EPA Office of Brownfields and Land Revitalization

Region 5 Climate Training

February 15, 2023
10am – 12pm CT

Purpose

This training will…

- Increase understanding of regional climate risks
- Train participants on climate risk screening
- Identify climate adaptation and resilience strategies to consider in revitalization and redevelopment
- Highlight types of "deeper dive" analyses to request through technical assistance
- Outline brownfields grantee/applicant needs related to climate resiliency, including environmental justice
- Highlight regional examples

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Agenda

Overview	20 min
Incorporating Climate Resilience	15 min
Extreme Heat	20 min
Flooding	30 min
Brownfield Grantee and Applicant Resources and Needs	20 min
Reflections and Close	5 min

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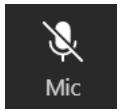
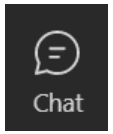
Housekeeping Rules

- Please mute your microphone 

- To ask a question, type into the chat box 

- Technical issues with Teams or Mural?
  - Chat or email D'Arcy.Carlson@icf.com
- Sessions will be recorded

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Introductions

EPA R5

Ashley Green, Brownfields Project Manager

Sarah Gruza, Brownfields Project Manager, Climate Adaptation Lead for R5 LCRD

ICF Team

Brenda Dix, Climate Resilience Director

Amanda Vargo, Climate Change and Sustainability Manager

Emily Blanton, Environmental & Urban Planning Specialist

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Keynote Speaker: Dr. Joel Scheraga

Dr. Joel Scheraga
Senior Advisor for Climate Adaptation, Office of Policy in the Office of the Administrator, US EPA

Mural Instructions

- Follow the link in the chat: https://bit.ly/R5climate
  - Note: It works best in Chrome

- Enter your name

Overview

Brownfields and Climate Change

Climate change poses a significant risk to brownfield sites. Considering climate change during brownfield assessment, clean up, and redevelopment is essential to reduce climate impacts and support local/regional climate resilience.

The first step is identifying potential climate impacts at your site.

It's critical to ensure future decisions support community resilience.

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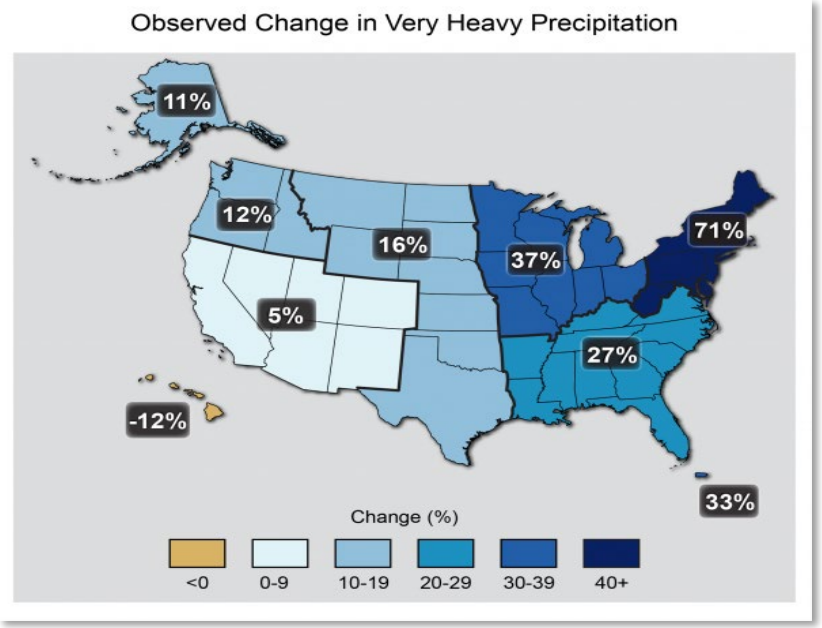
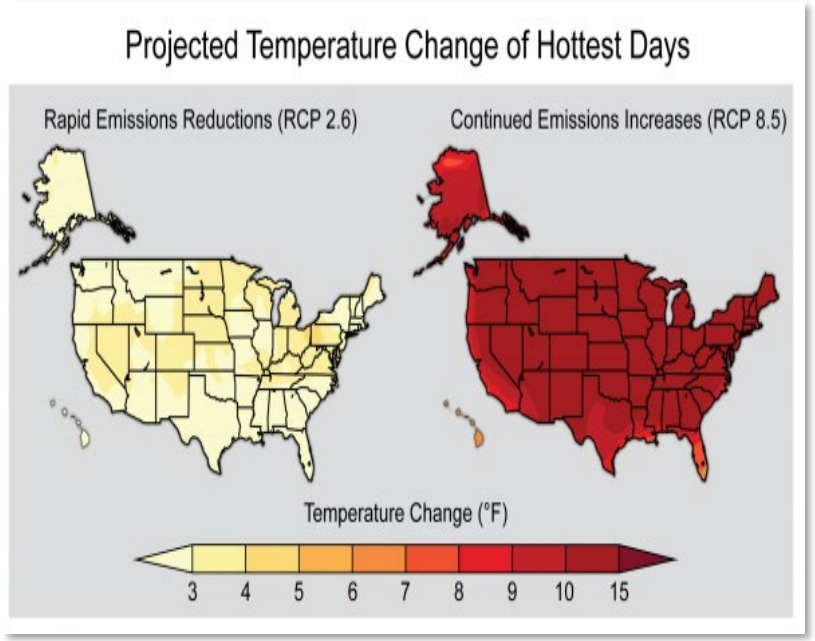
How is the climate changing?

Increasing heavy precipitation and floods



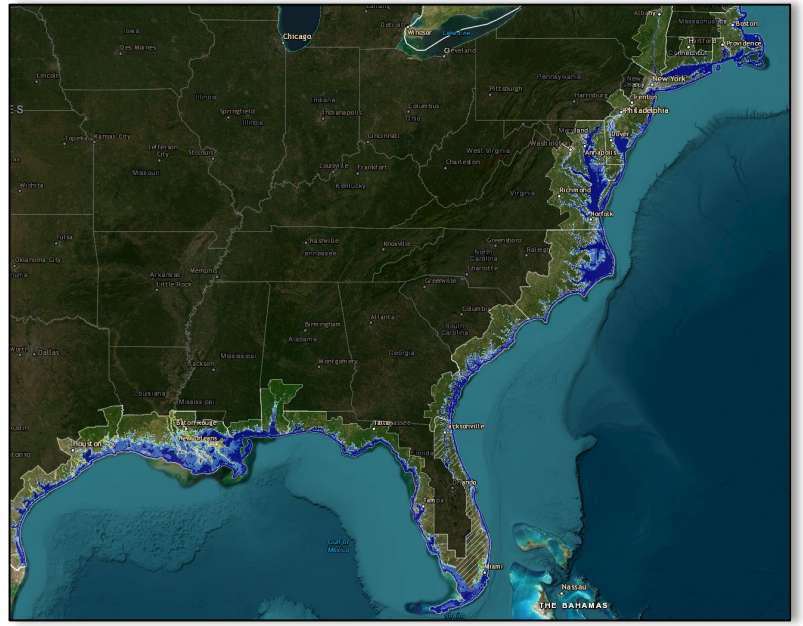
Change (%) in very heavy precipitation in 2012 relative to 1958
Source: USGCRP 2014

More extreme heat waves



Temperature change in 2100 relative to 1986-2005
Source: USGCRP 2014

Continued sea level rise and increased coastal flooding



Flooding at 5ft of sea level rise
Source: NOAA SLR Viewer

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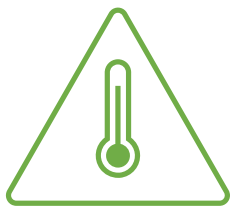
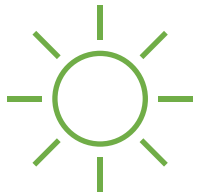
Climate Impacts to Brownfield Sites and Communities

Climate hazards affecting brownfield sites and communities:



Heat

Flooding



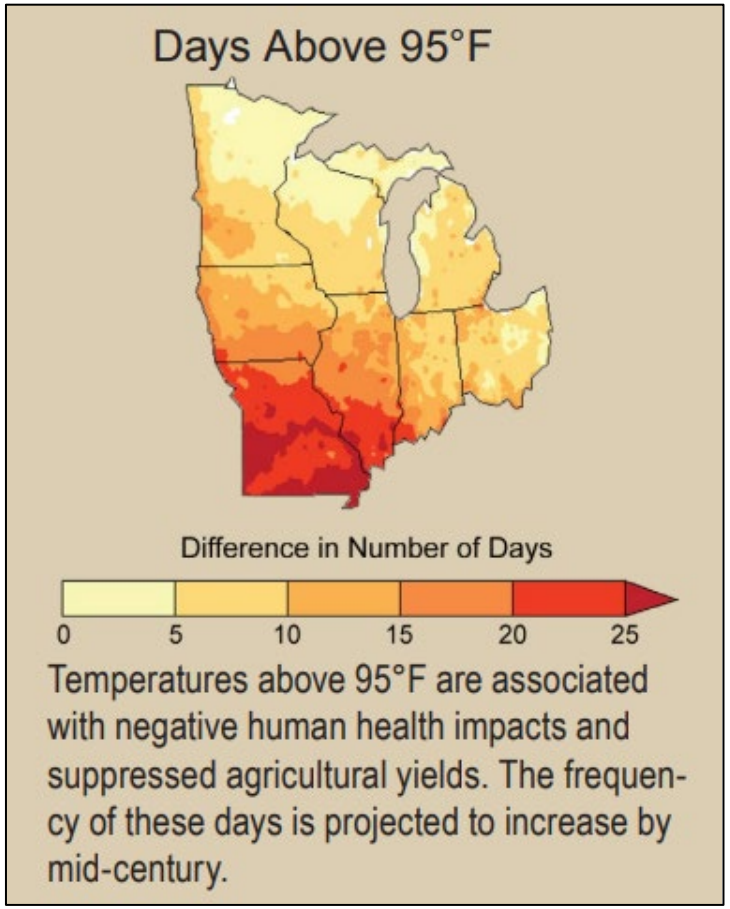
Drought

Lake Effect Snow

Wildfire

Climate Impacts: Heat

- Average annual temperatures are increasing
- Heat waves are increasing in length and frequency
- Extreme heat events can worsen the urban heat island (UHI) effect, posing various health risks to communities
  - Disadvantaged communities are especially vulnerable to UHI impacts



Climate projections in the Midwest for 2041-2070, compared to 1971-2000.
Source: USGCRP 2014, NOAA

