

Strategy RI-5: Provide Housing to Unhoused Persons

Theme: Resilient Infrastructure

Strategy RI-1: Create a More Resilient Power Grid

More frequent power outages caused by extreme storms will weaken the power grid. Creating a resilient power grid means diversifying the sources of energy used to power the city as well as encouraging buildings to update their energy efficiency. Renewable energy sources like wind and solar are also susceptible to extreme storms, but by including these types of electricity production (especially when coupled with energy storage systems) in Terre Haute's energy portfolio, it's less likely

that one storm will cause a complete blackout. Many grants are available to assist with a large change such as this, and prioritizing a renewable energy initiative in a climate plan such as this one opens more opportunities for funding. The Sustainability Commission could be a good group to champion this effort.

Grants are also available for green building and renewable infrastructure that would lessen the burden on the power grid. Buildings that are LEED certified are specifically designed to be energy efficient. Strategy RI-3 would work in tandem with this one to ensure that interested parties could legally renovate their buildings to be LEED certified or at least more energy efficient.

Incentivizing more electric vehicles, especially in local government, would also be a way to push the city toward greater energy efficiency. This is an initiative the City is already pursuing, so emphasizing EV adoption could be a stepping stone toward a broad focus on energy efficiency as a whole.

Addresses Risks
8, 10, 12, 14, 16

Lead* & Implementing Partner(s)
City Council*; Mayor's Office, Duke Energy, OnePlanet Solar, Rose-Hulman Institute of Technology, Sustainability Commission

Effectiveness

Evaluation Metrics

- Number of total blackouts and brownouts annually
- Number of new LEED certified buildings
- Number of electric vehicles in city fleet

Upfront Costs

Ongoing Costs

Potential Actions

1. Increase the number of electric vehicle chargers
2. Apply for grants to implement more solar and wind energy
3. Apply for grants focussing on green building and renewable infrastructure

Theme: Resilient Infrastructure

Strategy RI-2: Create More Safely Floodable Areas

Increased flooding, particularly within proximity to a large body of water like the Wabash River, is likely to be inevitable as climate change worsens. Impervious surfaces that cover urban areas make flooding an even more prevalent issue, but there are ways to reduce this flooding risk by implementing different types of infrastructure. Both private landowners and local government have opportunities to create safely floodable areas.

Local government (city or county) can purchase the rights to wetlands and choose to leave them undeveloped, as wetlands like the Wabashiki Fish and Wildlife Area naturally take in extra water and reduce flooding. Government can also establish rules for what type of development can occur in

flood-prone areas. Strategy NS-4 describes using rain gardens to assist with flooding, but design standards and regulations for those first need to be integrated into the City's zoning ordinance.

Private landowners can also choose to not develop on their land to maintain permeable surfaces. Government can incentivize this by a number of means, and this sort of partnership would ensure the presence of floodable areas throughout the city, not just in public spaces.

Addresses Risks
1, 2, 10

Lead* & Implementing Partner(s)
City Council*; Insurance companies, Vigo Soil and Water Conservation District, RiverScape, City Planner, City Engineering

Effectiveness

Evaluation Metrics
- Number of buildings flooded annually
- Amount of land purchased by government to stop development

Upfront Costs

Ongoing Costs

Potential Actions
1. Identify and purchase development rights for wetland or flood-prone properties
2. Develop an incentive-based program with the intent of permanently establishing open space and flood reservoirs that retain private ownership and management
3. Develop and adopt design standards for bioswales and rain gardens

Theme: Resilient Infrastructure

Strategy RI-3: Update City and County Construction Policies

Increased flooding and extreme storms will place more burden on infrastructure in Terre Haute. One way to combat this is to re-evaluate how buildings are built and maintained so that they are more energy efficient and resilient to water. Integrating more water-resistance into standard construction practice and providing incentives for buildings to become LEED certified are just two ways this can be accomplished. By assessing zoning and building codes to ensure that buildings are being constructed as well as possible, infrastructure in Terre Haute will become stronger and safer.

Not only does this strategy promote resilience, but it does mitigation work as well. Commercial greenhouse gas emissions were the largest emissions sector in the 2021 Greenhouse Gas Inventory, and reducing the amount of non-renewable energy needed by commercial buildings will help to begin reducing those emissions (Bhattacharyya, 2022).

Infill is another way to promote resilience and mitigation. Choosing to build within the already built environment on vacant lots or replacing abandoned buildings reduces urban sprawl, in turn reducing the amount of impervious or impermeable surface area in Terre Haute and the need for commercial

utility lines to continue extending. Infill can also help with the aesthetic of Terre Haute; by building over blight and abandoned buildings, revitalization efforts will be enhanced..

Addresses Risks
1

Lead* & Implementing Partner(s)
City Council*; City Planner, County Commissioners, Vigo Area Plan Commission, large landowners, loan officers at local banks

Effectiveness

Evaluation Metrics
- Amount of energy used in commercial buildings
- Number of buildings with water leakage issues

Upfront Costs

Ongoing Costs

Potential Actions
1. Assess/audit current construction requirements
2. Encourage infill to realize compact urban development

Theme: Resilient Infrastructure

Strategy RI-4: Use City Vacant Lots for Resilient Purposes

Like Strategy RI-3, this effort focuses on purposeful development and its resilience benefits. Urban infill of vacant lots is a good strategy for this, but another way to utilize blighted areas involves planting them with greenery. This strategy targets flooding risks, loss of biodiversity, and extreme heat. Planting gardens, either with wildflowers or food crops, is a good way to promote biodiversity and the benefits of healthy eating. By establishing bioswales in vacant lots, flooding risk can be reduced. Residents' mental health may be improved through integration of greenery into urban spaces. This strategy recognizes that parks and nature preserves are not the only places where people can experience nature.

Addresses Risks
3, 6

Lead* & Implementing Partner(s)
Terre Haute Department of Redevelopment* City Council, Mayor's Office

Effectiveness

Evaluation Metrics
- Number of vacant lots filled

Upfront Costs

Ongoing Costs

Potential Actions
1. Create an ordinance to plant city vacant lots with wildflower habitats

2. Allow for rain gardens and bioswales to be created on vacant lots
3. Establish a community garden program for vacant lots

Theme: Resilient Infrastructure

Strategy RI-5: Improve Access to and Use of Water

A decreased water supply is a very salient vulnerability as the likelihood of droughts increases. Using water more purposefully in the city will help ensure that this resource is not wasted, and providing all residents equal access to water will promote climate equity. This strategy recommends expanding the piped water system for this reason. Being part of the piped water system means you are part of an established network that is more likely to support you when water is scarce. Private wells are unregulated in Indiana, increasing risk of exposure to unsafe water (Indiana Department of Health).

City government can also set an example of smart water usage by implementing low-flow toilets in their facilities. Grants are available for government water-saving initiatives. Groups and individuals can enroll in the U.S. Department of Energy's Water Saving Initiative for funding and resources related to this goal. By prioritizing water saving and smart water usage in the government, we can lead by example so that businesses and homeowners can follow suit.

Addresses Risks
13, 19, 21

Lead* & Implementing Partner(s)
Sustainability Commission*; Mayor's Office, Fire Department, Parks Department, City Engineer, Vigo County School Corporation, Indiana American Water Company

Effectiveness

Evaluation Metrics
- Number of low-flow toilets established in public buildings
- Number of homes moved to a piped water system

Upfront Costs

Ongoing Costs

Potential Actions
1. Establish low-use toilets in public buildings
2. Establish funding for local government water-saving initiatives
3. Expand the piped water system to eliminate need for private wells

Theme: Resilient Infrastructure

Strategy RI-6: Provide Housing to Unhoused Persons

Those who are the most vulnerable to all climate vulnerabilities are unhoused persons. A 2021 survey counted over 500 unhoused people in Vigo County (Greninger, 2021). Extreme heat and extreme weather, both storms and blizzards, can be fatal, and those without access to shelter are most likely to die from climate change. The city could, as part of their revitalization efforts, move unhoused persons into empty homes, potentially with the criteria that those enrolling in the program have jobs or an acceptable police record. This strategy has the potential to receive public backlash, but studies have shown that providing unhoused persons with a place to live that is not a shelter not only improves their lives but saves taxpayer money through reducing healthcare and emergency department costs (Garrett, 2012). The climate crisis must include equity as a core tenet of its solutions, and helping those most vulnerable to its dangers is absolutely a part of that.

Addresses Risks
2, 4, 8, 16, 20

Lead* & Implementing Partner(s)
City Council*; City Planner, Terre Haute Redevelopment Commission

Effectiveness

Upfront Costs

Ongoing Costs

Evaluation Metrics

- Emergency room visits
- Costs to taxpayers

Potential Actions

1. Provide renovated houses for the unhoused community
2. Work with shelters to provide more livable and safe conditions for unhoused people

Healthy and Safe Citizens

Maintaining and improving the physical and mental health of Terre Haute's residents is a top priority. As new climate-related impacts arise, greater investment in wellness, personal resilience, access to health care, and health care capacity will be needed.

The impacts of climate change on peoples' health and safety are multiple and significant. They include heat-related illnesses, an increasing incidence of allergies and asthma, respiratory and heart disease related to ozone exposure, exposure to contaminants and hazardous materials, food-borne and water-borne illnesses, pest-related disease, and mental health impacts. Flooding and extreme heat are chief concerns for Terre Haute, which is located along the Wabash River and does not have a comprehensive canopy cover.

Health-related impacts of climate change are not evenly distributed. Those who are most at risk include lower-income residents, people who work or live outdoors, infants and older adults, people with existing health conditions, and people who live in neighborhoods with higher heat, flood risk, and/or pollution. Redlining practices that occurred in Terre Haute in the 20th century have in turn reduced access to healthcare, safe housing, and natural environmental protection for low-income people of color in Terre Haute.

Strategies to support healthy and safe citizens

Strategy HS-1: Building Community Resilience to Heat and Extreme Weather

Strategy HS-2: Ensure Preparedness of Healthcare Providers First Responders

Strategy HS-3: Provide Refuge Day and Night During Heat Emergencies

Strategy HS-4: Support Persons Involved in Mandatory Outdoor Activities

Theme: Healthy and Safe Citizens

Strategy HS-1: Build Community Resilience to Heat and Extreme Weather

Extreme heat is one of the most concerning consequences of climate change, as its health detriments are highly dangerous and difficult to combat, especially when lacking monetary resources. Working as a community to build resilience to extreme heat and weather is crucial to combating climate change. This strategy, like many others in this report, proposes a cooling center network (that can also function as a heating network in extreme cold) that is available to all community members. However, cooling centers have the opportunity to be more than just that; they can function as resilience hubs, places that provide resources for many of the other strategies in this report. They can offer tree planting

resources like seedlings and mulch; those in charge of community gardens or native plantings can have resources in these centers for volunteers. Workshops and events held in these centers can teach climate resilience, which is not a piecemeal idea. It is a holistic way for a community to come together to combat the effects of climate change. Integrating all of the strategies in this plan into a network that people can be involved in and access to is imperative for community buy-in and further progress on resilience and mitigation. By bringing Hauteans from all walks of life together in this resilience hub network, collaboration and cooperation can be fostered while also providing for health and safety.

Addresses Risks
2, 4, 12, 15, 18, 20

Lead* & Implementing Partner(s)
Sustainability Commission*; local businesses, public buildings, Terre Haute Parks Department, Vigo County Public Library

Effectiveness

Evaluation Metrics
- Number of resiliency hubs established

Upfront Costs

Ongoing Costs

Potential Actions
1. Establish resiliency hubs that include cooling/heating centers, community gardening/tree planting resources, and information and assistance related to healthcare

Theme: Resilient Infrastructure

Strategy HS-2: Ensure Preparedness of Healthcare Providers and First Responders

As climate change worsens, increased heat will not only be a health stressor on its own, but longer periods of warmth will increase the chances of vector-borne diseases. Flooding, storms and other extreme weather can injure residents as well. Overall, the healthcare system will most likely be overburdened. In order to ensure the health and safety of citizens, our healthcare and emergency response systems must be prepared to treat climate change related illnesses and injuries.

Accomplishing this must involve hospitals as well as City and Vigo County law enforcement and fire departments. A climate emergency plan for first responders would outline how to handle an influx of persons utilizing the system. The Fire Department could plan for the potential for increased and more severe fires; increased heat is linked to more violence, which the Police Department could plan to deal with; the major hospitals in the area could prepare for treating climate-related illnesses and injuries (Thomas and Wolff, 2023).

This plan could potentially also identify vulnerabilities in emergency response infrastructure. Once that information is known, grant applications would be much easier. Making the emergency response

system more resilient would strengthen it beyond just resilience and foster a new level of collaboration between all members of the system.

Addresses Risks
8, 10, 15, 18, 21

Lead* & Implementing Partner(s)
Vigo County Emergency Management*; local hospitals and healthcare facilities, Police Department, Vigo County Sheriff, local Fire Departments, Duke Energy, CenterPoint

Effectiveness

Evaluation Metrics
- Adoption of a climate emergency plan

Upfront Costs

Ongoing Costs

Potential Actions
1. Develop a climate emergency plan for first responders
2. Assess and improve infrastructure systems
3. Equip first responders with solar power and other backup power systems

Theme: Resilient Infrastructure

Strategy HS-3: Provide Refuge Day and Night During Heat Emergencies

Extreme heat will not just affect residents during the day. Even at night, temperatures in the summer will be hotter than ever, and in very extreme cases, cooling centers must be available to citizens of Terre Haute 24 hours a day. The cooling center network proposed in other strategies in this plan should be prepared for crisis situations during the hottest days of the year. Those without access to air conditioning will be especially vulnerable during these times, so their safety should be prioritized.

There are other ways to promote cooling besides cooling centers. Splash pads, tree cover, misting fans, and public pools are just some of the ways the city can promote cooling during heat emergencies. Any new park development plans could integrate this strategy by building or fixing up these structures. By providing these sorts of refuges, it is possible to reduce the number of citizens who are forced into hospital care, lessening the burden on the healthcare system.

Addresses Risks
4, 15, 18, 20

Lead* & Implementing Partner(s)
Sustainability Commission*; Local businesses and organizations, City Planner, Haute City Center Mall

Effectiveness

Evaluation Metrics
- Number of cooling centers established
- Attendance at cooling centers

Upfront Costs

Ongoing Costs

Potential Actions

1. Establish a crisis cooling center network that allows for overnight stays
2. Emphasize splash pads, tree cover, misting fans, and public pools in planning efforts

Theme: Resilient Infrastructure

Strategy HS-4: Support Persons Involved in Mandatory Outdoor Activities

Not all outdoor activity is optional. Some Terre Haute residents, like unhoused persons and outdoor workers, must be outside, even in the most dire conditions. As extreme heat increases, those involved in mandatory outdoor activities should be a priority in health and safety considerations. Other strategies in this plan discuss cooling centers for the general population, but a program targeted specifically at cooling those who must be outside in heat is imperative. Climate resilience should include equity at every turn, especially when considering the health of residents.

Because many strategies in this plan propose cooling centers, the establishment of a cooling center network will most likely be a priority when implementing Climate Ready Terre Haute. Within a cooling center network, spaces and supplies should be made available for the most vulnerable.

Besides cooling centers, tree cover is another extremely important way to ensure the health and safety of vulnerable populations. The last Street Tree Inventory completed by Terre Haute was in 2021, and this should be updated within the next few years, especially as trees become more affected by extreme heat and weather. By continually updating the status and health of street trees, the City can be better equipped to maintain a public tree cover to assist in the safety of those who must be outside.

Addresses Risks
2, 4, 15, 18, 20

Lead* & Implementing Partner(s)
Existing non-profits and businesses*; City Forester, Tree Advisory Board

Effectiveness

Evaluation Metrics

- Completion of a street tree inventory
- Number of cooling centers established

Upfront Costs

Ongoing Costs

Potential Actions

1. Establish cooling stations in high-risk pedestrian areas
2. Complete a street tree inventory

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Implementation and Evaluation

Climate Ready Terre Haute is a plan for building climate resilience. To realize this vision, the strategies and actions identified here need to be implemented, monitored, and revised as necessary.

Terre Haute's Sustainability Commission will be tasked with implementing these strategies. It is important to recognize that much of the work outlined in this plan falls on community groups, organizations, and partner agencies. Coordination and collaboration will be essential.

Creating Implementation Plans

The Commission's first order of business will be to develop 1-year and 3-year implementation plans focusing first on the high priority actions identified in this plan. Determining the order of implementation for these actions will require a Task Force to consider public support, political feasibility, and available resources. These can include existing tools and resources such as Multi-Hazard Mitigation Plans, partnerships with anchor institutions, and innovative funding mechanisms. Additionally, any prerequisites for implementation of specific actions should be identified and included in the implementation plan timeline.

At regular intervals, likely every 12 months, the Commission will assess what is needed to keep the current actions moving forward or what corrective action may be needed. They will also consider if changes to the next 3-year plan are needed based on what has been learned.