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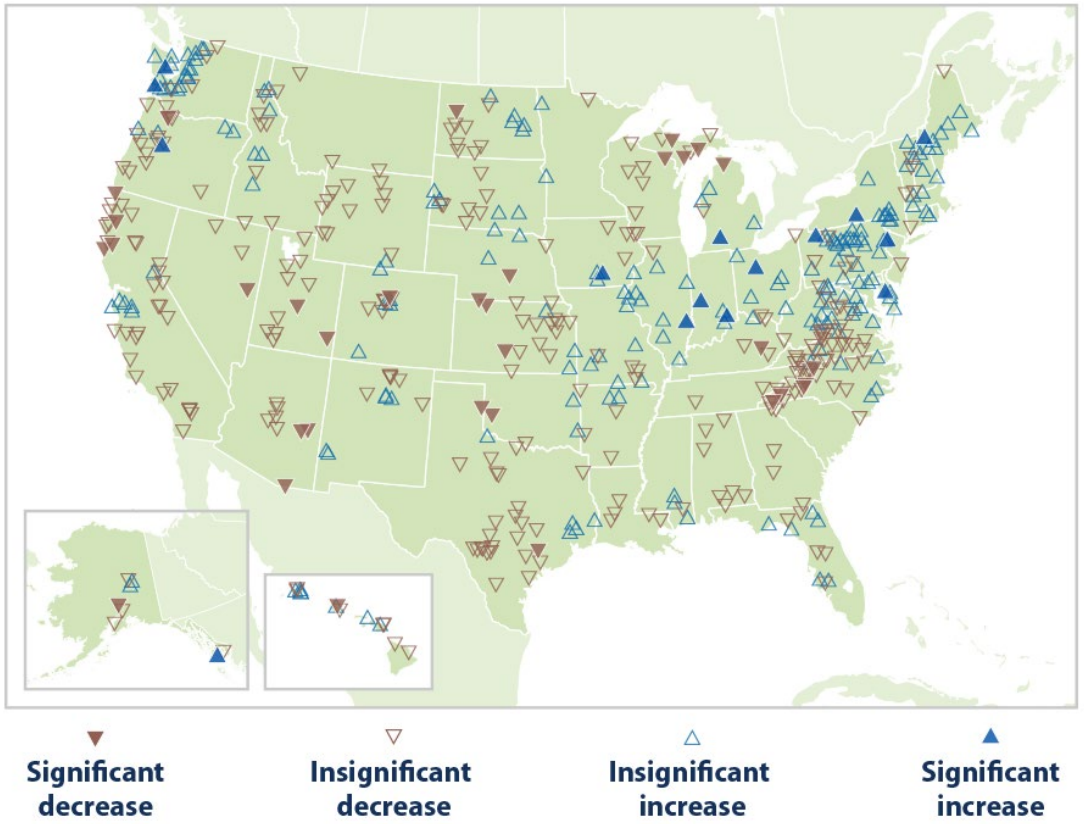
Climate Impacts: Flooding

- Increases in the frequency and magnitude of heavy precipitation events can increase risk of flooding

- Flood events can damage essential infrastructure and cause contaminants to spread from brownfield sites



Change in the Magnitude of River Flooding in the United States, 1965-2015.
Source: EPA 2016

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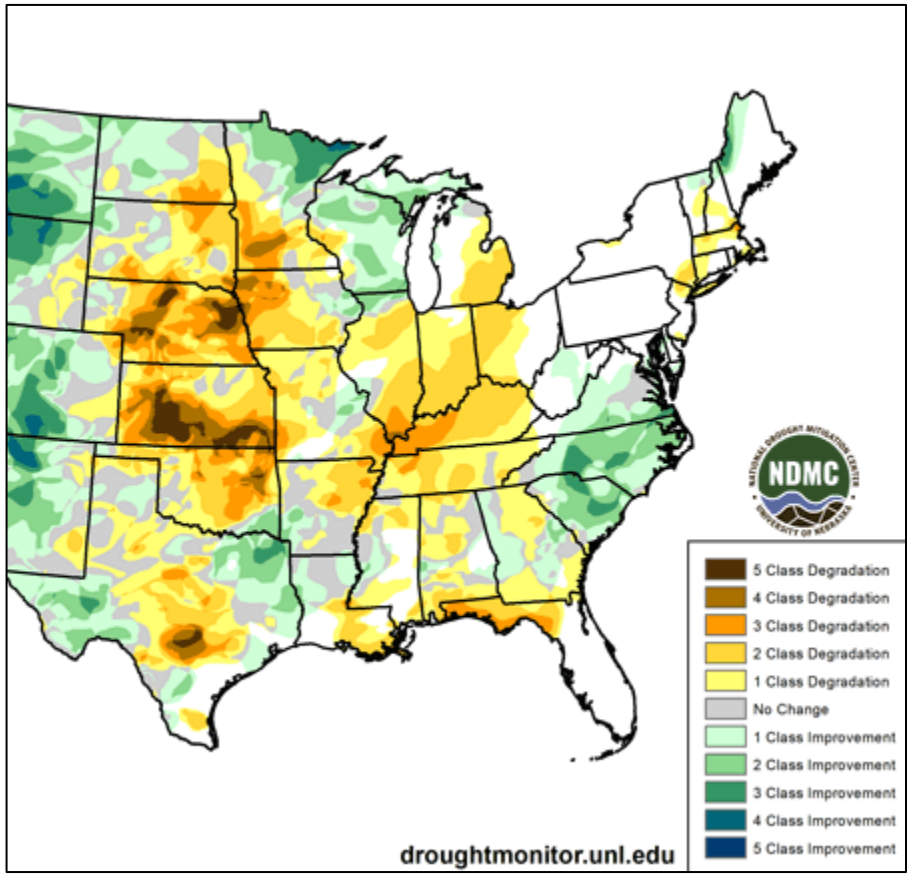
Climate Impacts: Drought

- Uncertainty about future drought behavior in the Midwest
- Regional trends generally suggest:
  - Wetter conditions and fewer droughts
  - Greater oscillation between dry periods and flood events
- Drought conditions can impact vegetation at a brownfield site; vegetation helps with erosion control, reducing flooding, etc.



Drought conditions in December 6, 2022 compared to December 7, 2021, Source: NDMC 2022

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Climate Impacts: Lake Effect Snow

Lake effect snow is dependent on:

- Warmer lake surface temperatures relative to below freezing air temperature
- Unfrozen lake surface allowing evaporation to fuel lake effect snow bands
- As the warming in the Midwest continues, reductions in lake ice may increase the frequency of lake-effect snows until winters become so warm that snowfall events shift to rain

Source: GLISA 2023

Lake effect snow is complex and difficult to project with climate change

Snowmelt can carry contaminants from brownfield sites

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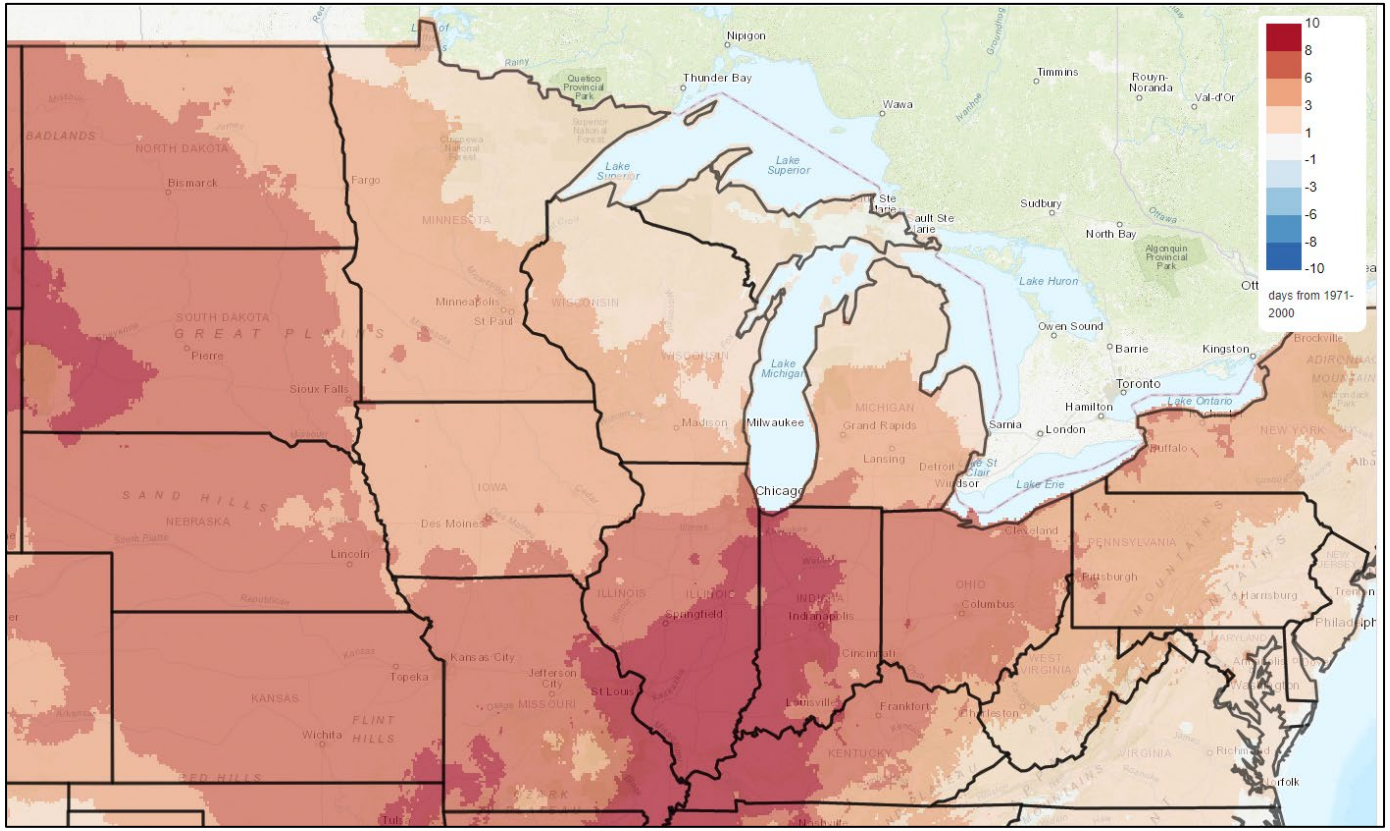
Climate Impacts: Wildfire

- Wildfires are becoming more frequent, with longer seasons and larger burned areas
- By mid-century, the number of extreme fire danger days during summer is projected to increase by 1-6 days in most of the region, and up to 10 days in parts of Illinois and Indiana
- Wildfires can spread toxic contaminants from brownfield sites, posing various health risks to surrounding communities



Projected Change in "Extreme" Fire Danger Days, Summer High Emissions (RCP 8.5), Source: Climate Toolbox

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How can Brownfield Redevelopment support Community Climate Resilience?

Resilience:
The capability to **anticipate, prepare for, respond to, and recover from significant multi-hazard threats** with minimum damage to social well-being, the economy, and the environment.

Why consider resilience?

Minimize brownfield cleanup and redevelopment vulnerabilities to climate change and extreme weather

Many members of vulnerable populations live close to brownfields, and brownfield redevelopment creates opportunities to improve the quality of life for these populations while mitigating the impacts of climate change

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Cost of Inaction

In 2021, there were 20 weather and climate disasters in the U.S. that cost at least $1 billion

Leaving a brownfield site unprotected from future climate impacts can lead to:

- Increased and repeated damage over time
- Higher management and insurance costs
- Negative human health and environmental impacts

Identifying and addressing climate risks at brownfield sites is a good long-term investment as it provides benefits to communities and developers alike.

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Benefits of Investing in Climate Resilience

Requires **less maintenance** and repair

Increases community resilience through **more resilient infrastructure and reliable service**

Increases property values and attracts additional green investments

Environmental benefits, including improved stormwater management, water quality, air quality and wildlife habitats

Community benefits, including improved public health and safety; increased recreation space; green jobs; and environmental justice

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Who Is Most Affected by Climate Change?