Monitoring and Evaluation

An important component of these implementation plans is the identification of indicators and metrics for evaluating success. The Task Force will use the information provided during the Vulnerability Assessment and Strategy Development workshops to begin building an evaluation framework and identifying thresholds where corrective action may need to be taken.

The Task Force will identify what to measure for each action and what defines success. They will also identify whether existing data collection efforts may be used and what opportunities there will be for community members to participate in data gathering.

Sharing Progress

Terre Haute is committed to providing regular updates and sharing the progress toward implementing these strategies and actions. The Sustainability Commission will present their progress, obstacles, and new opportunities to the City Council semi-annually.

Local Government Action

Concurrently, Terre Haute will undertake implementation of the strategies identified as internal. These actions should be in place and operational within three years of the completion of *Climate Ready Terre Haute*. Progress updates, obstacles, and opportunities should occur on the same timeline as the other actions in this plan and be included in the City's public information portal.

Glossary

100-Year Flood Zone – the land that is expected to be flooded due to a flood event that has a 1 in 100 chance of being equaled or exceeded in any given year.

Biodiversity – The overall number and types of species of plants and animals in a particular place or habitat.

Bioswales – Channels or other low-lying areas that use plant materials and soil mixes to treat, absorb, and convey stormwater runoff, as an alternative to storm sewers. They improve water quality by removing debris and pollution. They also provide landscaping that, depending on the plant species chosen, may create habitats for birds, butterflies, and local wildlife.

Brownfields – A property that may have soil or groundwater contamination.

Carbon Storage or Sequestration – The removal of carbon dioxide (CO2) from the atmosphere to be stored elsewhere, including in natural systems such as forests,, soils, and wetlands.

Clean energy – Energy used by people and businesses that doesn't cause greenhouse gas pollution. Includes electricity, transportation, buildings, and food systems.

Climate Change – Climate change is a long-term change in the average weather patterns that have come to define Earth's local, regional and global climates. These changes today are due to the rise in global temperatures caused principally by the release of excess greenhouse gasses (chiefly carbon dioxide) from the burning of fossil fuels and deforestation since the beginning of the industrial revolution. Climate change is often referred to as the suit of symptoms due to the fever that is global warming.

Climate Change Adaptation – Actions that protect people or nature from, or prepare them for, the current and future impacts of climate change.

Climate Change Mitigation – Actions that reduce greenhouse gas emissions (primarily from fossil fuels combustion) or increase the storage of carbon (primarily in soils, forests, and other natural systems).

Climate Equity – Removing or addressing obstacles to climate resilience such as discrimination, poverty and their consequences.

Contaminant/Toxin/Pollutant – a substance that makes something less pure or makes it poisonous (contaminant); any substance poisonous to an organism (toxin); any substance, as certain chemicals or waste products, that renders the air, soil, water, or other natural resource harmful or unsuitable for a specific purpose (pollutant).

Ecosystem Services – Represent the many and varied benefits of a healthy natural environment. They include the production of food and water, the stabilization of the climate, control of disease, nutrient cycles and oxygen production, and spiritual and recreational benefits.

Energy Efficiency – is the reduction of the amount of energy required to provide the same level of products and services.

Equity – Achieving the same level of opportunity based on variable levels of support and assistance depending on the difference in historical disparity and current need. Some types of equity of concern include racial, economic, social, and intergenerational.

Food Insecurity – An economic or social condition of limited or uncertain access to adequate food supply.

Fossil Fuels – a group of energy sources that were formed when ancient plants and organisms were subject to intense heat and pressure over millions of years. There are three major types of fossil fuels: coal, oil, and natural gas.

Green Building Design – the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation, and deconstruction.

Green Infrastructure – is the use of natural and engineered ecological systems to provide specific services to the community, often in relation to stormwater management, but also including cooling, pollination, and filtration.

Greenhouse Gas (GHG) – A gas that absorbs infrared radiation (heat) in the atmosphere and contributes to global warming. Greenhouse gasses include carbon dioxide, methane, water vapor, nitrous oxide, CFCs and HFCs (refrigerants), among others.

Habitat - the natural home or environment of an animal, plant, or other organism.

Impervious Surfaces – These are land surfaces that repel rainwater and do not permit it to infiltrate (soak into) the ground. Impervious (or impermeable) surfaces are mainly artificial structures—such as pavements that are covered by water-resistant materials such as asphalt, concrete, brick, stone—and rooftops. Soils compacted by urban development are also highly impervious. (Also see "Pervious surfaces").

Infill – In urban planning infill refers to developing vacant or under-used parcels within existing urban areas that are already largely developed. The slightly broader term "land-recycling" is sometimes used instead.

Infrastructure – refers to the built environment such as buildings; energy generation and distribution systems; water delivery, storm- and wastewater systems; floodwalls and culverts; roads, highways, bridges, and many other basic structures.

Multi-Modal Transportation – Travel by multiple means of transportation, including biking, driving, taking a bus or subway, riding an electric scooter, etc. It is particularly relevant for people using public transportation because routes are usually not completely provided by one mode of transportation. For example, walking to catch a bus to a train station.

Natural Capital – the value of natural systems and the services that they provide for humanity, from the inherent value of biodiversity to the economic value of flood abatement, natural pest control, or tourism.

Passive Solar – Technology that uses sunlight without active mechanical systems. Such technologies convert sunlight into usable heat (in water, air, and thermal mass) with little use of other energy sources. This contrasts with active solar which converts sunlight into electricity.

Pervious Surfaces – Surfaces that allow water to percolate through to the area underneath rather than becoming runoff (Also see "Impervious surfaces").

Resilience – the ability of people and their communities to anticipate, accommodate and positively adapt to or thrive amidst changing climate conditions and hazard events.

Renewable Energy – Energy produced from sources that do not deplete or can be replenished within a human's lifetime. The most common examples include wind, solar, geothermal, biomass, and hydropower.

Sustainability – A broad concept that refers to meeting the needs of the present without compromising the ability of future generations to meet their needs.

Urban Heat Island – The increase in temperature within an urban area as compared to the surrounding rural and naturally vegetated areas. This additional heat comes from heat-absorbing buildings, impervious surfaces, channelization of waterways, and the removal of canopy cover.

Vectors – An insect that transmits a disease is known as a vector, and the disease is referred to as a vector-borne disease. For example, Lyme disease transmitted by a deer tick.

Weatherization – Weatherization or weatherproofing is the practice of protecting a building and its interior from the elements, particularly from sunlight, precipitation, and wind, and of modifying a building to reduce energy consumption and optimize energy efficiency.

Appendix 1: Climate Change Trends Primer

Introduction

People around the world are experiencing changing environmental conditions that affect their daily lives. Many changes are due to human-caused climate change, resulting from the burning of fossil fuels and deforestation. Climate change is a global problem, yet the impacts and opportunities for action are local. As climate change accelerates with continued greenhouse gas emissions, local communities will need to be prepared for impacts and take action to protect people and the natural resources they depend on. Like other parts of the U.S., Terre Haute is experiencing a rapid change in climate, and people are seeking strategies to increase safety, wellness, and resilience.

In Terre Haute, residents report changes in the severity of storms, the frequency of extreme weather events like heat waves, the timing of the seasons, water availability, vegetation, and wildlife. All these changes can affect peoples' health, culture, and livelihoods. Local infrastructure such as roads and bridges are also at risk from severe heat, storms, and flooding. Many changes are already occurring, and many more are expected to occur in an ever more challenging future as global temperatures climb due to human actions.

If global action to greatly reduce greenhouse gas emissions is taken quickly, the long-term severity of climate change will be reduced, and local strategies to adapt will be more successful. In the near term, because of long-lasting greenhouse gasses already emitted, drastic change will continue over the next decades. Thus, local action and planning to reduce the impacts of climate change are needed.

This climate change primer provides information on the expected trends and impacts specific to Terre Haute, Indiana. Understanding climate change trends and impacts is the first step toward identifying climate related risks and vulnerabilities. The next step will be to commit to strategies that build overall resilience for both the people and natural resources of the region.

Climate Change Data and Models

The Earth's climate is regulated by atmospheric gasses commonly referred to as greenhouse gasses for their role in trapping heat and keeping the earth at a livable temperature. These gasses include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and water vapor (H_2O). Carbon Dioxide plays an especially large role due to its long-lasting nature and amount compared to other gasses. The atmospheric concentration of carbon dioxide has risen from 280 parts per million (ppm) to more than 422 ppm (Keeling Curve) in the past century, driven largely by the burning of fossil fuel, deforestation, and other human activity (*Climate Change: Atmospheric Carbon Dioxide*, 2022).

Information from ice cores allows us a glimpse into carbon dioxide levels over hundreds of thousands of years. This data shows us that carbon dioxide has fluctuated between about 175 and 300 ppm over the last 800,000 years and the current level is far above anything detected in this time period. The Earth's

atmosphere has always undergone a series of heating and cooling effects; however, as greenhouse gas levels continue to increase past normal levels, scientists predict the temperature will continue to rise far past anything humans have ever seen.

For over a century, scientists have known that increases in the concentration of greenhouse gasses in the atmosphere result in warmer temperatures. Long-term tracking data from weather stations and other research support this expected trend. Traditional knowledge from indigenous communities around the globe also indicates that there has been substantial change in conditions over time, especially since the end of the last ice age.

To look at projected future climate, data analysts use computer models based on scientific understanding of the Earth's climate. The Intergovernmental Panel on Climate Change (IPCC), which is made up of thousands of leading scientists from around the world, has created a suite of 25+ global climate models (GCMs) from different institutions with which to predict future trends. The IPCC models were created independently and vary substantially in their output. Yet most of the uncertainty in future conditions comes not from the models themselves, but from estimating exactly how much action needs to be taken to reduce greenhouse gas emissions in the future. The different possible greenhouse gas concentrations (called Regional Concentration Pathways, or RCPs), depend on whether the international community cooperates on reducing emissions.

In this report, we provide projections based on both a lower emissions pathway where emissions are greatly reduced (RCP 4.5) and a higher emissions pathway where emissions are only slightly reduced (RCP 8.5) similar to the current global trajectory.

A note about uncertainty

All models have uncertainty because complex processes are simplified and assumptions are made about how the Earth's processes work. Therefore, various models may show different trends in future climates. How much they agree or disagree with each other provides information about uncertainty. However, this uncertainty is similar to other types of models that scientists use every day to make decisions about the future, including economic models, population growth models, and ecological system models.

Much of the data on future trends in this report has been compiled from an ensemble, or average, across many GCMs, which have been adjusted or "downscaled" from the global scale (coarse) to local scales (fine) using climatological data that reflects variation across the local landscape. When ensembles are used, it is important to understand the range of variation among the different models, as it can be quite great. In general, precipitation projections are associated with higher uncertainty (more variation among models) while temperature projections are associated with lower uncertainty (more agreement among models). Additionally, short to medium-term projections have lower uncertainty than long-term projections.

Global Climate Trends

Global climate is changing quickly compared to past climate change throughout the Earth's history. Large storms and severe heat waves have increased in both frequency and severity across most of the world (Wuebbles et al., 2017).

The hottest year on record was 2023 (Figure 1) with global temperatures 2.43 °F (1.35 °C) above the pre-industrial average (1850-1900) (Climate Change: Global Temperature). The 10 hottest years since record-keeping began have all occurred in the past decade (2014-2023). The last few years have also seen record-breaking, climate-related weather extremes. In the U.S., there were 18 weather- and climate-related events that cost more than $1 billion each in 2022, making it the third largest total on record ($165 billion) since 1980 (National Centers for Environmental Information, 2023).

Models project continued average global warming of 5.0° to 10.2° F (2.8° to 5.7° C) by the end of this century and continued warming for the next two centuries if emissions continue to increase (Figure A1-2) (Wuebbles et al., 2017). Because higher latitudes (closer to the poles) warm faster than areas closer to the equator, the United States is expected to warm significantly more than the global average.

Global Average Surface Temperatures

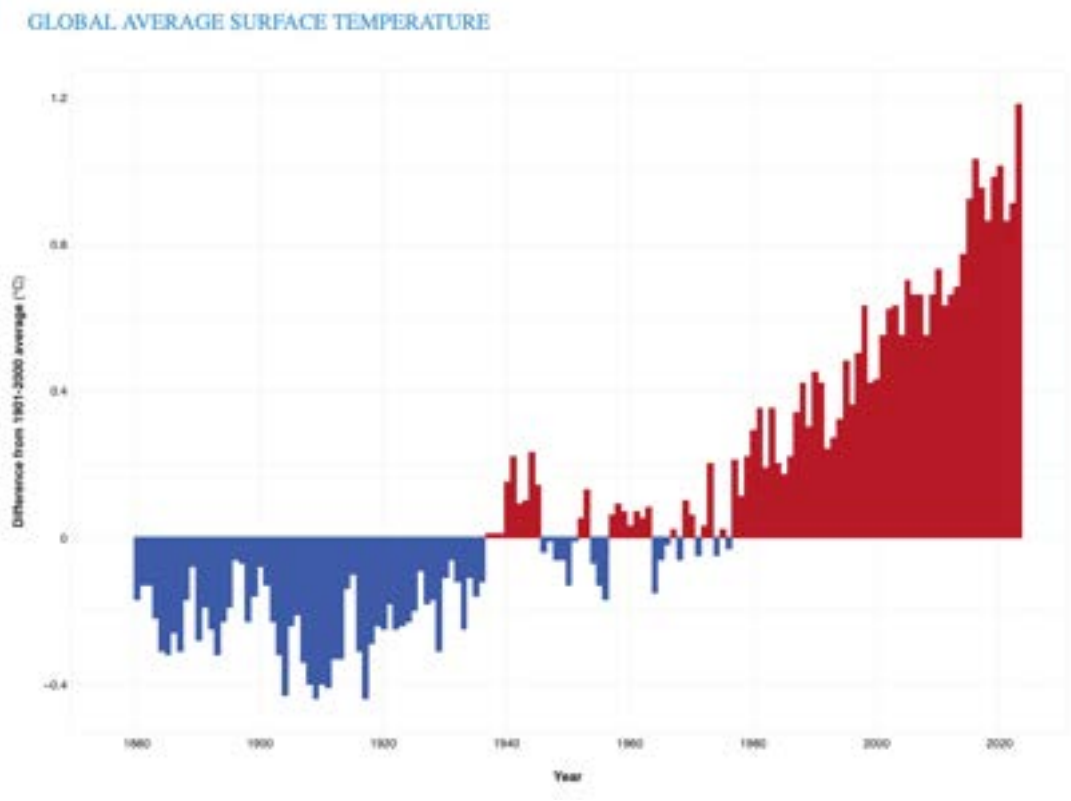

Figure 1. Yearly surface temperature from 1880–2023. Blue bars indicate cooler-than-average years; red bars show warmer-than-average years (Climate Change: Global Temperature, 2024).

The Intergovernmental Panel on Climate Change (IPCC) modeled future scenarios of greenhouse gas (GHG) concentrations in the atmosphere using anthropogenic radiative forcing. These are called Representative Concentration Pathways (RCPs). The numbers following "RCP" indicate the radiative forcing around the year 2100 and indicate different scenarios where humanity shifts away from fossil fuels at different speeds. High emission scenarios used in this primer refer to RPC 8.5. Low emission scenarios refer to RPC 4.5 because RPC 2.6 is generally no longer attainable. In this report, we provide projections based on a lower emissions pathway where emissions are greatly reduced (RCP 4.5) and a higher emissions pathway where emissions level off (RCP 8.5) (Schmittner, 2018).

Global Average Surface Temperatures with RCPs

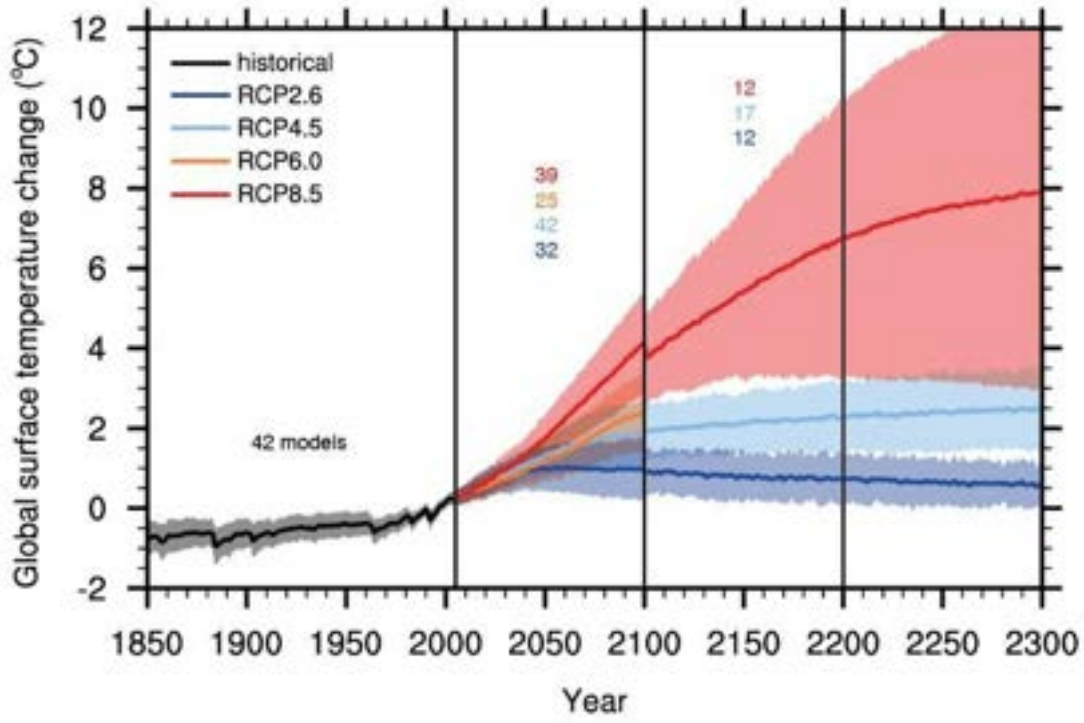

Figure 2. Global average surface temperature projections, 1986-2005 relative to RCP projections.