Climate change impacts are disproportionately felt by disadvantaged communities who have the least capacity to prepare for and recover from climate-related events

A disadvantaged community may be characterized by the following variables:

- Low income; high and/or persistent poverty
- High unemployment and underemployment
- Racial and ethnic segregation
- High housing cost burden and substandard housing
- Low transportation access, high transportation burden
- Limited water and sanitation access/affordability
- Disproportionate climate impacts

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How can Brownfield Redevelopment Support Environmental Justice Initiatives?

- Justice40 Initiative was created by the Biden administration to confront and address the history of underinvestment in disadvantaged communities
- EPA Brownfields Grant Competition advances Justice40 priorities – 86% of communities selected for funding in 2022 are in historically underserved areas

Existing EPA EJ tools:

- Justice40 Climate and Economic Justice Screening Tool (CEJST) (Version 1.0): "A geospatial mapping tool to identify disadvantaged communities that are marginalized, underserved, and overburdened by pollution."
- EJScreen: An environmental justice mapping and screening tool.
- EnviroAtlas: Interactive web-based tool to inform policy and planning decisions.

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Climate Safe Neighborhoods in Greater Cincinnati

Groundwork Ohio River Valley

- Groundwork Ohio River Valley is an organization dedicated to the equitable restoration of the natural and built environment in the Greater Cincinnati area through community partnerships.
  - Urban Environment
  - Reaching people left behind by the environmental movement
  - National network of 25 trusts
- Three main programs
  - Climate Safe Neighborhoods
  - Green workforce development
  - Citizen science

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Climate Safe Neighborhoods (CSN) Goals

- Explore and communicate the relationship between the climate crisis and institutionalized racism.
- Support the capacity of residents to self-advocate for more equitable distribution of resources.
- Develop and implement short-term mitigation measures for extreme heat and flooding.
- Impact policy to prioritize equitable climate resiliency.

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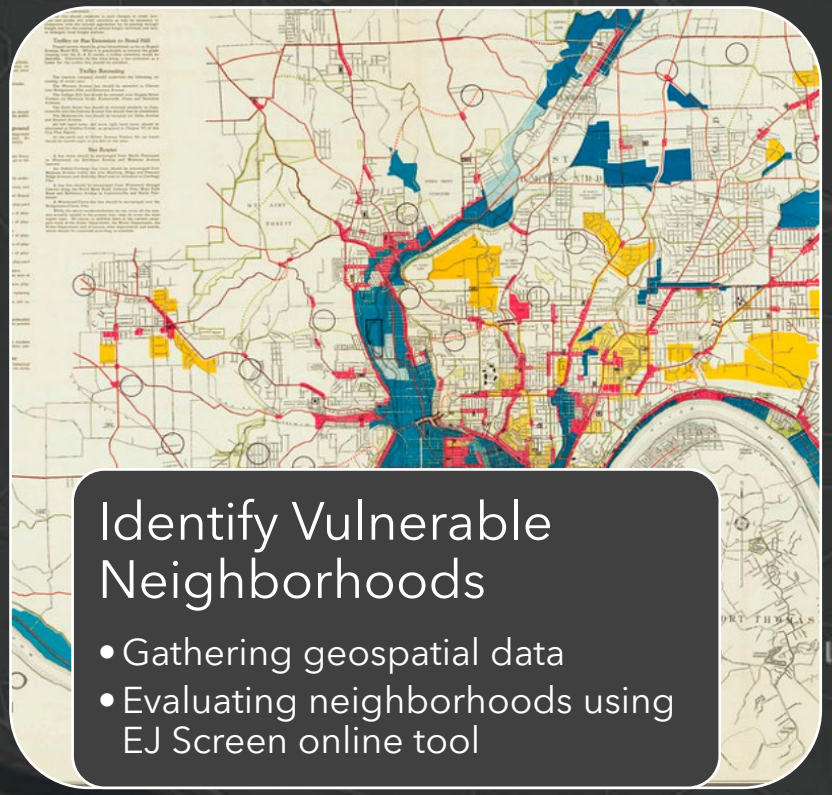
CSN Timeline



Identify Vulnerable Neighborhoods

- Gathering geospatial data
- Evaluating neighborhoods using EJ Screen online tool

Climate Advisory Group Meetings

- Climate change education
- Mapping activities
- Climate Resiliency Plan

Implementation

- Neighborhood tree plantings
- Community gardens
- Green roofs

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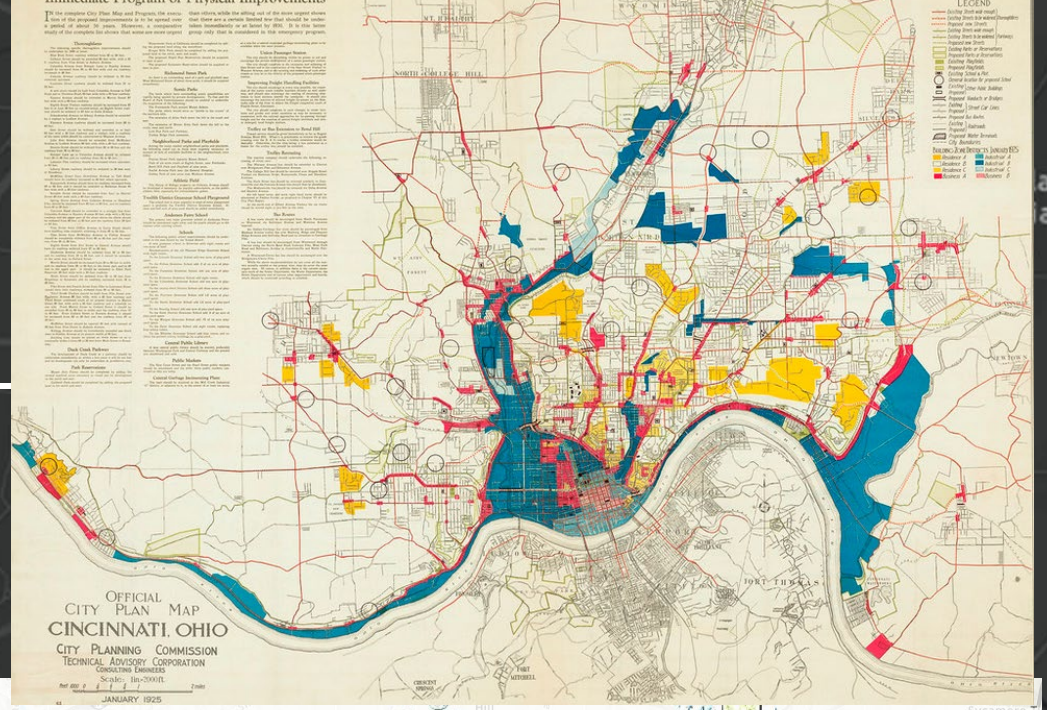
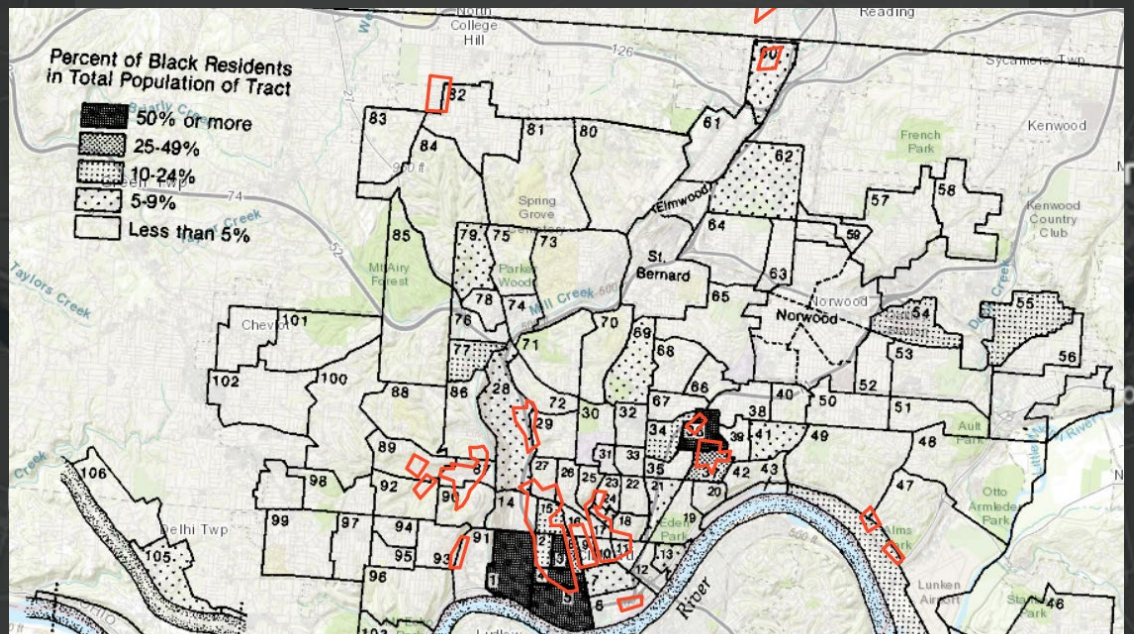
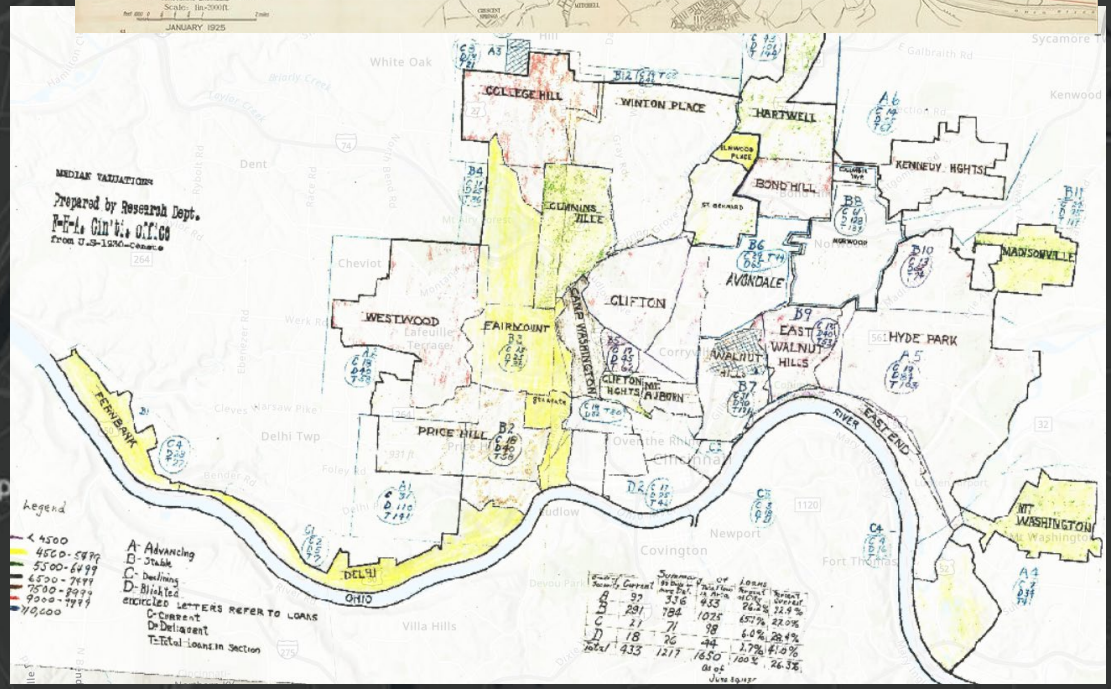
Using GIS to Identify Vulnerable Neighborhoods