Past and Future Trends in Indiana

Indiana is facing many challenges due to rising temperatures caused by climate change. The following figures and accompanying text delve into the changing weather patterns in Indiana.

Temperature

Since 1895, Indiana has seen an average temperature increase of approximately 1.2°F, an average of 0.1°F, per decade. However, since 1960, the average temperature increase is approximately 0.4°F, showing an increase in climate change's effects over time. By 2050, temperatures are projected to increase between 5-6° F under the medium and high emissions scenarios, respectively. By the end of the

century, average temperatures are expected to be 6 to 10° F higher than the historical average (Widhalm et al., 2018).

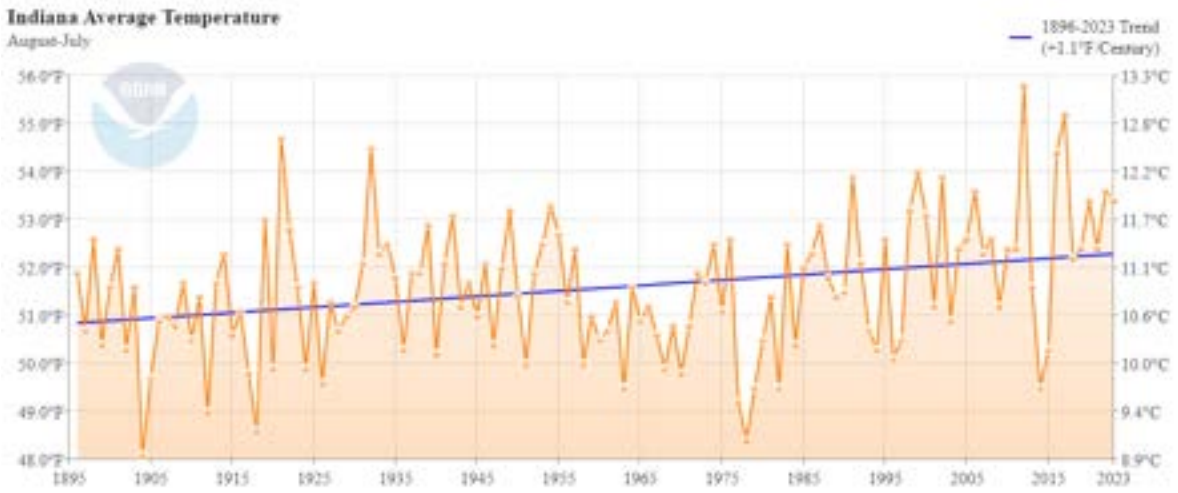

Figure 3. Statewide annual average temperature for Indiana from 1895 to 2023 is shown in orange. The blue solid line shows the increasing trend in annual temperature (1.1°F/century). Image from NOAA Climate Monitoring.

Similarly, maximum temperatures have increased decade-on-decade, with a marked increase from 1960 to present. Maximum temperatures from 1960 to 2016 have increased by an average of 0.3° F per decade; from 1896 to 2016, maximum winter and spring temperatures have increased by an average of 0.1° F per decade. While there has not been an increase in extreme heat days (defined as days where the maximum temperature is over 95° F) from 1960 to 2016, they are projected to increase significantly in the future, from seven per year (present) to between 38 to 51 days per year.

Figure 4. Statewide maximum temperature for Indiana from 1896 to 2023 is shown in red. The blue solid line shows the increasing trend in maximum temperature (0.4°F/Century). Image from NOAA Climate Monitoring.

Extreme cold days (minimum temperatures below 5° F) and frost days have decreased from 1960 to 2016 by 8 and 9 days respectively. The northern third of Indiana is expected to experience the most significant decrease, from an average of 13 per year to only six by 2050. Indiana's frost-free season has increased by nine days since 1895. By the middle of the century, the number of frost-free days is projected to increase by between 3.5 and 4.5 weeks. This has direct effects on Indiana's growing season length as the average first/last freeze dates for northern, central, and southern Indiana change.

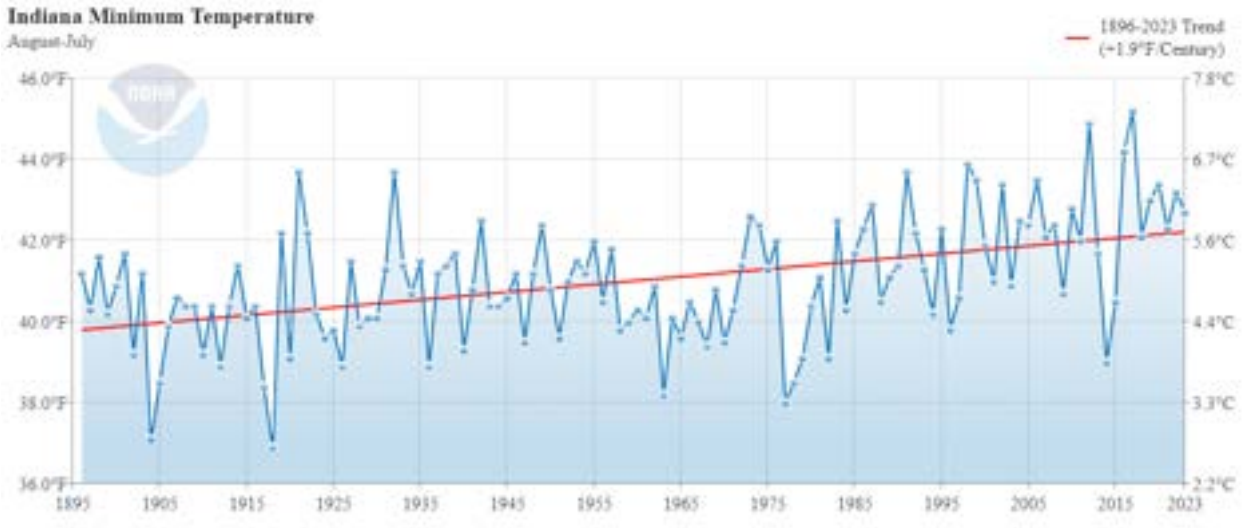

Figure 5. Statewide maximum temperature for Indiana from 1896 to 2023 is shown in blue. The red solid line shows the increasing trend in minimum temperature (1.9°F/Century). Image from NOAA Climate Monitoring.

Precipitation

Annual precipitation in Indiana has also increased significantly since 1895. Average annual precipitation has increased by 5.6 inches, and different regions of the state have seen different amounts of increase. In the future, rainfall is expected to increase by approximately 6-8%, depending on the emissions scenario. This increase is not expected to fall evenly throughout the year—multiple climate models suggest a high likelihood of more precipitation during the winter and spring months, with less certainty about changes in precipitation during the summer and fall. The number of days with precipitation events that exceed the 1900 to 2016 period's 99th percentile for Indiana will become more common.

Indiana's risk of drought conditions in the future is also worsening. The frequency of drought conditions is expected to increase, particularly during the later parts of the growing season (Cherkauer et al., 2021).

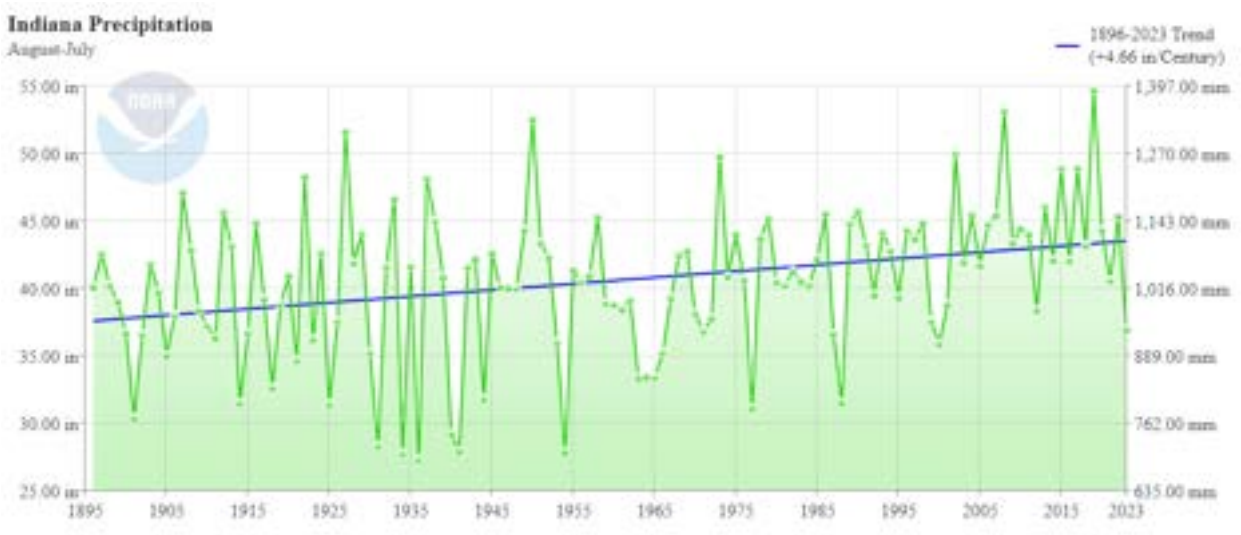

Figure 6. Statewide average precipitation for Indiana from 1896 to 2023 is shown in green. The blue solid line shows the increasing trend in precipitation (4.66 in/Century). Image from NOAA Climate Monitoring.

Past and Future Trends in Terre Haute

Like the rest of Indiana, the climate of Terre Haute has already changed over the past several decades with expectations of these trends to continue at the current rate of emission levels. The primary changes to climate characteristics for Terre Haute include:

- Warmer annual average temperatures and more significant warming in winter months.
- Decrease in the number of days below 32 degrees.
- Increase in extreme heat days (days above 95°F).
- Increase in heavy rainfall events, with an increase in flood potential.
- Increase in time between precipitation with an increase in drought potential.
- Greater variability in temperature and precipitation trends.

Climate Trends Snapshot – Terre Haute

	HISTORICAL TRENDS (1976–2005)	MID-CENTURY PROJECTIONS (2035-2064)	LATE-CENTURY PROJECTIONS	LATE-CENTURY PROJECTIONS *with reduced emissions*
Average annual temperature	53.7° F	58.3° F to 59.8° F	59.7° F to 63.4° F	57.8° F to 59.2° F
Single maximum temperature	97.9° F	103° F to 104.3° F	102.8° F to 119.0° F	101.3° F to 111.8° F
Average annual minimum temperature	43.2° F	47.6° F to 49° F	49.3° F to 52.5° F	46.4° F to 48.4° F
Number of days per year above 90° F	26.4 days	61.1 days to 70.3 days	66.3 to 137.4 days	42.4 to 106.0 days
Number of days per year below freezing	25.2 days	13.3 days to 15.1 days	1.2 to 14.5 days	4.8 to 20.7 days
Change in annual precipitation (in)	N/A (Used as a reference for change)	5.5% to 5.9%	6.9% to 7.5%	4.6% to 4.9%
Number of days per year with precipitation over 1 inch	4 days	5.0 to 5.4 days	4.4 to 9.0 days	3.7 to 6.6 days
Drought stress OR days per year with no precipitation (dry days)	182.9 days	185.8 to 187.5 days	166.7 to 231.5 days	174.2 to 203.0 days

Figure 7. Summary of climate trends expected for Terre Haute (Sources: data and projections from CMRA, Climate Explorer, and Climate Toolbox).

The following graphs depict historical and future trends from 1980 to 2080. The gray bars show observed historic values. The red area represents a range of climate projections if carbon emissions continue to grow at current rates, with the red line showing the median of higher carbon projections. The blue area represents a range of climate projections if carbon emissions stop increasing and stabilize, with the blue line showing the median of lower carbon projections.

Days with Maximum Temperature Above 95°F

The total number of days per year with maximum temperature above 95°F is an indicator of how often very hot conditions occur. Depending upon humidity, wind, and access to air-conditioning, residents may feel uncomfortable or experience heat stress or illness on very hot days. When maximum temperature

exceeds particular thresholds, residents can become ill and transportation and energy infrastructure may be stressed. A maximum temperature exceeding 95°F was once a rarity in Terre Haute. Now, it is not uncommon to see multiple days in a row over 95°F in the summer months. Climate projections forecast that, with unchecked carbon emissions, Terre Haute could have over 100 days annually with temperatures above 95°F by the end of the century (The Indiana Climate Change Impacts Assessment, Purdue University).

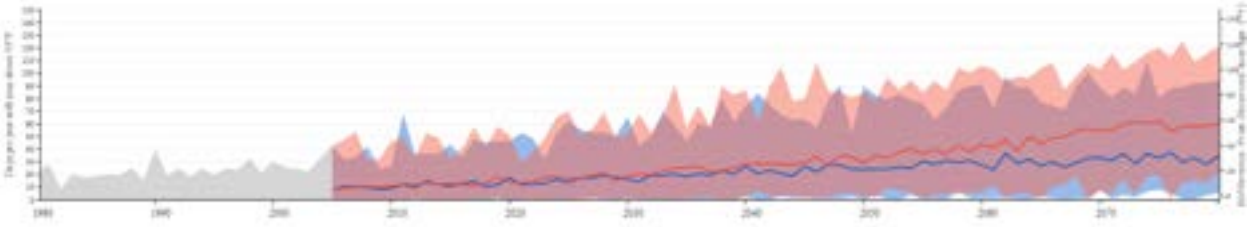

Figure 8. Annual days with maximum temperature above 95°F (Source: The Climate Explorer, 2023)

Days with Minimum Temperature Below 32°F

The total number of days per year with minimum temperature below 32°F is an indicator of how often cold days occur. Winter recreation businesses depend on days with below freezing temperatures to maintain snowpack. Additionally, some plants require a period of days below freezing before they can begin budding or blooming. This chart shows the observed average number of days with minimum temperatures below 32°F for Vigo County from 1980- 2080, the range of projections for the historical period, and the range of projections for two possible futures through 2080. If emissions stabilize, Terre Haute could average over 80 frost days well into the future.

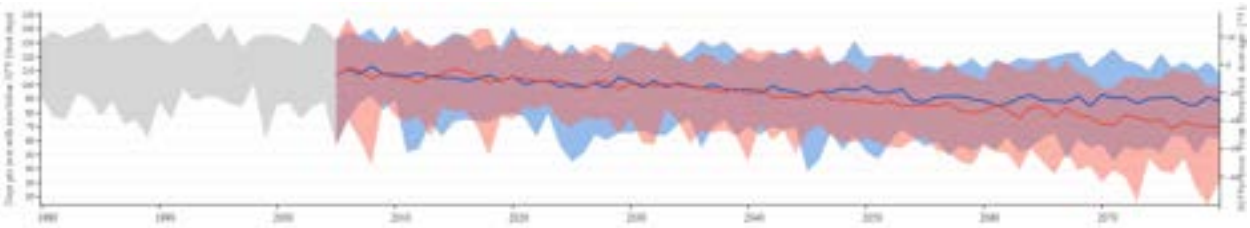

Figure 9. Annuals days with minimum temperatures below 32°F (Source: The Climate Explorer, 2023)

Cooling Degree Days

The number of cooling degree days per year reflects the amount of energy people use to cool buildings during the warm season. Cooling degree days are calculated using 65°F degrees as the base building temperature. On a day when the average outdoor temperature is 85°F, reducing the indoor temperature by 20 degrees over 1 day requires 20 degrees of cooling multiplied by 1 day, or 20 cooling degree days.

The number of CDD's in Vigo County has nearly quadrupled from the early 1970's to today. Future projections show that cooling-degree days could continue to rise more than 3,500 CDD's annually.

Figure 10. Annual cooling degree days (Source: US Climate Resilience Toolkit, 2023)

Extreme Rainfall Events

According to Purdue University's report "Indiana's Past and Future Climate: A Report from the Indiana Climate Change Impacts Assessment," extreme rainfall events, defined as having a daily rainfall total in the top one percent of all events, have increased over the last century and are expected to continue to do so. Heavy downpours contribute to soil erosion and nutrient runoff, which affects both water quality and crop productivity. These events can also overwhelm wastewater systems and create challenges for flood-control infrastructure. Averaged across the entire state, historically, an extreme rain event occurs when more than 0.86 inches of rain falls in a day. Since 1900, the number of days per year with extreme rain has been increasing by 0.2 days per decade on average. However, most of that increase has occurred since 1990.