- analysis of historical data
  - Housing segregation
  - Redlining
  - Industrial zoning

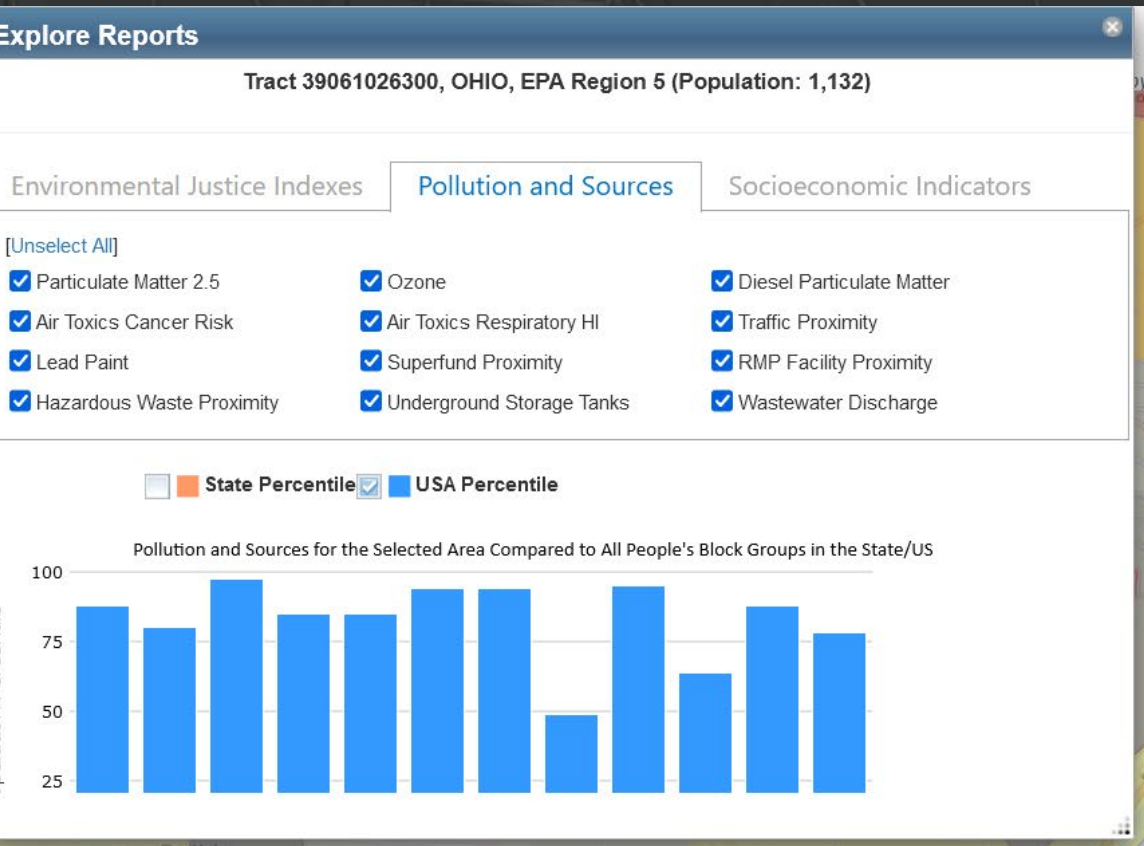


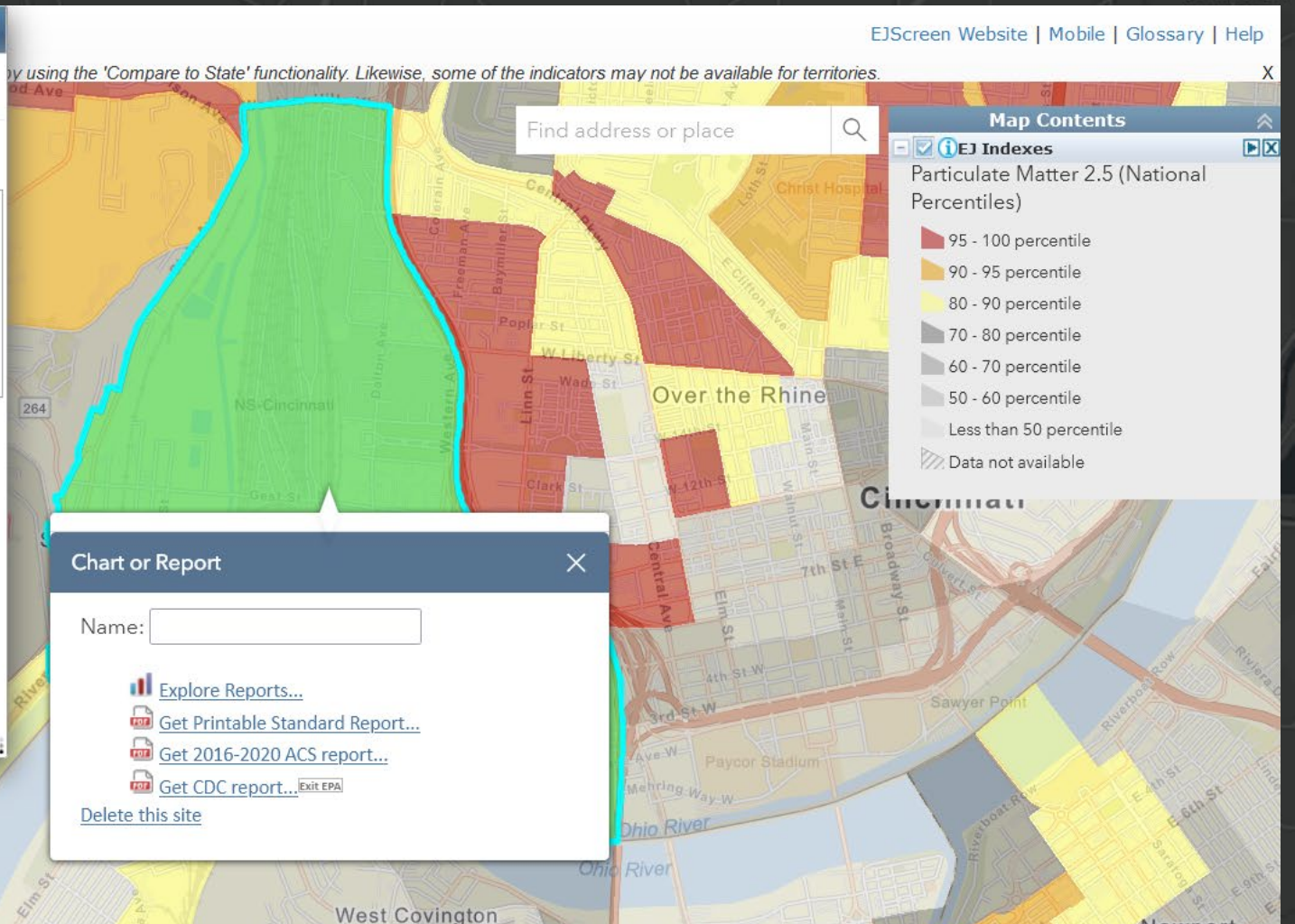




Evaluation of environmental vulnerabilities

- EJ Screen





Climate Advisory Group

- An intensive climate cohort designed to elevate community voices in planning processes.
- CAG members are paid to participate in meetings.
- Goals
  1. Understand climate change and its impacts in their neighborhood.
  2. Create a Climate Resiliency Plan that meets the needs of their community.

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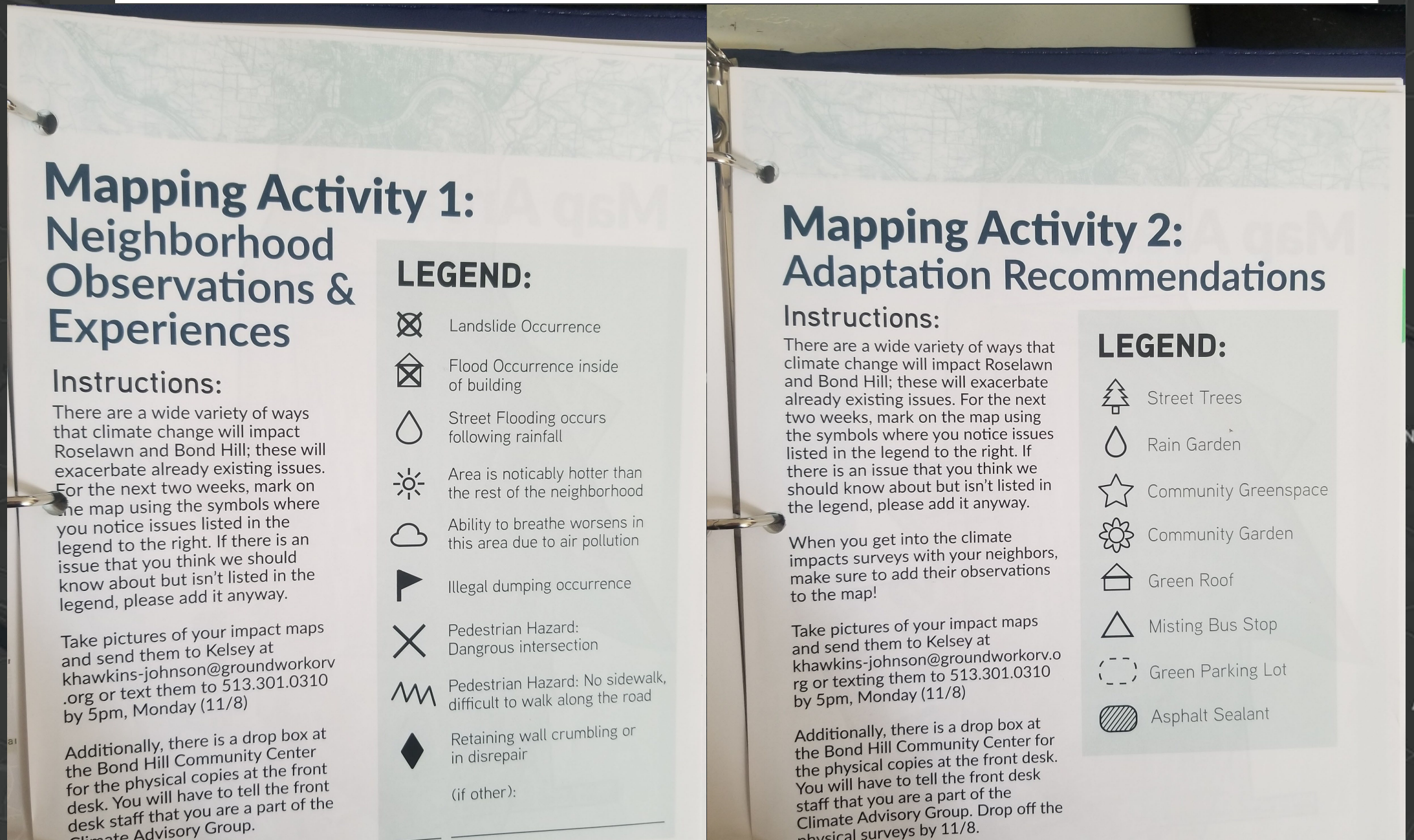
Mapping activities



Mapping Activity 1: Neighborhood Observations & Experiences

Instructions:

There are a wide variety of ways that climate change will impact Roselawn and Bond Hill; these will exacerbate already existing issues. For the next two weeks, mark on the map using the symbols where you notice issues listed in the legend to the right. If there is an issue that you think we should know about but isn't listed in the legend, please add it anyway.

Take pictures of your impact maps and send them to Kelsey at khawkins-johnson@groundworkorv.org or text them to 513.301.0310 by 5pm, Monday (11/8)

Additionally, there is a drop box at the Bond Hill Community Center for the physical copies at the front desk. You will have to tell the front desk staff that you are a part of the Climate Advisory Group.

LEGEND:

- Landslide Occurrence
- Flood Occurrence inside of building
- Street Flooding occurs following rainfall
- Area is noticably hotter than the rest of the neighborhood
- Ability to breathe worsens in this area due to air pollution
- Illegal dumping occurrence
- Pedestrian Hazard: Dangrous intersection
- Pedestrian Hazard: No sidewalk, difficult to walk along the road
- Retaining wall crumbling or in disrepair

(if other): _____

Mapping Activity 2: Adaptation Recommendations

Instructions:

There are a wide variety of ways that climate change will impact Roselawn and Bond Hill; these will exacerbate already existing issues. For the next two weeks, mark on the map using the symbols where you notice issues listed in the legend to the right. If there is an issue that you think we should know about but isn't listed in the legend, please add it anyway.

When you get into the climate impacts surveys with your neighbors, make sure to add their observations to the map!

Take pictures of your impact maps and send them to Kelsey at khawkins-johnson@groundworkorv.org or texting them to 513.301.0310 by 5pm, Monday (11/8)

Additionally, there is a drop box at the Bond Hill Community Center for the physical copies at the front desk. You will have to tell the front desk staff that you are a part of the Climate Advisory Group. Drop off the physical surveys by 11/8.

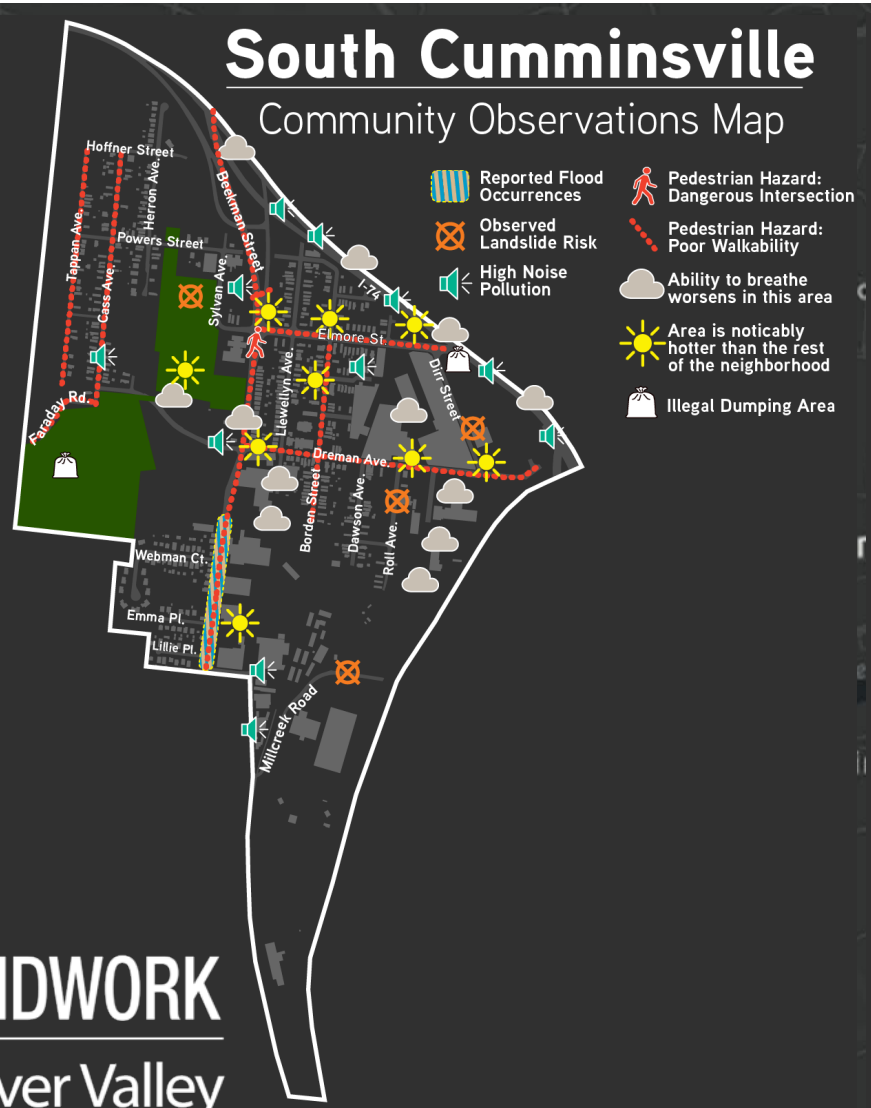
LEGEND:

- Street Trees
- Rain Garden
- Community Greenspace
- Community Garden
- Green Roof
- Misting Bus Stop
- Green Parking Lot
- Asphalt Sealant

South Cumminsville

South Cumminsville

Climate Impacts Map and Climate Resiliency Map



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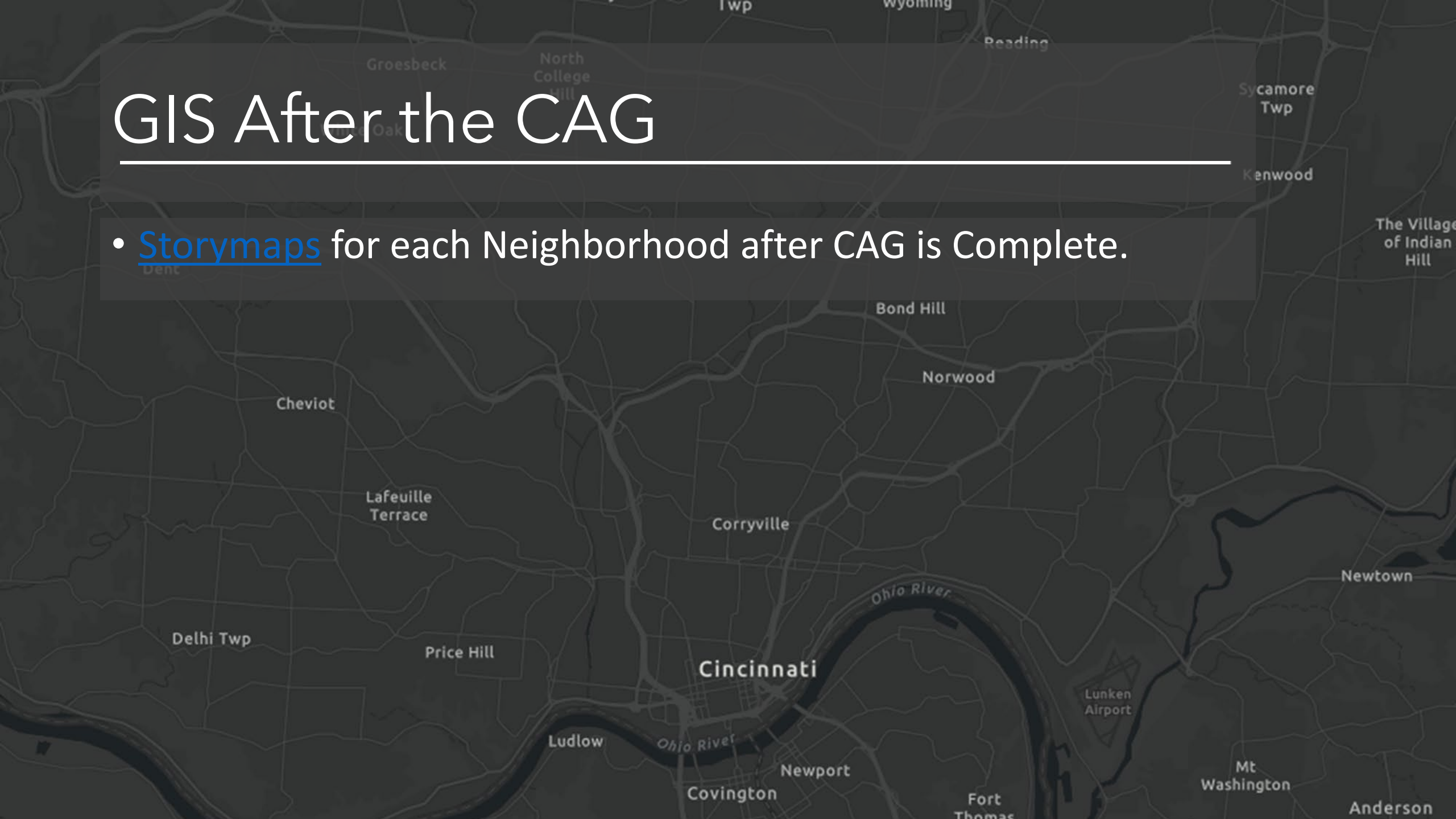
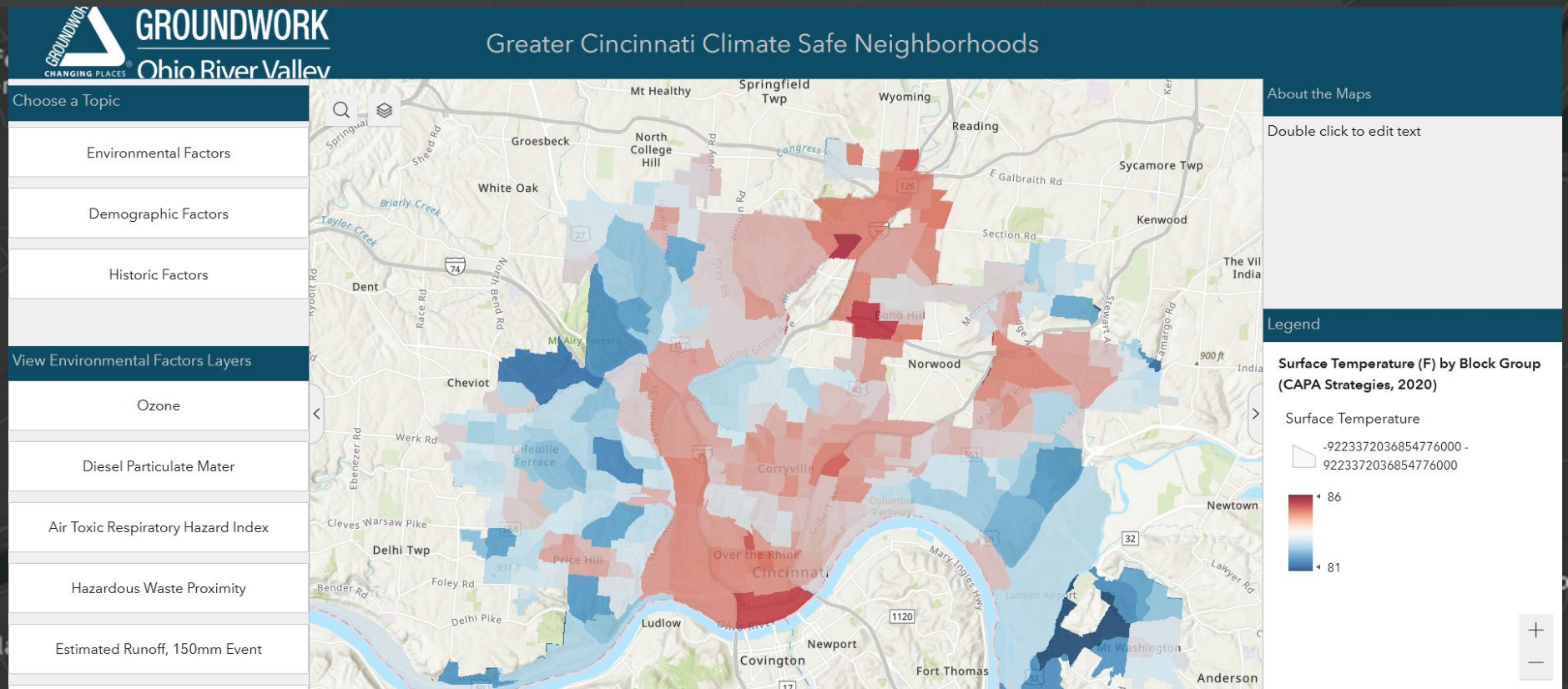
GIS After the CAG

- Storymaps for each Neighborhood after CAG is Complete.