From 1976-2005, Terre Haute averaged roughly four days a year with precipitation greater than one inch. Current projections show extreme rainfall events will continue to rise in Terre Haute and could reach an average of 9 days a year by the late 20th century unless emissions are reduced.

Figure 11. Extreme rainfall events (Source: US Climate Resilience Toolkit, 2023)

Conclusion

Climate change is already apparent throughout the U.S. and the Midwest. Warming is expected to continue and to accelerate in the coming decades and century, as greenhouse gasses already emitted continue to trap heat and change local weather patterns. The magnitude of late century warming and impacts depends on whether or not local communities around the world collectively reduce emissions of greenhouse gasses such as carbon dioxide and methane. There is much we can do to reduce the overall impacts of near-term climate change, ensuring that the most vulnerable populations, resources, and infrastructure are protected and resilient to ongoing change. Our ability to adapt to long-term changes

will depend heavily on how much we reduce emissions. This Climate Trends Primer is intended to inform the development of a Climate Resiliency Plan for the city of Terre Haute that results in strategies that increase overall resilience for both people and nature.

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Appendix 2: Community Trends

This overview of Terre Haute's community systems provides a snapshot of how the community and its surrounding area function. Natural systems, socioeconomic systems, infrastructure, and cultural resources all affect resident's quality of life and are inextricably tied to climate change.

Natural Systems

Urban Forests

Urban Forestry is important and highly valued by the residents of Terre Haute. The tree canopy provides numerous benefits that improve the environmental health, physical health and financial health of our community. The Urban Forester is responsible for approximately 17,000 street trees throughout Terre Haute. The City has launched The Little Trees program, which offers up to five trees a year to residents looking to plant trees on their property, and the Legacy Tree Replacement Program, which replaces trees destroyed by Emerald Ash Borer (City of Terre Haute). The City also offers the residents of Terre Haute the following services for trees located in the tree row or right of way:

- Risk Assessment
- Pruning Permits
- Emerald Ash Borer Treatment
- Tree Removal
- Tree Planting
- Tree Replacement

The community takes pride in the fact that Terre Haute has received the Tree City USA designation for the past 18 years from the National Arbor Day Foundation and in 2014 received the prestigious Sterling Tree City USA for its 10-year commitment to professional management and improvement of the City's canopy. Terre Haute's canopy is 28.32%, just over the national average of 27.1% (iTree, 2023; DeepRoot, 2010).

Waterways

Terre Haute lies in the Izaak Walton-Wabash River watershed, which includes other bodies of water like St. Joseph Lake, Lost Creek, Sugar Creek, and Otter Creek. The Wabash River, which is Indiana's state river, is the most major of these bodies. The city sits along the Wabash River just before it becomes the Illinois-Indiana border to the southwest.

According to the Environmental Protection Agency (EPA), all sections of the Wabash River in Terre Haute are "Impaired." This is in regards to following Clean Water Act regulations. The main pollutants in the Wabash are PCBs, which can cause major health risks in humans and animals (EPA, 2022). The Wabash River also has a history of severe flooding. Floods in 1913 and 2008 occurred across Indiana,

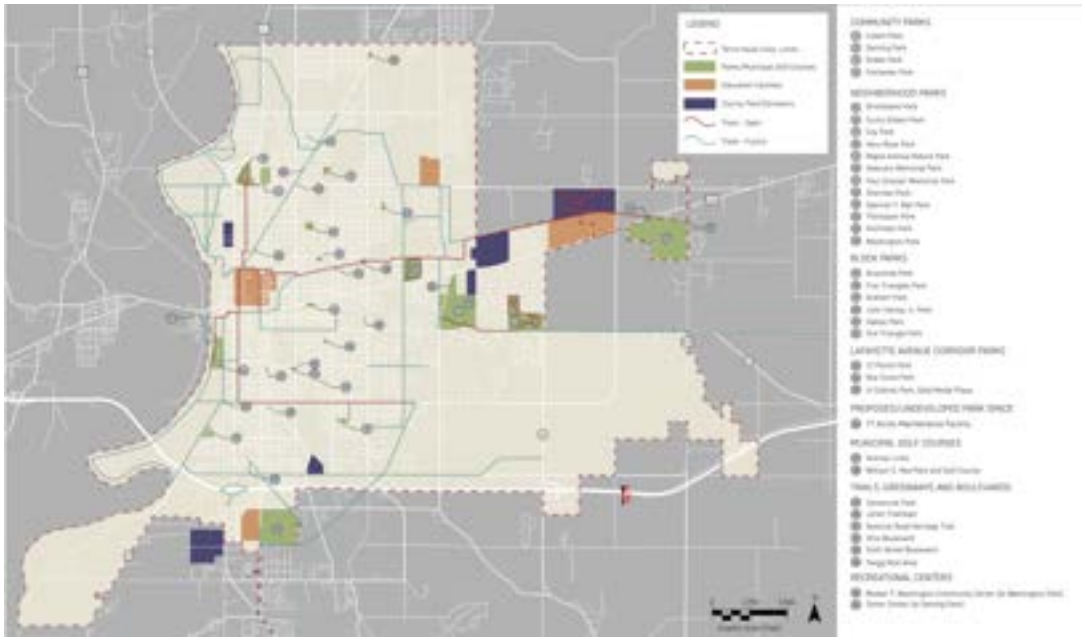
but were record-breaking in Terre Haute (Gustin, 2012). Now, as wetlands continue to be degraded, the chances of flooding are likely to increase.

Parks

The Terre Haute Parks Department owns over 1,000 acres of dedicated land, including community parks, neighborhood parks, block parks, two golf courses, as well as trails, greenways and boulevards. Its largest community park is Deming Park, 177 acres including a playground, holly arboretum, disc golf course, public pool, and sports facilities. Collett Park is on the National Register of Historical Places, and Dobbs Park features a Native American museum and state nature preserve (City of Terre Haute). The Parks and Recreation Master Plan classifies neighborhood parks, block parks, and Lafayette Avenue corridor parks as its other park categories, culminating in 25 parks of various size and utility (HWC Engineering, 2019). Terre Haute currently has a limited number of public trails, but the Master Plan outlines an extensive plan for a new trail system to be implemented in coming years.

There are many events and activities taking place in the City's parks throughout the year for visitors of all ages including classes, programs, camps, lessons and leagues. The community parks hold special holiday events throughout the year as well as an annual Old Fashioned Day at Collett Park and an annual 5K run at Deming Park (City of Terre Haute). The parks department heavily emphasizes family and community involvement on their acreage.

Beyond Terre Haute, Vigo County maintains six county parks including the award-winning Griffin Bike Park and multiple parks with campgrounds (The Haute). Together with the City's parks, Terre Haute residents have a wide variety of outdoor spaces and activities to choose from, contributing to the community's health, well-being, and connectedness to nature and each other.



All parks and green spaces in the city of Terre Haute (HWC Engineering, 2019)

Socioeconomic Trends

Population Trends

Terre Haute has a population of approximately 58,000 people. This population is stable, with only a 0.1% decrease in the last two years and only a 4% decrease from 2010 to 2020. Most of the population, 80.6%, is white, 11.4% Black or African American, and less than 2 percent of American Indian and Alaska Native, Asian, and Native Pacific Islander. Females make up approximately 49% of the population, and males 51%. A majority of the population is middle aged (18-65 years) at 60.1%. The elderly population, those 65 years and over, make up 15.1% of the population while those 18 years and younger make up 24.8%. College aged students are about 15% of the population, an important statistic to consider in college-centric communities (U.S. Census Bureau, 2022).

While Terre Haute is a large city, it is not dense. Its population per square mile is about 1,706 people. By comparison, West Lafayette, Indiana, a city of almost 13,000 fewer people, has a population density of about 3,283 people per square mile (U.S. Census Bureau, 2022).

Income, Housing, and Labor

The median household income (in 2021 dollars) is $38,750. One-fourth of the population lives in poverty. This is much higher than the Indiana average of 12.2% (U.S. Census Bureau, 2022).

The owner-occupied housing rate is 53.7% with approximately 2.24 persons per household. The remainder of the population are renters or unhoused. The median value of owner-occupied housing units is $87,500 while the median gross rent is $783 (U.S. Census Bureau, 2022).

Of the Terre Haute residents who are employed, 33.2% are in management, business, science, or arts related professions. This statistic includes employees of the higher education institutions in Terre Haute. The next largest employment category is service occupations at 23.9%. Terre Haute's unemployment rate is 4.4%, higher than the national average (U.S. Census Bureau, 2022). Anchor institutions in the city are Indiana State University, Rose-Hulman Institute of Technology, St. Mary-of-the-Woods College, Vigo County School Corporation, and Union Health.

Disadvantaged/Underrepresented Populations

Redlining has affected every corner of American society, and Terre Haute is no different. This systemic practice of grading neighborhoods, thereby influencing whether or not people in those neighborhoods received housing loans, has been proven to have also affected poverty, education, violence, addiction, and many more social factors. The importance of redlining

cannot be understated. The “Avenues” is a redlined area in Terre Haute, and two high-minority schools located in this area have historically scored worse on standardized tests than their low-minority counterparts (Larimer, 2020).

Redlined communities experience more frequent and severe effects of climate change. The City’s 2021 Urban Forestry Management Plan identifies several areas lacking canopy cover, and these areas align with historically redlined neighborhoods (Lane, 2021). Because these places lack trees, they are more susceptible to urban heat island effects, a heating phenomenon that is caused by a large amount of impervious surfaces. Those living near the Wabash River also have a higher chance of experiencing the effects of flooding, making them another disadvantaged group.

Citizens with disabilities are also an important group to consider. Of those under 65 years old, 15% have a disability. Furthermore, 10.3% of non-seniors are not covered by health insurance (U.S. Census Bureau, 2022). As air pollution and heat trends continue, those groups will be much more at-risk than their able-bodied and insured counterparts.

Infrastructure

Water supply and flood control

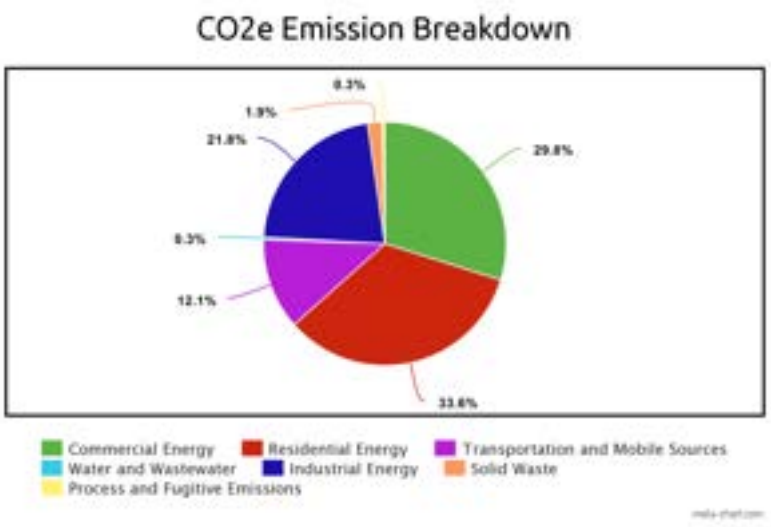
Terre Haute receives its water from four wells near the Wabash River. It is treated and distributed by the Indiana-American Water Company (City of Terre Haute).

Some areas of Terre Haute are designated as A areas on FEMA flood maps, which means they are high-risk flooding areas. Over 3,000 properties in the city are at risk of severe flooding in the next 20 years, and this is in part attributed to our changing climate, which will absolutely cause more flooding in the future (Risk Factor).

Energy

Like much of Indiana, Terre Haute receives most of its energy from Duke Energy (electric), Win Energy (electric), and CenterPoint Energy (natural gas). However, there is also the option for solar and wind energy through One Planet Solar and other private businesses (City of Terre Haute).

Terre Haute emitted over two million metric tons of carbon dioxide in 2019, and the largest sectors for emissions were commercial, residential, and industrial (Bhattacharyya, 2022).



Important Roadways

Terre Haute lies on U.S. 40 and U.S. 41, locally known as 3rd St. These are major highways connecting us to a large number of other major cities. Interstate highway I-70 also runs through the city. This connectivity is why the city refers to itself as the "Crossroads of America" (City of Terre Haute). Wabash Avenue is a main roadway with many businesses, and State Road 46 continues to develop.

Cultural Resources

Community History, Culture, and Growth

Before white settlement in Terre Haute, the land was primarily home to the Wea tribe, a faction of the larger Miami tribe that spread across Indiana and the Midwest. Today, there are no active indigenous tribes in the county, though Native Americans still make up about 2% of the City's population (U.S. Census Bureau, 2022).

Like many other small cities in Indiana, Terre Haute was a manufacturing hub for much of the early to mid-20th century. The Wabash River connected it to other cities when river travel was still popular. Companies like

Commercial Solvents, Pfizer, J.I. Case, Allis Chalmers, General Housewares, Western Paper, Midland Glass, Merchants Distilling, Terre Haute Brewing Company, Columbia Records and Sony DADC made their home here. Eventually Terre Haute faced an economic downturn as manufacturers moved out of Midwestern cities, but with its transportation network, Terre Haute remained a retail, service, educational, and healthcare hub for West Central Indiana and East Central Illinois. Terre Haute's institutions of higher education have helped to diversify the economy and keep people employed. The challenges associated with these drastic changes in economic conditions have created a sense of strength and resilience in the community.

In 2010, Terre Haute was named the Indiana Chamber of Commerce's Community of the Year. This title propelled the city to develop new projects to increase economic growth and highlight Terre Haute as a cultural hub. Now, the "See You In Terre Haute 2025" Community Plan is pushing the community toward economic and cultural success. It mentions improving waterways and beautifying the city, but it is important to note that this document does not mention climate change as a factor to consider when developing the economy, though these two affect each other intrinsically (City of Terre Haute, 2019). The 2018 state designation of Terre Haute's 41|40 Arts and Cultural District, encompassing Downtown, the Brewery District and much of Indiana State University, underscores the city's role as a regional hub of arts and culture.

Recreation and Quality of Life

Terre Haute offers its residents a variety of recreational activities that provide entertainment, community building and more. The Crossroads of America intersection, in the heart of downtown at 7th and Wabash, centers the Terre Haute Arts Corridor and the 41|40 Arts and Cultural District. This area features the Swope Art Museum, with American art from Andy Warhol, Grant Wood, Thomas Hart Benton, Edward Hopper and others; the Indiana Theatre, which has the second largest indoor movie theater screen in the state; and Art Spaces, a growing collection of outdoor sculptures which includes the ambitious "Turn to the River" project. The city also hosts its own symphony orchestra which plays a variety of concerts throughout the year, and the Community Theatre of Terre Haute, which provides an outlet for audiences to enjoy performances created by their fellow residents. The Terre Haute Children's

Museum, Larry Bird Museum, Eugene V. Debs Museum, and Vigo County History Center provide educational and recreational opportunities for citizens and visitors alike.

In 2022, Terre Haute ranked 86th in WalletHub's "Best Small Cities" ranking, which evaluates metrics concerning quality of life. It scored high on parks per capita, museums and restaurants per capita, and other metrics related to working and commuting. Where it lacks is economic health, education, and human health. According to the report, 20% of adults live in food deserts, and only 51.5% of adults are vaccinated against COVID-19 (Bennett, 2022).

The city is also located near other major cities like nearby Indianapolis and farther St. Louis, Louisville, Chicago, and Cincinnati.

Social Services

There is a wide variety of social services offered by the city, county, and nonprofit organizations in Terre Haute. There are 25 food pantries and soup kitchens in the city and a number of counseling and mental health services. Safety is a priority for the city, and that service includes both public safety and a network of neighborhood watch groups. Services for those with disabilities are limited, however, as are public libraries, of which there are only two for the entire city (City of Terre Haute).

Conclusion

Terre Haute has a vast network of natural systems, socioeconomic systems, infrastructure and cultural resources that makes it a unique and vibrant place to live and work. There are, of course, challenges that the city faces, especially in the socioeconomic category, and these challenges go hand-in-hand with the issues that climate change presents to Terre Haute. Recognizing the factors that make Terre Haute a

singular community, both positive and negative, is very important for resiliency task force members and the community at large. By working with and within the community resources outlined here, creating climate change solutions and resiliency can be a personal process for Hauteans, and the community can be involved in creating positive change.

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Appendix 3: Climate Vulnerability Assessment

Cities and counties throughout the nation and world are working to reduce greenhouse gas emissions in efforts to prevent warming more than 1.5°C (2.7° F). This level of warming has been recognized by the international scientific community as an important threshold, below which we can avoid catastrophic and runaway climate change (IPCC, 2022).

In addition to reducing greenhouse gasses, however, communities need to respond to the changes already being felt and plan for those still to come. Because greenhouse gasses can remain in the atmosphere for decades after release, we will continue to warm and experience impacts for many decades, even if we reduce emissions today.

While greenhouse gasses are measured globally, climate change impacts are experienced locally. Each community feels climate change in a different way, depending on historic conditions and local climatic conditions and patterns of change. As these local impacts and changes worsen over time, we will need to prepare and protect our most vulnerable resources and populations from the impacts.

Terre Haute has already experienced changes in temperature, rainfall, and extreme weather events. As changes in climate continue, we can expect increasing severity and frequency of extreme heat, larger storms with more wind and precipitation, more prolonged periods of drought, and changes to the forests and other natural features in and around the city. These changes are expected to become increasingly severe over the course of the century.

Determining which resources and populations are most vulnerable to ongoing and future impacts of climate change is the first step in developing effective strategies and sound solutions. While this Climate Change Vulnerability Assessment presents sector-specific vulnerabilities to the community, it is important to also look at Terre Haute in a holistic way. Many of the vulnerabilities identified here cross diverse sectors and affect people of all different walks of life.

Methods

On October 18, 2023, over 40 stakeholders from across the spectrum of Terre Haute came together at St. Mary-of-the-Woods College for a climate vulnerability assessment workshop. These stakeholders combined their local knowledge and expertise with information provided about climate science and model projections to identify and prioritize local vulnerabilities in the five primary systems of the community: Social Systems, Natural Systems, Built Systems, Economic Systems, and Cultural Systems.

Dr. Brendan Corcoran identifying vulnerabilities at the stakeholder workshop on October 18, 2023. Photo provided by Brady Kearns

The workshop participants were provided with a list of community concerns generated from the online survey outreach. They reviewed the scientific information on climate change and identified impacts that are already underway as well as potential impacts that are expected in the future. For each identified vulnerability, participants collected the following information:

Exposure	The specific climate trend or projection that is already causing or is expected to cause the impact
Timeframe	When the impact is expected to occur in Terre Haute
Certainty	The relative certainty that the impact will occur
Sensitivity	A relative measure of the degree of severity of the impact, given our understanding of the specific sector or population
Adaptive Capacity	The extent of existing resources, programs, or policies *already in place* to protect people or to respond to the changes with little disruption
Focal Populations	The specific neighborhood, population, area, or resource that is expected to be especially affected by the impact
Other Stressors	Additional and ongoing stressors to the focal population
Secondary Vulnerabilities	Other potential responses to, or effects related to, climate change that are likely to affect the vulnerability under consideration
Indicators	A quality or trait related to the focal population that can be tracked to indicate the effectiveness or success of actions taken to address this vulnerability

After identifying the specific vulnerabilities within each community system, participants ranked vulnerabilities across all systems to determine their relative priority. Most impacts identified in this vulnerability assessment are important to address, but action on some may be more urgent than on others, which is reflected in the ranking. See Table A3-1 at the end of this Appendix for a list of vulnerabilities in priority rank order. Additional populations and resources not specifically mentioned in this report may also be vulnerable.

> *"Climate change is among the greatest health risks of the 21st Century. Rising temperatures and more extreme weather events cost lives directly, increase transmission and spread of infectious diseases, and undermine the environmental detriments of health, including clean air and water, and sufficient food."* **World Health Organization**

Social Systems

Terre Haute is not immune to global health risks from climate change. Existing social threats are expected to be exacerbated with climate change, while new and emerging threats also take hold. Extreme events are already occurring more frequently, and emergency services will be increasingly taxed as these events become even more common.

Increased mental health challenges worsened by climate change – Climate change will undoubtedly put extra strain on many aspects of daily life like housing, recreational opportunities, and physical health.

Those all compound and can affect mental health, especially for those who are unhoused, in poverty, or in marginalized communities. Terre Haute's mental health infrastructure is not robust, making this an important vulnerability to address.

Increased frequent power outages due to extreme weather – Increased storm activity, tornadoes and high wind, and tree weakening due to lack of water all contribute to more frequent power outages. Those most at risk are unhoused people, hospitals, nursing homes, elderly, those dependent on electronic systems, and schools. In terms of adaptive capacity, emergency dispatch systems are backed up, and there are different power systems between the city and county, but this infrastructure needs to become more robust to handle more frequent brownouts and blackouts.

Decreased ability to grow produce due to changing water patterns – Changing water patterns—both flood and drought—along with the general unpredictability of weather that climate change brings will disrupt the growing seasons of local farmers. Yield may be less plentiful at farmers markets and there may be less stock at places like Ditzler Orchard and Holiday Hills Christmas Tree Farm. Those who grow their own food may be faced with higher food costs, and the social nature of agriculture and local food may suffer.

Decreased water supply due to changing precipitation patterns – Lessened or unpredictable rain and less snow caused by climate change will decrease the overall water supply for Terre Haute. Wells at the city's edges and in the county are particularly sensitive to this vulnerability; there are also fewer fire hydrants in the county than in the city. A system developed throughout unincorporated areas of Vigo County could use City infrastructure, but infrastructure costs are significant.

Greater risk of respiratory issues due to poor air quality – Poor air quality caused by greenhouse gas emissions and increased fires may worsen respiratory issues. Medical facilities may not have the capacity to handle a large influx of respiratory patients, and low income residents or those without health insurance facing these issues may suffer from a barrier to treatment. Those with pre-existing health conditions like asthma are also vulnerable.

Increased health risks from vector-borne diseases due to high heat – Ticks, mosquitoes, and other insects that increase in population due to increased heat and dry trees or standing water after flooding could contribute to spreading vector-borne diseases. With the planet warming, the range of disease vectors is increasing. Outdoor workers, those with disabilities, and children are the most at risk. Vaccines and repellant use could mitigate this vulnerability, but an increase in vaccinations puts more strain on medical facilities, and repellant use introduces more chemicals into the environment.

More severe fires due to drought and extreme heat – Drought and extreme heat from climate change will increase the chance of more severe fires. The unincorporated county is particularly at risk here because of a lack of infrastructure supporting firefighting. Less access to water in hydrants will impact all of Terre Haute. However, Terre Haute has many small bodies of water that could be utilized to adapt to this. Infrastructure improvements are costly but are already in motion. Many areas of Terre Haute are covered in green space, like parks, and these places are not at risk.

Identified Vulnerabilities: Social Systems

The vulnerability assessment identified the following social vulnerabilities to Terre Haute.

MEDIUM-HIGH

- Increased mental health challenges worsened by climate change
- Increased frequent power outages due to extreme weather
- Decreased ability to grow produce due to changing water patterns
- Decreased water supply due to changing precipitation patterns
- Greater risk of respiratory issues due to poor air quality

MEDIUM

- Increased health risks from vector-borne diseases due to high heat

MEDIUM-LOW

- More severe fires due to drought and extreme heat

Note: Overall vulnerability ranking is determined from the combined scores for time frame, sensitivity, and adaptive capacity

Built Systems

The infrastructure systems covered in this vulnerability assessment for Terre Haute include communications, electricity, water, wastewater, and energy utilities as well as roads, bridges, public buildings, homes, and businesses. Most infrastructure is built based on building codes that take into consideration the range of variation in temperature, precipitation, snowpack, and other climatic factors in the region.

Unfortunately, these codes are based on the historical climate rather than future climate. In many cases, outdated standards will be inadequate to meet the needs for safety and basic functioning under changing climatic conditions.

Some increasingly common infrastructure failures associated with climate change include inadequate stormwater infrastructure leading to road and bridge failure during extreme precipitation events; water contamination from combined sewer overflows; dry wells due to drought; schools shut down for lack of air conditioning during extreme heat events; and toxic algae contaminating municipal water supplies, particularly in low water years.

Identified climate change vulnerabilities to infrastructure in Terre Haute include:

Increased flooding risks due to more extreme weather – The higher frequency of extreme weather events and 100-year storms due to climate change will increase chances of flooding. Trees downed by increased weather events, electrical grid damage, damage to houses and businesses, and more variable growing seasons were all outcomes identified resulting from increased flooding. Floodplain residents,

people in poverty, and the southeast drainage area of the city are the most at risk. The Wabash River running along the City's western edge provides a unique challenge, particularly during flash floods.

Increased demand for cooling due to higher heat – Increased and extreme heat caused by climate change will have a direct effect on the cooling of homes and businesses. Utility costs to owners may rise and put strain on those who are low-income. An increased demand for cooling will also impact the utility infrastructure of Terre Haute. Participants called for reworking infrastructure at a household level to adapt to this vulnerability.

Increased strain on drinking water due to drought and increased heat – Terre Haute's drinking water comes from wells throughout the city. Drought and increased heat will limit the available water for drinking. Storm, waste, and drinking water systems are interconnected currently, but plans to separate those systems to ensure safety and public health are in process.

Identified Vulnerabilities: Built Systems

The vulnerability assessment identified the following infrastructure-related vulnerabilities to Terre Haute.

HIGH
- Increased flooding risks due to more extreme weather

MEDIUM-HIGH
- Increased demand for cooling due to higher heat

MEDIUM
- Increased strain on drinking water due to drought and increased heat

Note: Overall vulnerability ranking is determined from the combined scores for time frame, sensitivity, and adaptive capacity

Natural Systems

Climate change can have significant impacts on natural systems, through increases in temperatures, extreme storms and drought. Increasingly, one of the most important functions of natural systems is to provide a buffer against the impacts of climate change. Intact natural systems can reduce the impacts of extreme events, such as floods, fire, and drought, on local communities. Forest and ecosystem management to maximize natural function is increasingly becoming a priority.

The vulnerability assessment revealed that Terre Haute's natural systems are vulnerable to climate change in the following ways:

Impact on trees from increased heat, decreased precipitation, and invasives – Drought, wind events, species loss, and changes in hardiness zones are all aspects of climate change that will affect tree communities. Loss of trees can increase the urban heat island effect, which can in turn affect physical health and contribute even further to global warming. Terre Haute has an urban tree program in place that would need to adapt to the decline in tree health.

In lower income areas, often with higher percentages of people of color, there is less natural habitat and fewer parks. Climate change will only exacerbate this disparity, degrading existing natural areas and diversity, thereby leading to more anxiety, less exercise, fewer meeting places for community connections, and more isolation.

Decreased biodiversity due to extreme heat and weather events – Beyond the human residents of Terre Haute, a thriving ecosystem helps to regulate the climate, and losing biodiversity can be brought on by extreme heat, extreme weather events, etc. The Wabash River is a major body of water that could be affected heavily through fish die-offs and algae blooms. The Wabashiki Fish and Wildlife Area is also highly at risk and under-prioritized.

As climate change progresses, more extremes are expected. This includes an increase in floods, drought, larger storms, severe heat waves, increased wind speeds, and hailstorms. Many of these extreme events will have impacts on species and their habitats.

Impacts to the Wabash River and its watershed due to flooding and drought – Flooding and drought, storms, loss of fish species, erosion, and more are all impacts of climate change and human activity that will deteriorate the health of the Wabash River. The Wabash is already contaminated primarily with PCBs, and these environmental stressors will only increase the risks posed by these toxins. However, the City's federally mandated Combined Sewer Overflow plan and recent RiverScape strategic plan concerning the river provide a strong base to adapt to this vulnerability.

Identified Vulnerabilities: Natural Systems

The vulnerability assessment identified the following natural systems-related vulnerabilities to Terre Haute.

MEDIUM-HIGH

- Impact on trees from increased heat, decreased precipitation, and invasives
- Decreased biodiversity due to extreme heat and weather events

MEDIUM

- Impacts to the Wabash River and watershed due to flooding and drought

Note: Overall vulnerability ranking is determined from the combined scores for time frame, sensitivity, and adaptive capacity

Economic Systems

Terre Haute's economy is built on many different types of businesses and industries, ranging from large-scale manufacturing to small local and diverse businesses. Climate change is expected to affect the local economy in numerous ways. Not only are transportation routes expected to be interrupted more frequently (see the Infrastructure section) but the cost of doing business is expected to rise.

Impacts on agriculture from increased heat and change in growing season – All effects of climate change, particularly increased heat and changes in the growing season, will affect agriculture. Businesses that depend on agritourism may see a decline in supply and revenue. Local farmers markets may not have enough vendors with supply to fill their stalls. Grocery stores that depend on local produce may need to outsource.

Healthcare industry affected by flooding, increased heat exposure, and poor air quality – Terre Haute's healthcare industry will be affected in a number of ways by climate change. Flooding and increased storm intensity may damage buildings and cause more frequent power outages. Health stressors like extreme heat and poor air quality may increase the number of patients, putting strain on employees and equipment. Increasing the capacity of medical facilities will be the main challenge in adapting to expected climatic changes.

Increased insurance costs due to extreme weather – Insurance costs are directly linked to the level of risk involved. As the risk of climate impacts such as flooding, hail, severe storms, drought, and wildfire increases, premiums will also increase. As climate-induced risk continues to rise, some areas may become uninsurable, transferring the full financial risk to individual property and business owners. Some major national insurers have already pulled out of especially high risk markets like Florida.

Credit rating agencies have added "resiliency" in their rating criteria for city and state governments, affecting the ability of local governments to raise bond funds and the rates that taxpayers pay for those funds. For instance, Standard and Poor's regularly publishes extensive research on the climate-related

risks to cities (S&P Global, n.d.). They also evaluate environmental, social, and governance risks as a key part of their ratings methodology.

Impacts to the tourism sector affected by increased heat, extreme weather – Increased heat and humidity and an increase in extreme weather will affect the tourism sector. Terre Haute's many parks and historical sites may see less traffic and engagement from non-residents. There is potential here to turn to local resident buy-in to fill in the gaps created by less tourism. The Destination Wabash Avenue Plan currently in the works and the recently opened Terre Haute Convention Center are efforts to revitalize our downtown by drawing in non-residents for economic activity.

Identified Vulnerabilities: Economic Systems

The vulnerability assessment identified the following business and economy-related vulnerabilities to Terre Haute

MEDIUM-HIGH

- Impacts on agriculture from increased heat and change in growing season
- Healthcare industry affected by flooding, increased heat exposure, and poor air quality

MEDIUM

- Increased insurance costs due to extreme weather

MEDIUM-LOW

- Impacts to the tourism sector affected by increased heat, extreme weather

Note: Overall vulnerability ranking is determined from the combined scores for time frame, sensitivity, and adaptive capacity

Cultural Systems

The character of Terre Haute comes from complex local history and culture that has developed over many generations. Located on the Wabash River, Terre Haute has always been a prime location for development, leading white settlers to colonize the area and develop new businesses and economies. Changing with the times, Terre Haute has become an educational and green space hub.

Today, Terre Haute is a thriving center for many families, business owners, and industries. Citizens of Terre Haute value its small-town feel combined with big-city amenities and cultural offerings like festivals, museums, arts, and parks.

Outdoor activities limited by poor air quality – Higher temperatures associated with climate change, particularly in the summer, exacerbate the health impacts caused by existing air pollution and create

drier conditions, leading to increases in wildfire and the risk of wildfire smoke. Cultural and community programming often happens outdoors. Festivals, sporting events, and park events could be canceled or moved indoors due to poor air quality, denying residents the chance to enjoy and benefit from the outdoors. Increased heat is also a stressor that could limit outdoor activities.

Greenways affected by weather severity – Drought, flooding, high heat, and storms will all affect the natural environment, including greenways. Terre Haute residents are particularly invested in their natural spaces, making this a high-priority vulnerability for all. Weakened greenways decrease city beautification, especially in notable places like the National Road Heritage Trail, and the high monetary and time costs of infrastructure development make this vulnerability difficult to adapt to.

Blueways/rivers affected by weather severity – Drought, high heat, and flooding will all contribute to affecting blueways and rivers. Recreation on the Wabash River and the two lakes in Fowler Park may be limited. Decreasing wetlands and increasing impervious surfaces will heighten this vulnerability if not addressed. Mitigating this vulnerability will rely heavily on legislation.

Cultural facilities limited by adaptive costs – Many cultural facilities already face a lack of funding or staffing and are faced with closures and cutbacks. Climate change will increase stress through increased heat and extreme weather events that will force these facilities to pay higher utility bills and adapt their

programming to poor air quality or high heat. Schools, churches, libraries, nonprofits, museums and public parks are all at risk of this vulnerability.

Outdoor activities limited by high heat – As the world continues to warm, high heat days will become more extreme and frequent in Terre Haute. This will limit community time outdoors, leaving gathering spaces empty. Children, the elderly, and those with disabilities are particularly at risk. Parades and festivals that bring the community together could be canceled or moved indoors.