Ongoing CSN GIS

- Advocacy and education
  - CSN Dashboard- presenting easy to digest data related to climate change.
  - Combine EJ Screen data with community members' lived experiences



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Expanding CAG Materials to Include Brownfield information

- CAG Members have identified brownfield sites in their neighborhoods as environmental hazards.
- CAG Members have asked for more instruction on brownfields and their mitigation.
- Goal to include brownfield training in CAG meetings.

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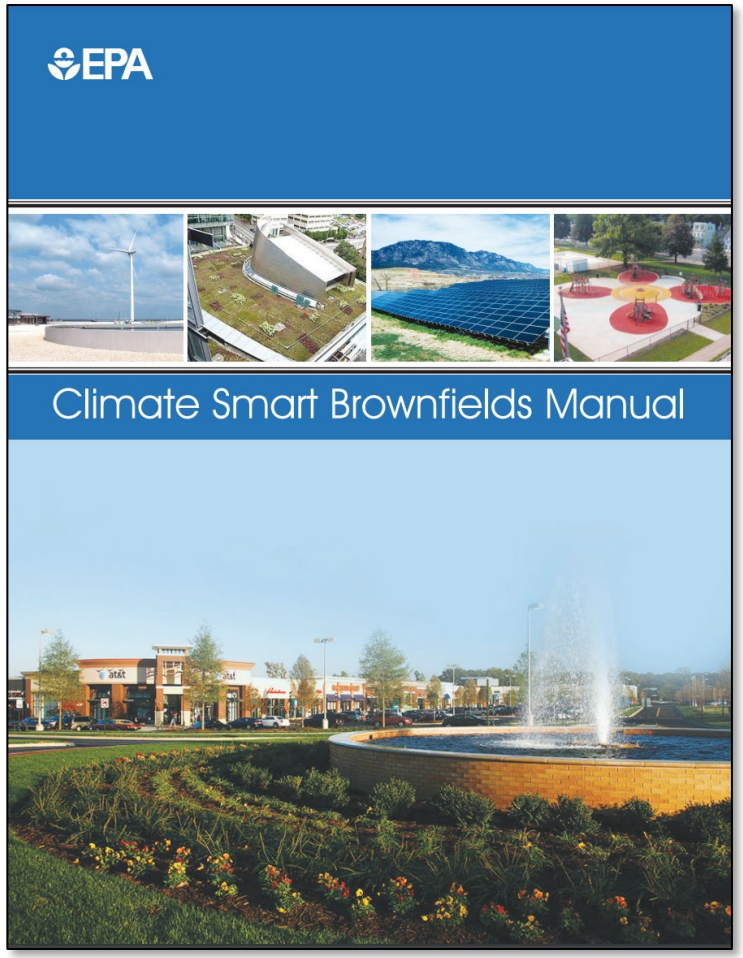
Incorporating Climate Resilience

Climate Smart Brownfields Manual



Goal 1. Help communities think about climate adaptation, mitigation, and resiliency throughout the brownfield redevelopment process

- Consider climate projections when performing assessments, evaluating brownfield cleanup alternatives, and planning for redevelopment
- Reduce emissions through sustainable approaches on brownfield sites throughout cleanup, redevelopment, and reuse of the property

Goal 2. Provide references and tools that brownfield practitioners, community members, and state and local governments can use

Specific examples of how municipalities have used climate smart strategies for brownfield redevelopment are included throughout the manual

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Example Strategies to Adapt and Mitigate Climate Impacts (Appendix A)

1 Planning

Strategies for the planning stage of a brownfield project:

Strategy	Adaptation	Mitigation
Adopt climate-conscious building codes	✓	
Offer tax incentives/rebates	✓	✓
Zoning ordinances	✓	✓
Update floodplain management plans	✓	✓
Update coastal and wetland management plans	✓	✓
Update hazard mitigation plans	✓	✓
Engage the community in planning	✓	✓

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Example Strategies to Adapt and Mitigate Climate Impacts (Appendix A)

1 Planning

2 **Assessment**

Strategies for the assessment stage of a brownfield project:

Strategy	Adaptation	Mitigation
Conduct climate-focused Phase 1 and 2 ESAs	✓	✓
Identify interim uses	✓	✓
Evaluate reuse options that are climate conscious	✓	✓
Identify potential risk factors and vulnerabilities	✓	✓
Follow assessment-relevant ASTM Guidelines for Greener Cleanups		✓
Conduct analysis of Brownfield Cleanup Alternatives (ABCA)	✓	✓

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Example Strategies to Adapt and Mitigate Climate Impacts (Appendix A)

1 Planning

2 Assessment

3 **Demolition**

Strategies for the demolition stage of a brownfield project:

Strategy	Adaptation	Mitigation
Identify opportunities for deconstruction		✓
Plan early		✓
Reduce energy use		✓
Reuse/recycle materials		✓

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Example Strategies to Adapt and Mitigate Climate Impacts (Appendix A)

1 Planning

2 Assessment

3 Demolition

4 **Cleanup**

Strategies for the cleanup stage of a brownfield project:

Strategy	Adaptation	Mitigation
Reduce energy use and emissions		✓
Reduce water use and impacts to water sources	✓	✓
Reduce waste and manage materials sustainably		✓
Minimize unnecessary soil and habitat disturbance or destruction	✓	✓
Use native species to support habitat	✓	✓
Select onsite remediation approaches		✓

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Example Strategies to Adapt and Mitigate Climate Impacts (Appendix A)

1 Planning

2 Assessment

3 Demolition

4 Cleanup

5 **Redevelopment**

Strategies for the redevelopment stage of a brownfield project:

Strategy	Adaptation	Mitigation
Install green infrastructure	✓	✓
Incorporate renewable energy development	✓	✓
Incorporate green building techniques (e.g., green roofs, energy and lighting efficiency, passive survivability, flood protection)	✓	✓
Complete streets	✓	✓
Incorporate multi-modal transit	✓	✓
Promote accessibility and community social cohesion	✓	✓

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EPA Technical Assistance - Ashland, WI

- Former railroad trestle on the Lake Superior shoreline
- Redevelopment focuses on activating the upland area of the historic Ore Dock and connecting to the waterfront park
- Major design element is the hybrid engineered shoreline

S/G/A LANDSCAPE ARCHITECTURE URBAN DESIGN
STROMBERG/GARRIGAN & ASSOCIATES

DRAFT FOR DISCUSSION PURPOSES ONLY

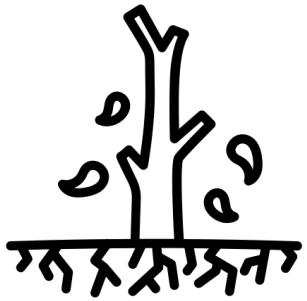
ORE DOCK SITE REUSE PLAN - PRIMARY REDEVELOPMENT
U.S. EPA Brownfields and Land Revitalization Technical Assistance
City of Ashland, WI

SCALE: 1"=60'-0"

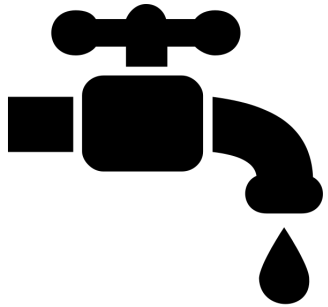
02/09/2023

Extreme Heat

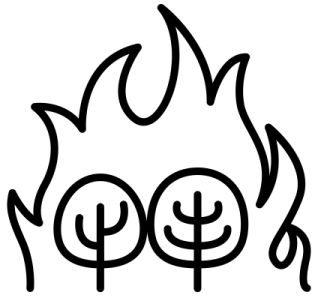
Extreme Heat Risks to Brownfield Sites



Vegetation stress



Decreased water availability



Drought & wildfire

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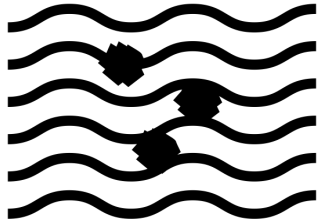
Extreme Heat Risks to Communities

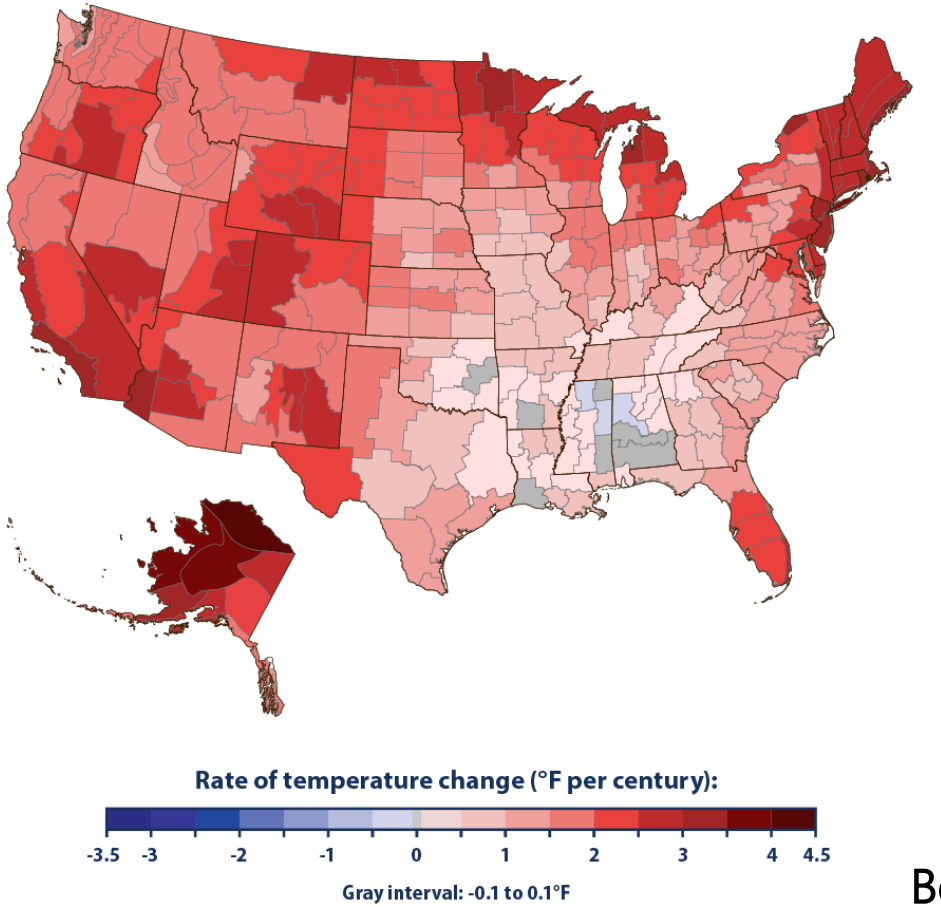
Heat-related illness & death



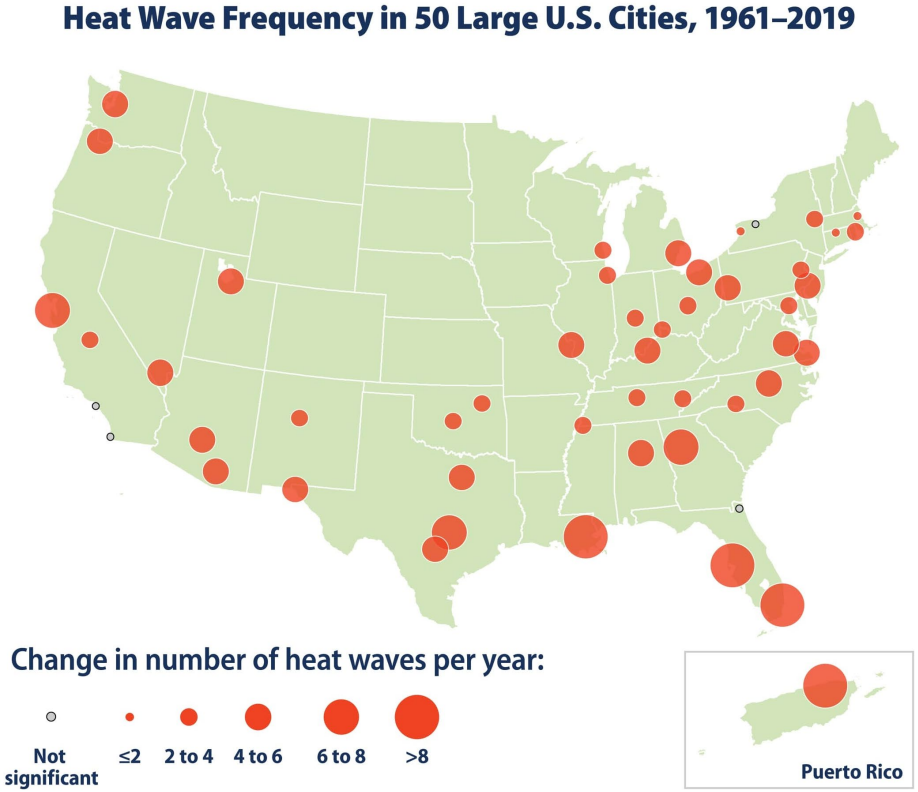
Reduced air & water quality

Extreme Temperatures & Heat Waves

Rate of Temperature Change in the United States, 1901-2021



Change in Heat Wave Frequency in the United States, 1961-2019



Both global average and extreme temperatures are projected to increase by 2050, with heatwaves becoming longer, more frequent, and more severe.

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Other Contributors to Extreme Heat

- Increased urbanization & impervious surfaces
  - Exacerbates extreme heat
  - Excess heat emitted by buildings, roads, and other infrastructure
  - Lack of tree cover and green space can worsen extreme heat, especially for disadvantaged communities located in densely populated areas

- Increased humidity
  - Makes the "feel-like" temperature higher
  - **The frequency and magnitude of high humidity events are expected to increase with climate change.**

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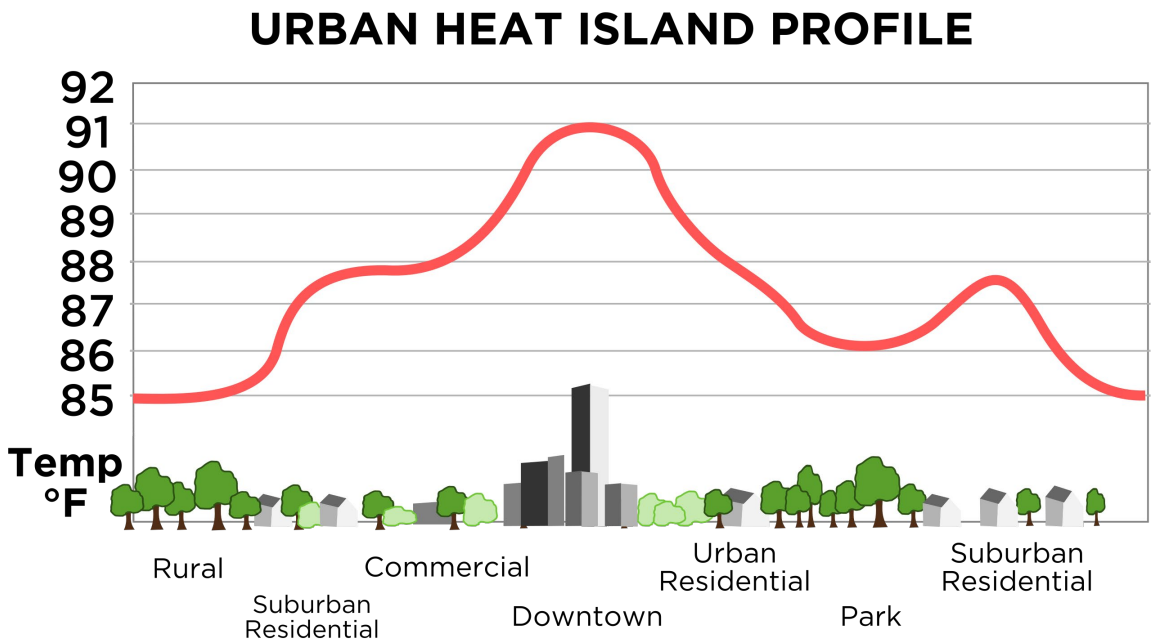
The Urban Heat Island (UHI) Effect

Increasing temperatures and humidity coupled with more urban development will worsen the UHI effect.

Daytime temperatures in UHIs are about 1-7°F higher than temperatures in outlying areas.

Nighttime temperatures are about 2-5°F higher.



Heat.gov

Heat.gov is the web portal for the National Integrated Heat Health Information System (NIHHIS).

Features

- Current conditions and future outlooks for different heat indicators
- Collection of heat health tools and products, including extreme heat vulnerability mapping
- Information on urban heat islands and planning and preparing for extreme heat events

NIHHIS

NATIONAL INTEGRATED HEAT HEALTH INFORMATION SYSTEM

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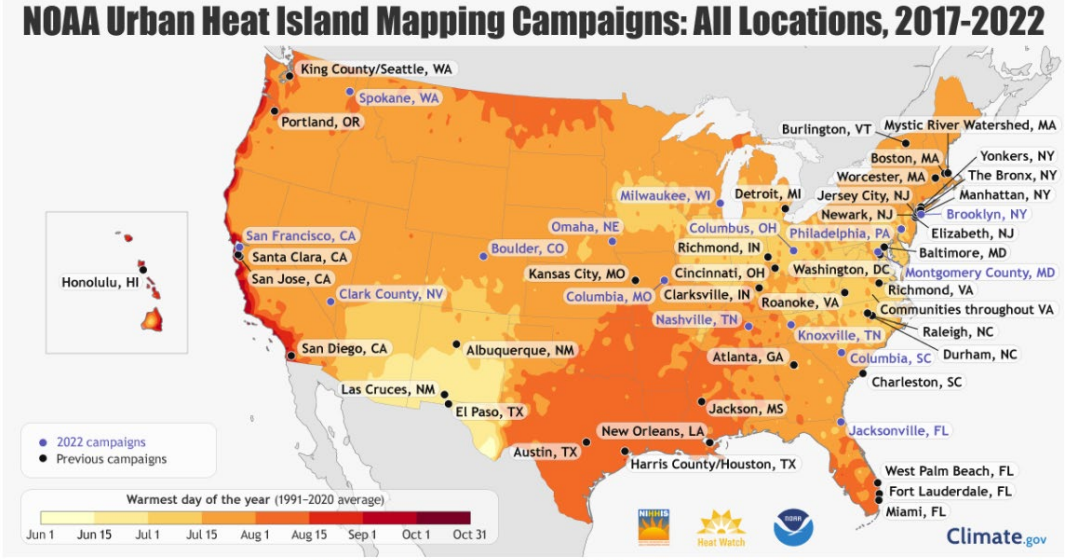
UHI Mapping Campaign

Heat.gov also offers a UHI mapping campaign that supports communities across the U.S.

You can apply for your city to be included in the next mapping campaign!



NOAA Urban Heat Island Mapping Campaigns: All Locations, 2017-2022

UHI is very localized, making it difficult to assess on a national scale. Mapping heat risk in your local area is an important first step in understanding how UHI impacts your community.

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Example heat adaptation strategies

- Reduce pavement
- Use lighter colored materials
- Incorporate creative shade and heat mitigation considerations in building designs
- Incorporate green infrastructure (e.g., green roofs, rain gardens, bioswales)
- Plant more native trees and other vegetation
- Plant heat/drought-tolerant species
- Establish cooling centers (e.g., temporary shelters during extreme heat)

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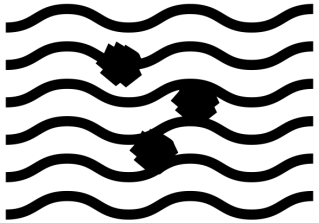
Exercise

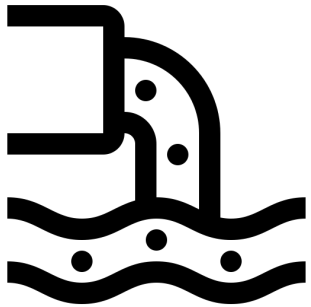
Develop a list of strategies to reduce heat impacts through brownfield redevelopment.