Identified Vulnerabilities: Cultural Systems

The vulnerability assessment identified the following community culture-related vulnerabilities to Terre Haute

HIGH
- Outdoor activities limited by poor air quality
- Greenways affected by weather severity

MEDIUM-HIGH
- Blueways/rivers affected by weather severity
- Cultural facilities limited by adaptive costs

MEDIUM
- Outdoor activities limited by high heat

Note: Overall vulnerability ranking is determined from the combined scores for time frame, sensitivity, and adaptive capacity

Conclusions

Climate change is a global threat with locally unique impacts for communities. Because each region is affected differently, and each community has a unique combination of existing vulnerabilities and assets, it is vital to develop climate change solutions at the local level. Some of the most important vulnerabilities to Terre Haute include flooding risks, outdoor activities limited by poor air quality, and greenways affected by weather severity. Cultural vulnerabilities were on the whole the most sensitive with the least amount of adaptive capacity, though most vulnerabilities were identified as high sensitivity and medium adaptive capacity. This is promising; it shows that participants were confident in the resources and buy-in provided by Terre Haute. The most vulnerable residents and resources are generally those with the least adaptive capacity to deal with the additional impacts of climate change.

The international scientific community agrees that keeping average warming at the global level below 1.5°C (2.7° F) is vital to protect young people and future generations from catastrophic climate change. Emissions reductions are the first and most important step to preventing many of the worst impacts on

our community. However, many impacts are already occurring and need to be addressed to protect people and resources throughout the community. This is why building adaptive capacity and resilience is essential now.

Because climate change affects all sectors and resources, actions must be coordinated to increase overall resilience. Without coordination, actions in one sector or population could shift impacts to other sectors or populations, especially those who are already most vulnerable. Truly co-beneficial solutions to climate change address economic and social inequities, increase ecological health and resilience, and collaborate across diverse groups and resources.

Climate Change Vulnerabilities in Terre Haute

Table A3-1. Through extensive work with Terre Haute stakeholders, residents, and experts, the following climate change vulnerabilities were prioritized across all five community systems.

Climate hazards - The specific climate trend or projection that is already causing or is expected to cause the impact.

 **Severe Heat** – There could be 32-57 more days/year above 90° F

 **Larger Storms** - The amount of precipitation in the largest storms could increase 5-30%

 **Drought** - Drought stress could increase by 44-78%

 **Flooding** – More homes and businesses at risk of flooding

Timeframe	Sensitivity	Adaptive Capacity
When the impact is expected to occur *Near-term = current to 2030s* *Mid-term = 2040s to 2060s* *Long-term = 2070s to 2090s and beyond*	How much of a response or how great of an impact is expected *High, Medium, or Low*	Whether there are already existing resources, programs, or policies in place to protect people or to respond to the changes with little disruption *High, Medium,or Low*

Rank	Sector(s)	Vulnerability	Climate Hazard(s)	Time frame	Sensi-tivity	Adaptive Capacity
1	Built	Increased flooding risks due to more extreme weather		Near term	High	Low
2	Cultural	Outdoor activities limited by poor air quality		Near term	High	Low

3	Cultural	Greenways affected by weather severity		Near term	High	Low
4	Social	Increased mental health challenges worsened by climate change		Near term	High	Med
5	Natural	Impact on trees from increased heat, decreased precipitation, and invasives		Near term	High	Med
6	Natural	Decreased biodiversity due to extreme heat and weather events		Near term	High	Med
7	Economic	Impacts on agriculture from increased heat and change in growing season		Near term	High	Med
8	Economic	Healthcare industry affected by flooding, increased heat exposure, and poor air quality		Mid term	High	Med
9	Cultural	Blueways/rivers affected by weather severity		Near term	High	Med
10	Social	Increased frequent power outages due to extreme weather		Near term	High	Med
11	Social	Decreased ability to grow produce due to changing water patterns		Near term	High	Med
12	Cultural	Cultural facilities limited by adaptive costs		Near term	High	Med
13	Social	Decreased water supply due to changing precipitation patterns		Near term	Med	Low
14	Economic	Increased insurance costs due to extreme weather		Mid term	Med	Low
15	Social	Greater risk of respiratory issues due to poor air quality		Near term	Med	Low

16	Built	Increased demand for cooling due to higher heat		Near term	Med	Low
17	Natural	Impacts to the Wabash River and watershed due to flooding and drought		Mid term	High	High
18	Social	Increased health risks from vector-borne diseases due to high heat		Mid term	Med	Med / High
19	Built	Increased strain on drinking water due to drought and increased heat		Long term	Med	Med / High
20	Cultural	Outdoor activities limited by high heat		Near term	Med	Med / High
21	Social	More severe fires due to drought and extreme heat		Mid term	Med	High
22	Economic	Impacts to the tourism sector affected by increased heat, extreme weather		Near term	Med	High

Risk Matrix

The symbol → indicates highest priority for strategy development

High Sensitivity	Low Adaptive Capacity	Medium Adaptive Capacity	High Adaptive Capacity
	→ **Increased flooding risks** due to more extreme weather **Outdoor activities** limited by poor air quality **Greenways** affected by weather severity	→ **Increased mental health challenges** worsened by climate change → **Impact on trees** from increased heat, decreased precipitation, and invasives → **Decreased biodiversity** due to extreme heat and weather events → **Impacts on agriculture** from increased heat and change in growing season → **Healthcare industry** affected by flooding, increased heat exposure, and poor air quality → **Blueways/rivers** affected by weather severity **Increased frequency of power outages** due to extreme weather **Decreased ability to grow produce** due to changing water patterns **Cultural facilities** limited by adaptive costs	**Impacts to Wabash River and watershed** due to flooding and drought

Medium Sensitivity	→ **Decreased water supply** due to changing precipitation patterns → **Increased insurance costs** due to extreme weather **Greater risk of respiratory issues** due to poor air quality **Increased demand for cooling** due to higher heat	**Increased health risks** from vector-borne diseases **Increased strain on drinking water** due to drought and increased heat **Outdoor activities** limited by high heat	**More severe fires** due to drought and extreme heat **Impacts to the tourism sector** affected by increased heat, extreme weather
Low Sensitivity			

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Appendix 4: Developing Climate Resilience Strategies

On Jan. 24, 2024, a group of 43 local experts from diverse sectors of the community met for a daylong strategy development workshop. Most participants also attended the Vulnerability Assessment workshop (see Appendix 3). These stakeholders combined their local knowledge and expertise to identify and prioritize strategies that address Terre Haute's climate vulnerabilities. Workshop participants represented all five community systems: Built Systems, Natural Systems, Social Systems, Cultural Systems, and Economic Systems.

In the first part of the workshop participants reviewed the climate projections and vulnerabilities for Terre Haute and learned about the best practices for developing climate adaptation solutions, such as creating win-win and no-regrets strategies. Then participants developed a list of guiding principles that reflect the common values and priorities of Terre Haute.

Participants spent most of the day working in cross-sector breakout groups, identifying strategies and actions for a specific subset of vulnerabilities from the Vulnerability Assessment (see Appendix 3). These five breakout groups were organized around the same systems that the participants were experts in: Built Systems, Natural Systems, Social Systems, Cultural Systems, and Economic Systems. While many participants were placed in a group that pertained to their expertise, some members with a broader field of knowledge were placed in a different breakout group to provide cross-sector knowledge to each group and strategy.

For each vulnerability, group members reviewed a list of possible strategies developed from a review of existing community plans and reports, and a national database of solutions. Participants then brainstormed additional options and prioritized the list of possible strategies for each vulnerability. For each of the top priority strategies, participants collected the following information:

Possible Actions	Specific actions to help achieve the strategy
Co-benefits	Any potential positive impacts of the strategy to groups, resources, or populations other than those that are the focus of the action.
Trade-offs	Any potential negative impacts of the action related to groups, resources, or populations other than those that are the focus of the action, or how the action could make climate change worse or prevent resilience in other sectors.

Responsible Party	Who is potentially responsible for implementing the action, and other implementation partners
Upfront/Capital Cost	The relative upfront or capital cost (High, Medium, or Low)
Ongoing/Maintenance Cost	The relative ongoing or maintenance cost (High, Medium, or Low)
Effectiveness	The relative effectiveness of the proposed action (High, Medium, or Low), based on how much the action will reduce vulnerability and lead to greater climate resilience.
Metrics	What will be measured (both quantitative and qualitative) to help track and evaluate success of the strategy and/or specific actions

At the end of the workshop, participants ranked all strategies across all breakout groups in terms of their relative priority and according to the set of guiding principles developed earlier in the day. See the list of strategies in this priority order below.

It is important to note that this ranking is only a starting point for the implementation phase of *Climate Ready Terre Haute*. Additional information and resources may impact which strategies and actions are implemented first, and which may need to wait.

Priority	Strategy	Theme
1	**Strategy RE-1: Develop Smart Parks**	Resilience Education
2	**Strategy NS-1: Connect Farmers to the Local Economy**	Robust Natural Systems
3	**Strategy RE-2: Build Capacity for Growing and Using Food**	Resilience Education
4	**Strategy RE-3: Establish a Homegrown National Park program**	Resilience Education
4	**Strategy NS-2: Improve Natural Conservation of Water**	Robust Natural Systems

5	**Strategy RI-1: Create a More Resilient Power Grid**	Resilient Infrastructure
6	**Strategy HS-1: Build Community Resilience to Heat and Extreme Weather**	Healthy and Safe Citizens
7	**Strategy RI-2: Create More Safely Floodable Areas**	Resilient Infrastructure
8	**Strategy NS-3: Replace Existing Canopy With Trees Adapted to Warmth and Drought**	Robust Natural Systems
9	**Strategy RI-3: Update City and County Construction Policies**	Resilient Infrastructure
10	**Strategy HS-2: Ensure Preparedness of Healthcare Providers and First Responders**	Healthy and Safe Citizens
11	**Strategy NS-4: Create a Greenway Along Wabash Ave**	Robust Natural Systems
12	**Strategy RE-4: Create a Marketing Plan for Resilient Species to Plant**	Resilience Education
13	**Strategy HS-3: Provide Refuge Day and Night During Heat Emergencies**	Healthy and Safe Citizens
14	**Strategy RI-4: Use City Vacant Lots for Resilient Purposes**	Resilient Infrastructure
15	**Strategy RE-5: Improve Resilience on the Heritage Trail**	Resilience Education
16	**Strategy RI-5: Improve Access to Water**	Resilient Infrastructure
17	**Strategy HS-4: Support Persons Involved in Mandatory Outdoor Activities**	Healthy and Safe Citizens
18	**Strategy RI-6: Provide Housing to Unhoused Persons**	Resilient Infrastructure

Appendix 5: Climate Resilience Strategies

Listed below are the climate adaptation strategies for Terre Haute, as identified by local stakeholders and community members. These are presented in the order of their priority within each of the main themes. The risk numbers refer to the identified climate vulnerabilities, listed at the end of this table and described in more detail in Appendix 3.

Community Values

Enhances environmental health and biological diversity

Supports efforts to reduce greenhouse gas emissions (mitigation)

Helps to build equity for historically marginalized groups

Cross-sector strategy addresses multiple types of needs across the community

Terre Haute leads through direct governmental action

Indicates a high priority item

Effectiveness	Upfront or Capital Costs	Ongoing or Maintenance Costs
High, Med, Low *The level of certainty that the strategy will reduce vulnerability and lead to greater climate resilience*	**$ or $$ or $$$** *The relative upfront costs of initiating the strategy*	**$ or $$ or $$$** *The relative costs for ongoing support or maintenance for the strategy*

Strategies for Resiliency Education

Strategy	Risk	Community Values	Responsible Party *Supporting Parties*	Effectiveness	Upfront Costs	Ongoing Costs
Strategy RE-1: Develop Smart Parks	2, 4, 12, 20, 22		City Parks Department *City Engineering, City Signage Department*	High	$$$	$
Strategy RE-2: Build Capacity for Growing and Using Local Food	6, 7, 11		Sustainability Commission *Purdue Extension, USDA, Vigo County Health Department, Union Health, ISU*	Med	$$	$
Strategy RE-3: Establish a Homegrown National Park program	3, 4, 6		Sustainability Commission *Master Gardeners, Purdue Extension, Parks Dept.,Homeowners*	Med	$$	$
Strategy RE-4: Create a Marketing Plan for Resilient Species to Plant	1, 5, 6, 16		City Forester *TREEs, Inc.*	Med	$$	$$
Strategy RE-5: Improve Resilience on the National Road Heritage Trail	3, 4, 6, 22		City Engineering *Parks Dept, Sustainability Commission, Master Gardeners, Purdue Extension, ISU*	High	$	$$

Strategies for Robust Natural Systems

Strategy	Risk	Community Values	Responsible Party *Supporting Parties*	Effectiveness	Upfront Costs	Ongoing Costs
Strategy NS-1: Connect Farmers to the Local Economy	4, 7, 11		Terre Foods *West Central Indiana Small Business Development Center, City Council*	High	$$	$$
Strategy NS-2: Improve Natural Conservation of Water	12, 13, 19		Sustainability Commission *Vigo County School Corp, City Planner*	Mid	$$$	$$
Strategy NS-3: Replace Existing Canopy With Trees Adapted to Warmth and Drought	5, 6		City Forester *City Planner, City Council*	Mid	$$	$$
Strategy NS-4: Create a Greenway Along Wabash Avenue	1, 3, 6		Chamber of Commerce *Sustainability Commission, local businesses, Downtown Business Alliance*	Mid	$$$	$$

Strategies for Resilient Infrastructure

Strategy	Risk	Community Values	Responsible Party *Supporting Parties*	Effectiveness	Upfront Costs	Ongoing Costs
Strategy RI-1: Create a More Resilient Power Grid	8, 10, 12, 14, 16		City Council *Duke Energy, OnePlanet Solar, Sustainability Commission*	High	$$$	$$$
Strategy RI-2: Create More Safely Floodable Areas	1, 2, 10		City Council *Insurance companies, Soil and Water District*	High	$$$	$
Strategy RI-3: Update City and County Construction Policies	1		City Council *City Planner, large landowners, loan officers*	Med	$	$$$
Strategy RI-4: Use City Vacant Lots for Resilient Purposes	3, 6		Redevelopment Office	High	$	$
Strategy RI-5: Improve Access to Water	13, 19, 21		Sustainability Commission *Fire Department, City Engineer*	Low	$$$	$$$
Strategy RI-6: Provide Housing to Unhoused Persons	2, 4, 8, 16, 20		City Council *City Planner*	High	$$$	$$$

Strategies for Healthy and Safe Citizens

Strategy	Risk	Community Values	Responsible Party *Supporting Parties*	Effectiveness	Upfront Costs	Ongoing Costs
Strategy HS-1: Build Community Resilience to Heat and Extreme Weather	2, 4, 12, 15, 18, 20		Sustainability Commission *Master Gardeners, Vigo County School Corp.*	Med	$$	$
Strategy HS-2: Ensure Preparedness of Healthcare Providers and First Responders	8, 10, 15, 18, 21		Vigo County Emergency Management *local hospitals and healthcare facilities, Police Department, Fire Department, Duke Energy, CenterPoint*	High	$$$	$
Strategy HS-3: Provide Refuge Day and Night During Heat Emergencies	4, 15, 18, 20		Sustainability Commission *Local businesses and organizations*	Med	$$$	$
Strategy HS-4: Support Persons Involved in Mandatory Outdoor Activities	2, 4, 15, 18, 20		Existing non-profits and businesses City Forester, Tree Advisory Board	Med	$$$	$

List of Climate Vulnerabilities or Risks

This list is presented in priority order as determined by stakeholders and community members. See Appendix 3 for more details and information on these identified vulnerabilities.

1. Increased flooding risks due to more extreme weather
2. Outdoor activities limited by poor air quality
3. Greenways affected by weather severity
4. Increased mental health challenges worsened by climate change
5. Impact on trees from increased heat, decreased precipitation, and invasives
6. Decreased biodiversity due to extreme heat and weather events
7. Impacts on agriculture from increased heat and change in growing season
8. Healthcare industry affected by flooding, increased heat exposure, and poor air quality
9. Blueways affected by weather severity
10. Increased frequency of power outages due to extreme weather
11. Decreased ability to grow produce due to changing water patterns
12. Cultural facilities limited by adaptive costs
13. Decreased water supply due to changing precipitation patterns
14. Increased insurance costs due to extreme weather
15. Greater risk of respiratory issues due to poor air quality
16. Increased demand for cooling due to higher heat
17. Impacts to the Wabash River and watershed due to flooding and drought
18. Increased health risks from vector-borne diseases due to high heat
19. Increased strain on drinking water due to drought and increased heat
20. Outdoor activities limited by high heat
21. More severe fires due to drought and extreme heat
22. Impacts to the tourism sector affected by increased heat and extreme weather

Appendix 6: Community and Stakeholder Outreach

The process of developing the *Climate Ready Terre Haute* plan was the result of significant time and input from a variety of people in and around the Terre Haute community. The "Whole Community Resilience" process utilized by Terre Haute included a series of stakeholder workshops, each designed to solicit feedback to inform the development of appropriate and actionable solutions. Terre Haute also promoted one online survey to get additional feedback from the public throughout the process.

Stakeholder Workshops

On Oct. 24, 2023, a group of 40 local experts from diverse sectors of the community met for a daylong vulnerability identification workshop. These stakeholders combined their local knowledge and expertise with climate science and model projections to identify and prioritize local vulnerabilities in all major sectors of the community. This information was used to help develop the Climate Vulnerability Assessment, found in Appendix 3.

On Jan. 24, 2024, Terre Haute hosted a second stakeholder workshop with many of the same participants from the vulnerability assessment workshop. This second workshop focused on identifying strategies and actions to address each of the vulnerabilities identified in the Climate Vulnerability Assessment (see Appendix 3). The 43 participants worked in cross-sector breakout groups, each with a set of related vulnerabilities from across the five community systems.

Terre Haute deeply appreciates the time, expertise, and knowledge of these workshop participants:

Amjad Alrehaili
Sister Barbara Battista
Bill Berry
Dr. Shikha Bhattacharyya
Ellie Blaine
Tammy Boland
Maria Bonilla-Thompson
Lillien Chew
Dr. Brendan Corcoran
Diarmuid Corcoran
Martha Crossen
Lori Danielson
Josey Daugherty

Therese Dorau
Sylvester Edwards
Jared Ell
John-Michael Elmore
Ana Maria Erazo
Tabby Flynn
Daniel Garcia
Jack Hayes
Kathleen Heath
Lorrie Heber
Debbie Hensley
Tyler Hudson
Ben Jenson
Penny Kahl
Brady Kearns
Brendan Kearns
Tina Lambert
Melinda Leo
Kathryn Lisinicchia
Candace Minster
Mark Minster
Jessica Murphy
Todd Nation
Tyler Nevill
Jim Poyser
Lora Rivera
Philip Roberts
Ann Ryan
Anne-Therese Ryan
Jane Santucci
Karen Schneiders
Sydney Shahar
Deb Sitarski
Faye Snodgrass
Dr. Jim Speer
Leif Speer
Jesse Tohill
Dr. Ana Carolina Vaz
Patti Weaver
Jeremy Weir
Ryan Wickens
Kristan Williams

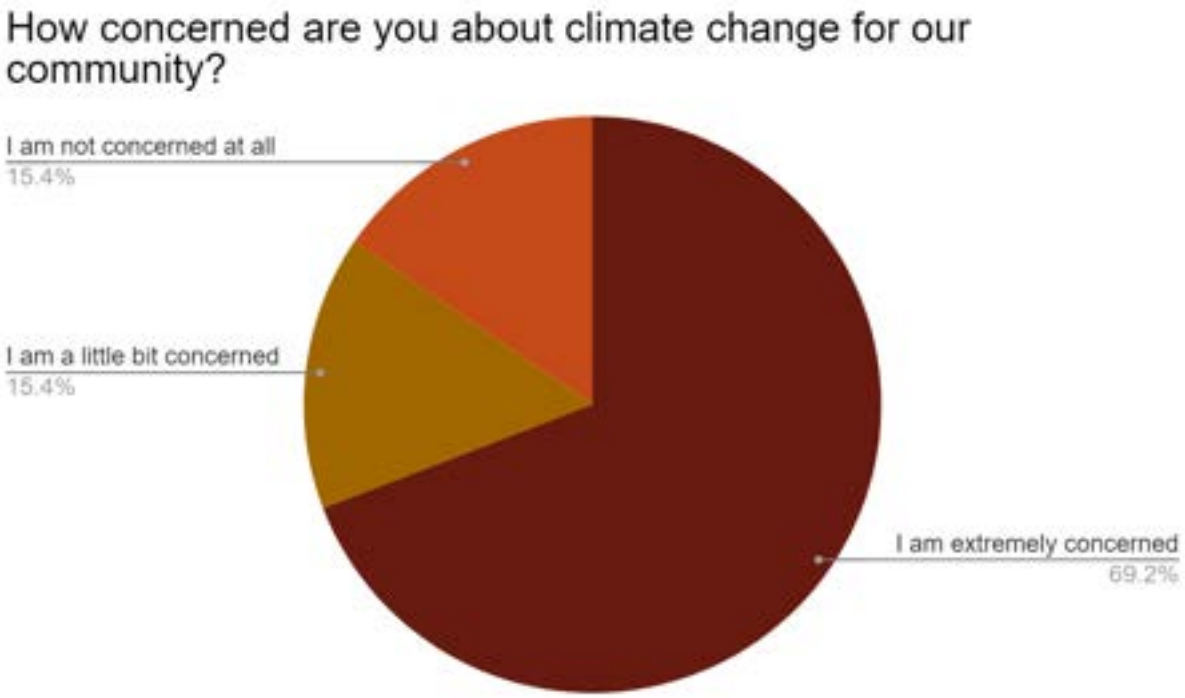
Community Surveys

During the development of *Climate Ready Terre Haute*, a community survey was used to gather information from the broader public that was used to develop this report. This survey was distributed across the community via different networks and channels, including the City's Facebook page.

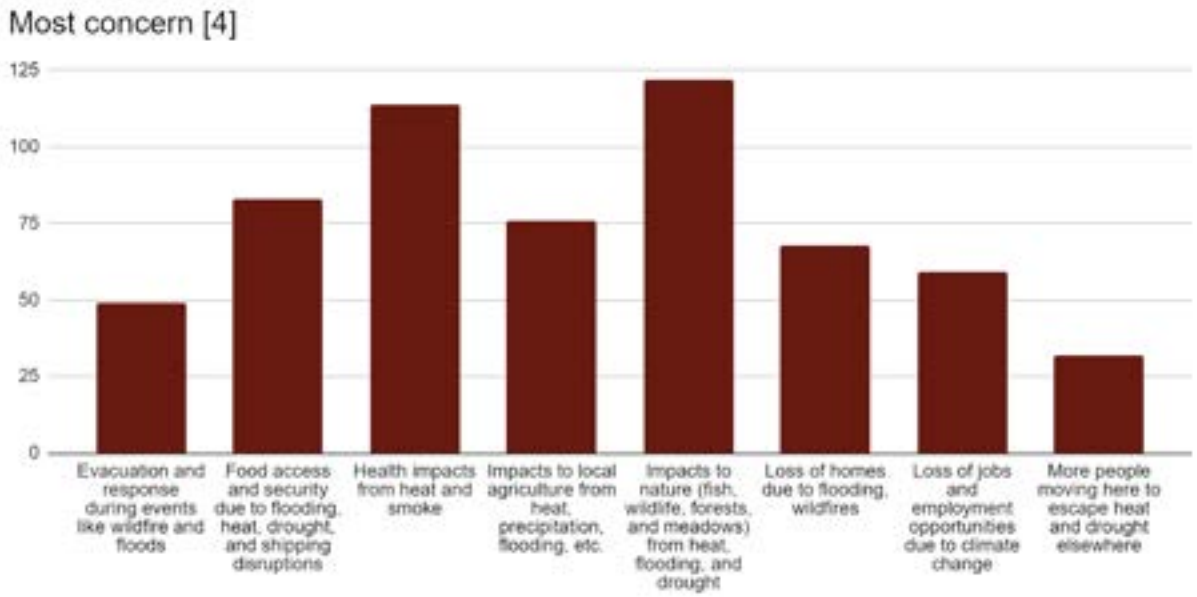
This survey is not intended to be scientifically sound, rather it is designed to inform the resilience building process while also serving as a mechanism to educate local residents. Information is provided here to explain how responses were used and facilitate transparency in this process.

Vulnerability Assessment Survey

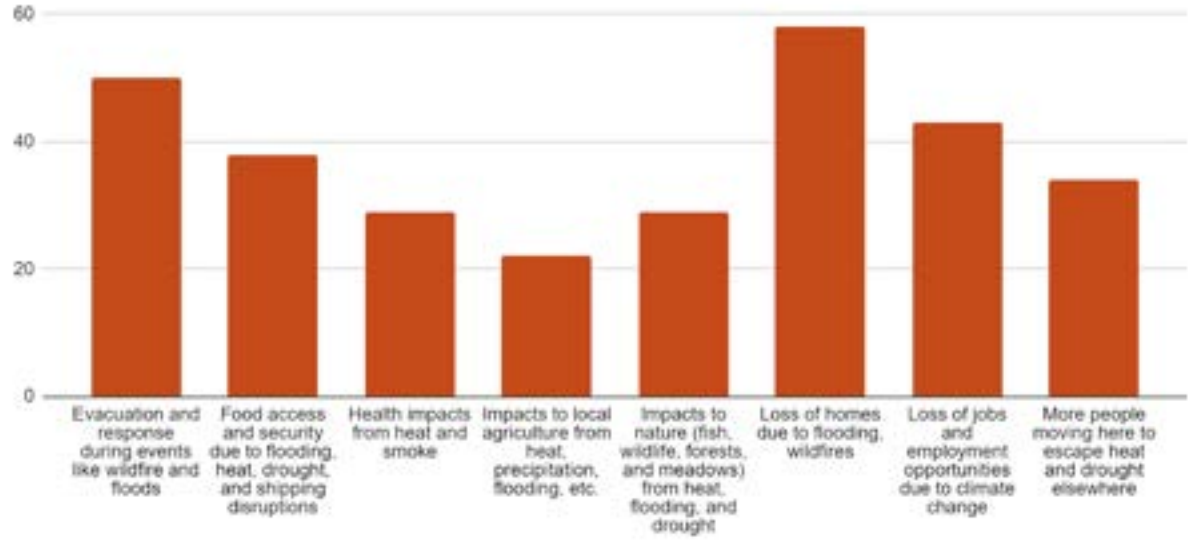
The survey was conducted from Sept. 22, 2023 to Oct. 6, 2023 and collected a total of 202 responses. This survey presented information about the changes expected in Terre Haute, and asked what impacts are already being seen and what, if any, specific concerns exist. All of the responses collected were used in the Vulnerability Assessment workshop. They are summarized in the following graphics.



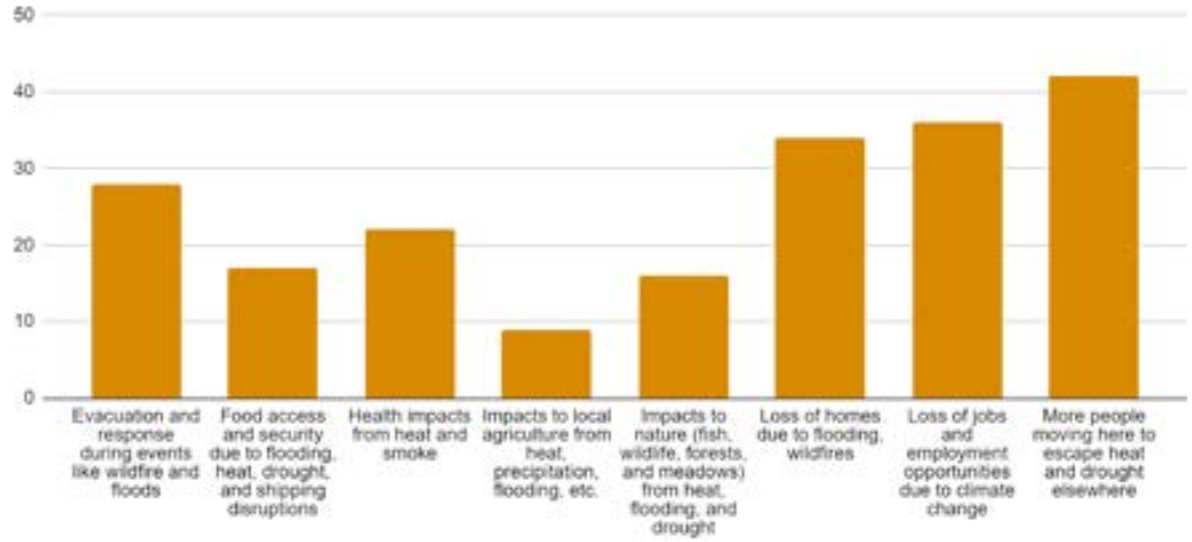
How much do each of the following potential climate impacts concern you? Please choose 1 through 4 for each, 1 being the least concern and 4 being the most concern.

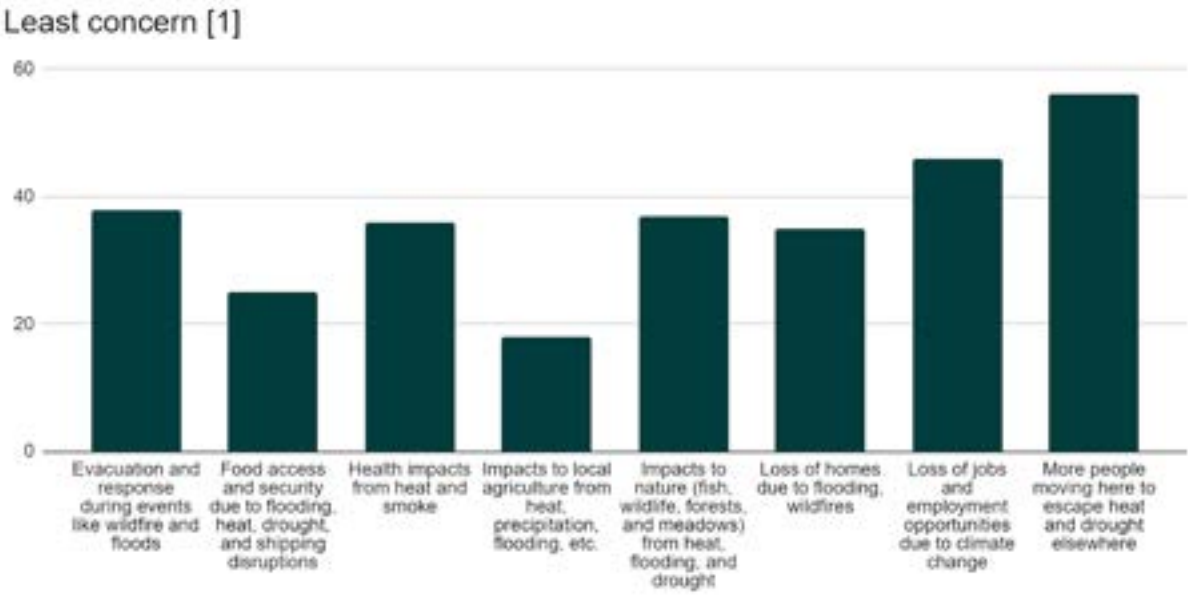


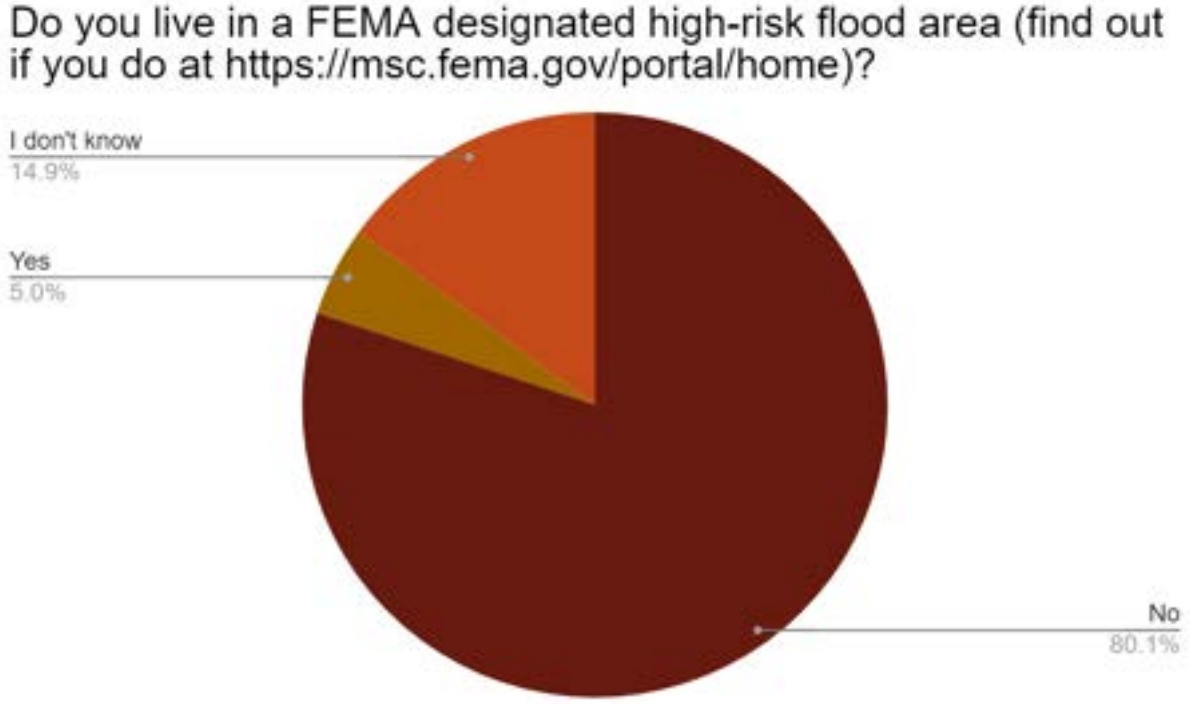
Some concern [3]



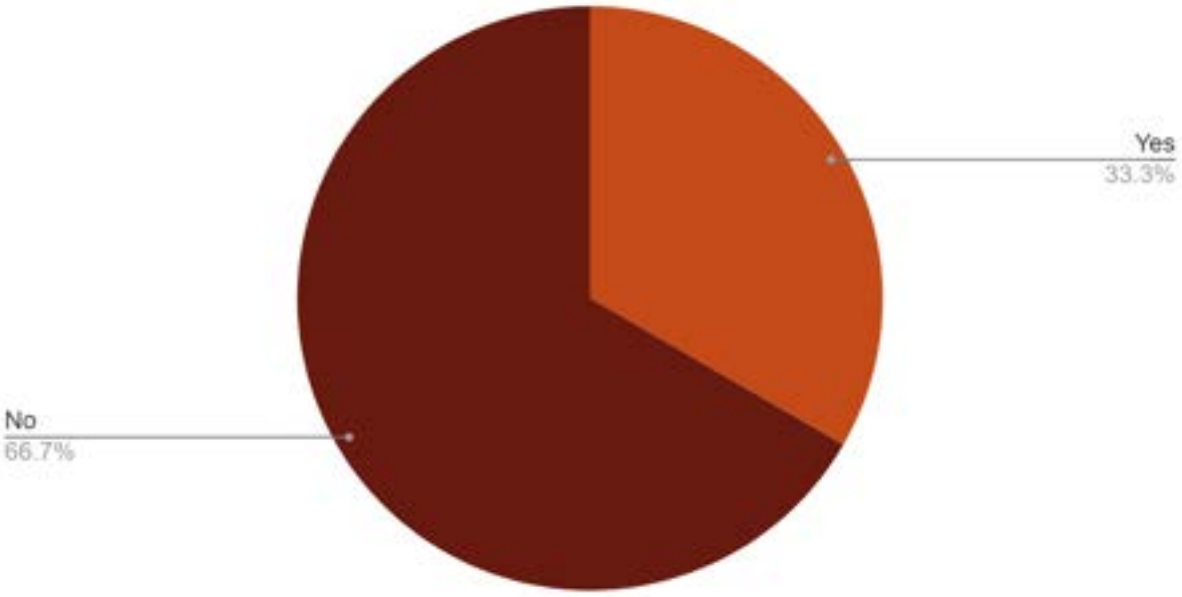
Little concern [2]



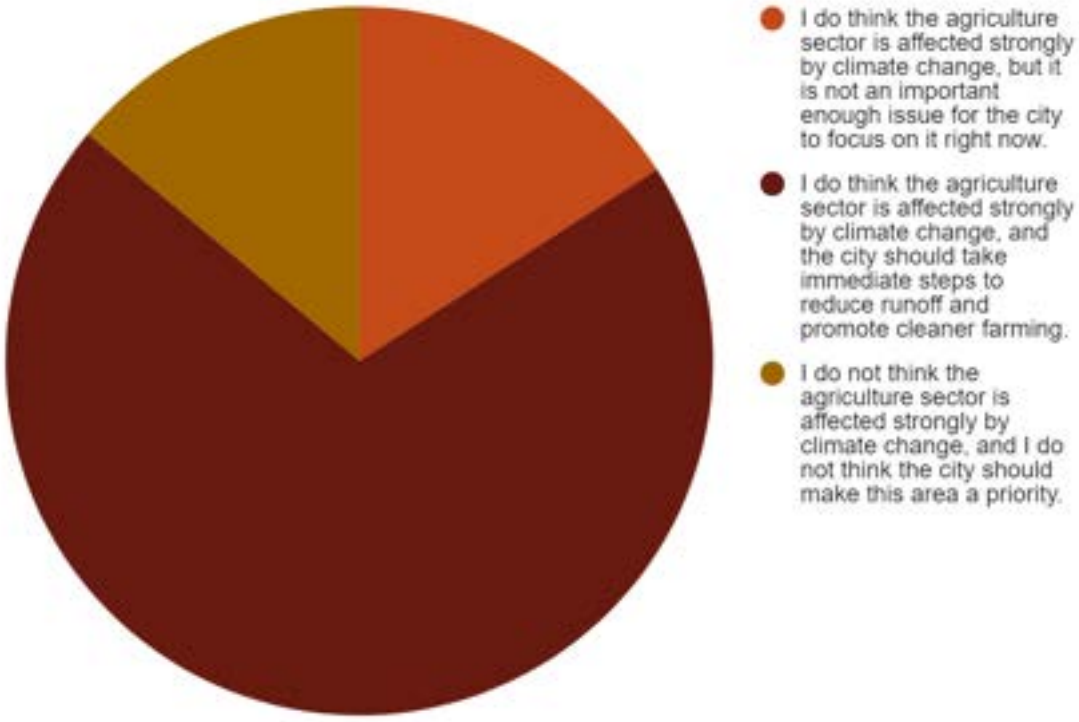

Least concern [1]
60
40
20
0
Evacuation and response during events like wildfire and floods
Food access and security due to flooding, heat, drought, and shipping disruptions
Health impacts from heat and smoke
Impacts to local agriculture from heat, precipitation, flooding, etc.
Impacts to nature (fish, wildlife, forests, and meadows) from heat, flooding, and drought
Loss of homes due to flooding, wildfires
Loss of jobs and employment opportunities due to climate change
More people moving here to escape heat and drought elsewhere

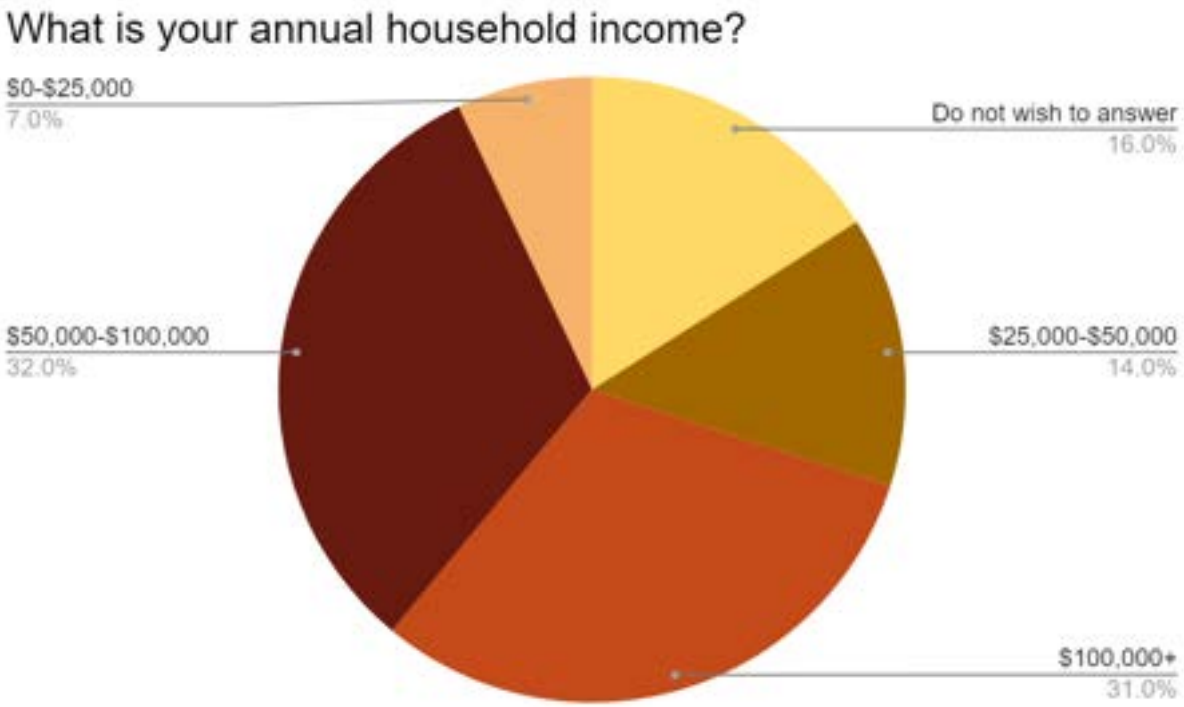

Do you live in a FEMA designated high-risk flood area (find out if you do at https://msc.fema.gov/portal/home)?
I don't know
14.9%
Yes
5.0%
No
80.1%

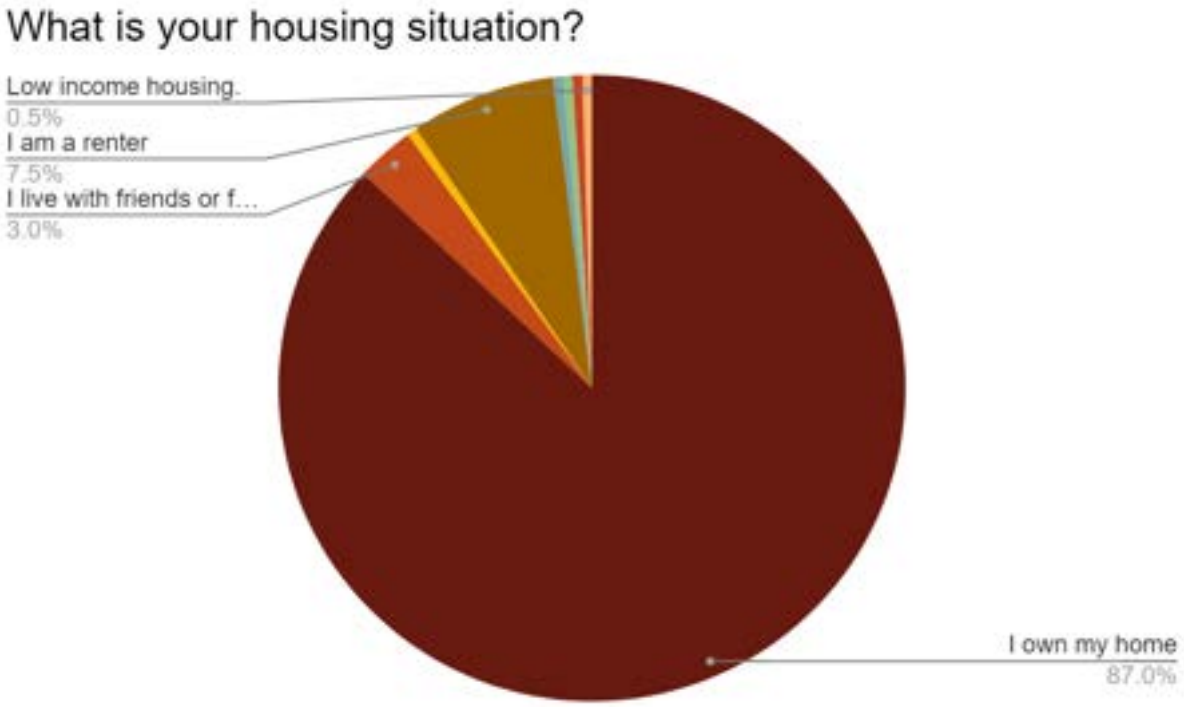
If you answered YES to the previous question, do you feel prepared for potential increased flooding?

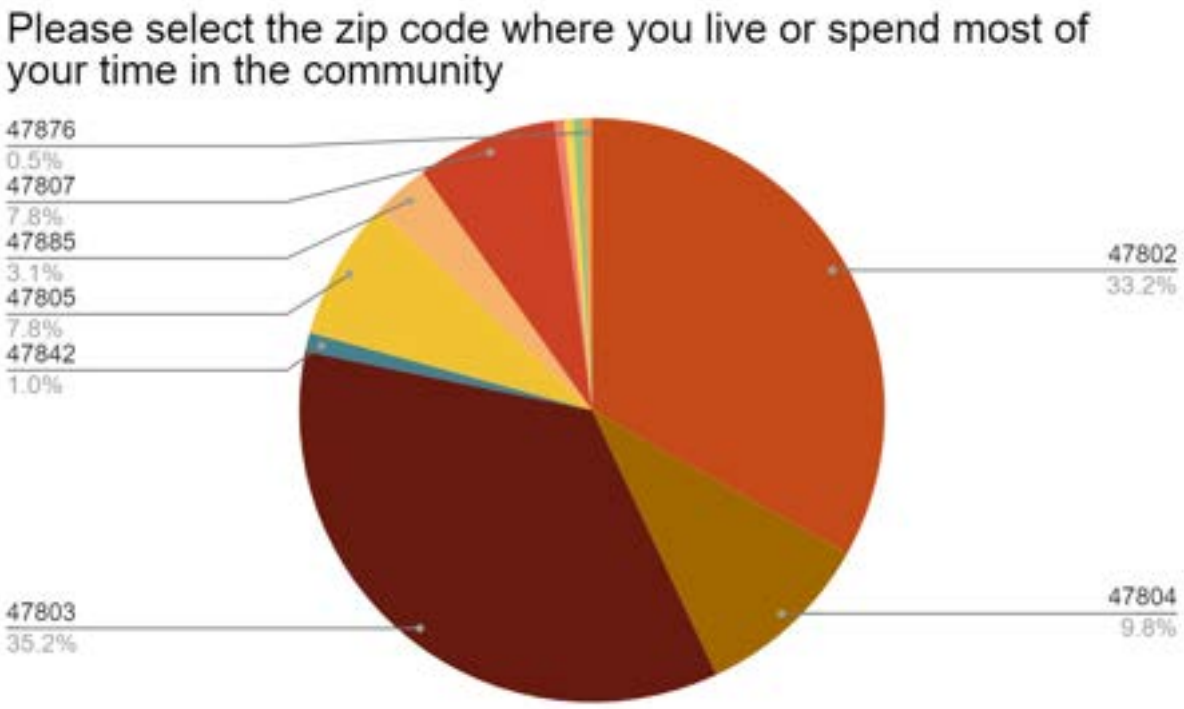


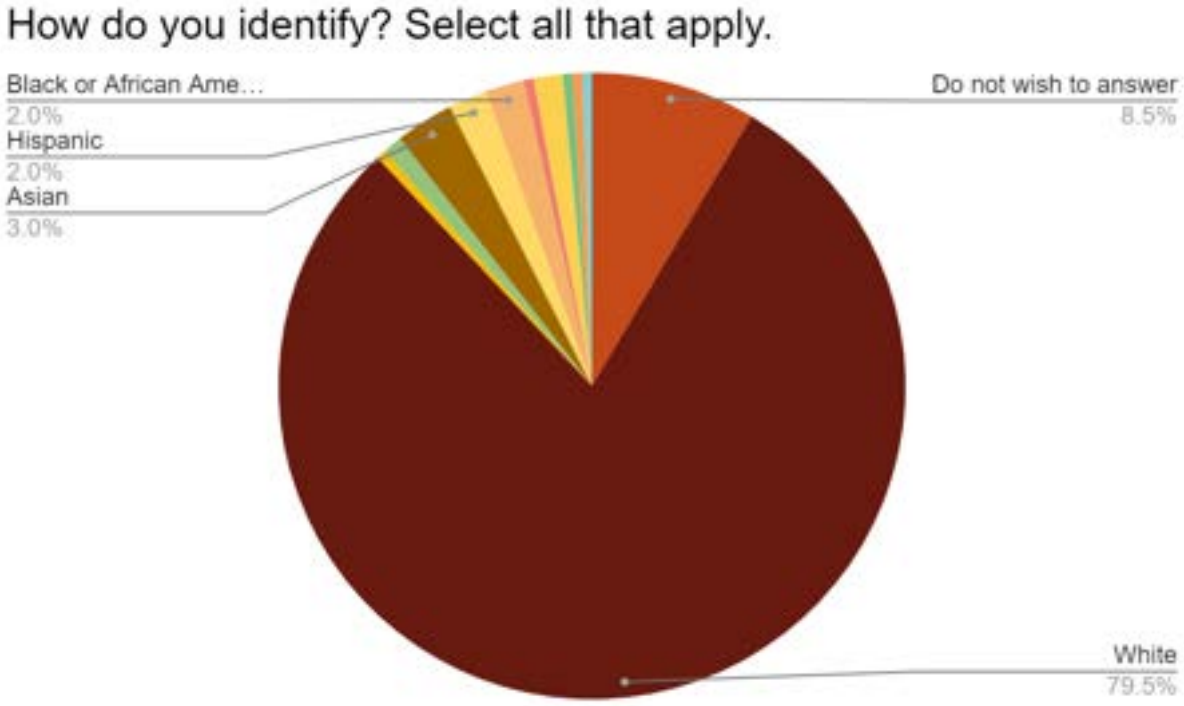
Which sentence most closely aligns with your feelings on agricultural/climate change issues?




What is your annual household income?
$0-$25,000
7.0%
Do not wish to answer
16.0%
$50,000-$100,000
32.0%
$25,000-$50,000
14.0%
$100,000+
31.0%


What is your housing situation?
Low income housing.
0.5%
I am a renter
7.5%
I live with friends or f...
3.0%
I own my home
87.0%


Please select the zip code where you live or spend most of your time in the community
47876
0.5%
47807
7.8%
47885
3.1%
47805
7.8%
47842
1.0%
47802
33.2%
47804
9.8%
47803
35.2%


How do you identify? Select all that apply.
Black or African Ame…
2.0%
Hispanic
2.0%
Asian
3.0%
Do not wish to answer
8.5%
White
79.5%