Flooding

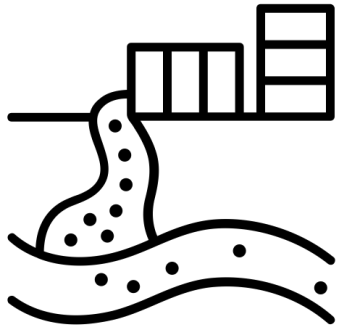
Flooding Risks to Brownfield Sites



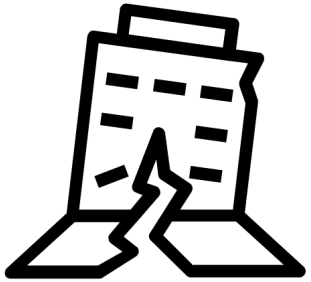
Compromised drinking water quality



Disrupted stormwater drainage



Spread of contaminants from site to community



Damage to critical infrastructure

Major Contributors to Flooding

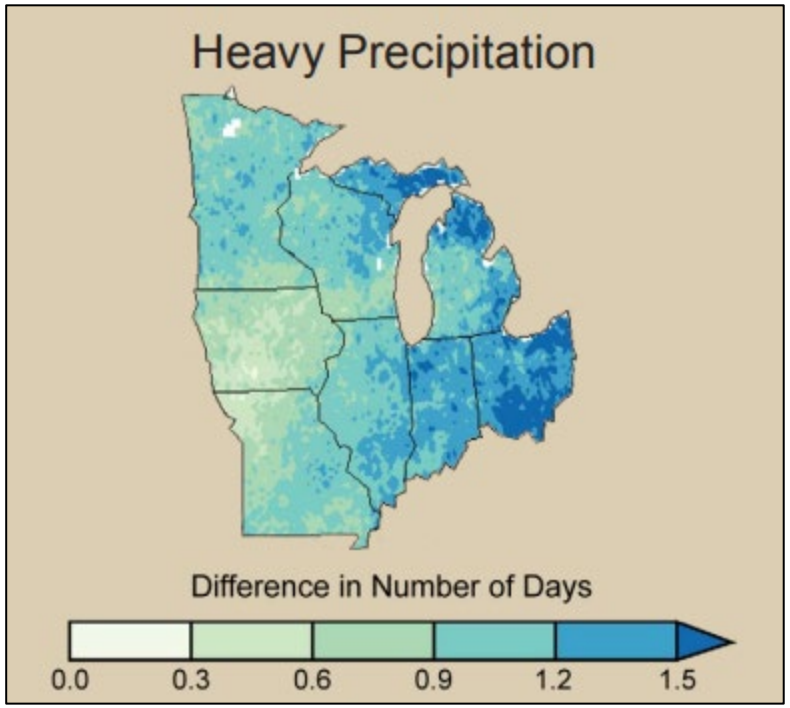
Increased precipitation

Expanded impervious surfaces

Development in floodplains

Increased Precipitation

- Extreme precipitation events are increasing in frequency + intensity due to climate change
- Precipitation patterns are also becoming more variable (e.g., longer dry periods between heavy rainfall events)
- Increased precipitation leads to an increased risk of flooding



The frequency of days with very heavy precipitation (the wettest 2% of days) in the Midwest for 2041-2070, compared to 1971-2000.
Source: USGCRP 2014, NOAA

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Impervious Surfaces

Development of urban centers and infrastructure → Increased impervious surface area → Increased runoff and localized flood risk

Source: EPA 2022

Development in Floodplains

A growing number of Americans are living within a 100-year flood zone

- Across the nation, the annual cost of flooding is expected to increase by 26% by 2050.

Floodplains are changing

- Flooding is occurring more frequently in areas not included in the historic floodplain

Source: EPA 2022

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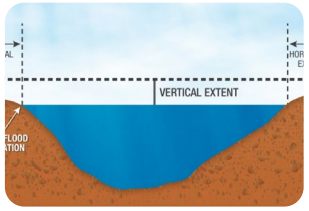
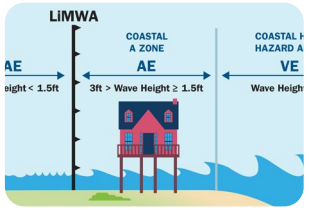
Inland Flooding: Understanding FEMA Resources and Guidance



Federal Flood Risk Management Standard



Flood Zone Codes

Flood Maps

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Federal Flood Risk Management Standard (FFRMS)

- Established under executive Order 11988, *Floodplain Management* (1977) to push federal agencies to manage current and future flood risks
  - Revoked then reinstated through EO 14030, *Climate-Related Financial Risk*

- Federally funded buildings and projects are required to use one of three approaches for project siting, design, and construction:

Climate Informed Science Approach (CISA)	Freeboard Value Approach (FVA)	500-Year Floodplain

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FEMA Flood Maps

The FEMA Flood Map Service Center is the official public source for flood hazard information.

The maps are flood insurance rate maps.

- Not forward looking; only reflect past flooding conditions.
- Helpful but not meant to provide complete picture of flood risk.
- Capture river and coastal flooding, not urban and flash flooding from short but high-intensity rainfall events.

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FEMA Flood Maps: Zone Codes

FEMA Flood Maps have different zones, which indicate the type and likelihood of flooding. These zones correspond to flood insurance requirements based on the flood risk.

Risk Type	Zones Codes Start With:	Description
High	A or V	- Referred to as Special Flood Hazard Areas (SFHAs) - Areas in the 100-Year Flood zone (1% annual chance of occurring)
Low to Moderate	B, C, or X (or a shaded X)	- Risk of flooding reduced, but not completely removed. - Areas between the base flood and the 500-year flood zone (0.2% annual chance of occurring)
N/A	D	- Flood risk in area is undetermined or area is unstudied

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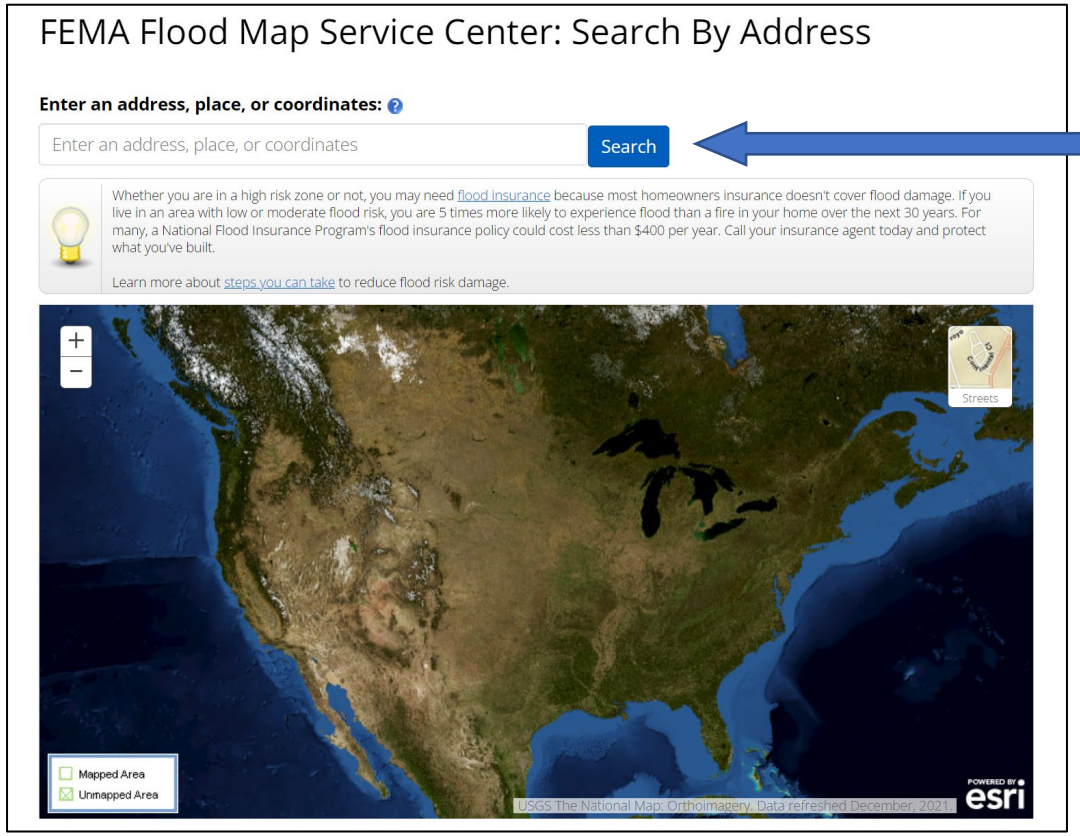
Accessing FEMA Flood Maps

1. Access maps through Address Search



Enter an address, place, or coordinates, and press search

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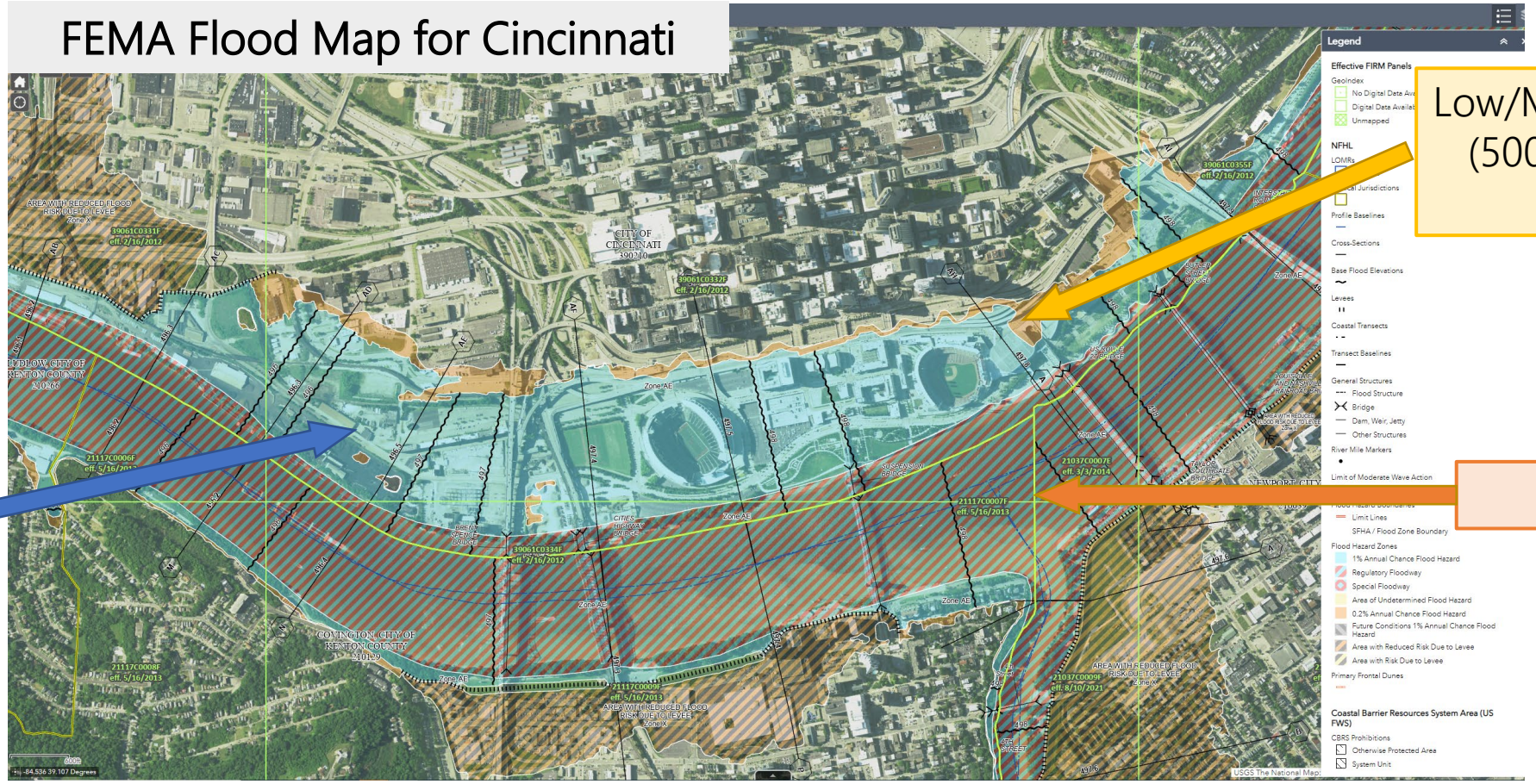
Accessing FEMA Flood Maps

2 Flood maps can be viewed in the National Flood Hazard Layer (NFHL) Viewer, where the user can view, download, and print current flood hazard data in an ArcGIS map.

FEMA Flood Map for Cincinnati



Low/Moderate Risk (500-year flood zone)

High Risk (100-year flood zone)

Ohio River

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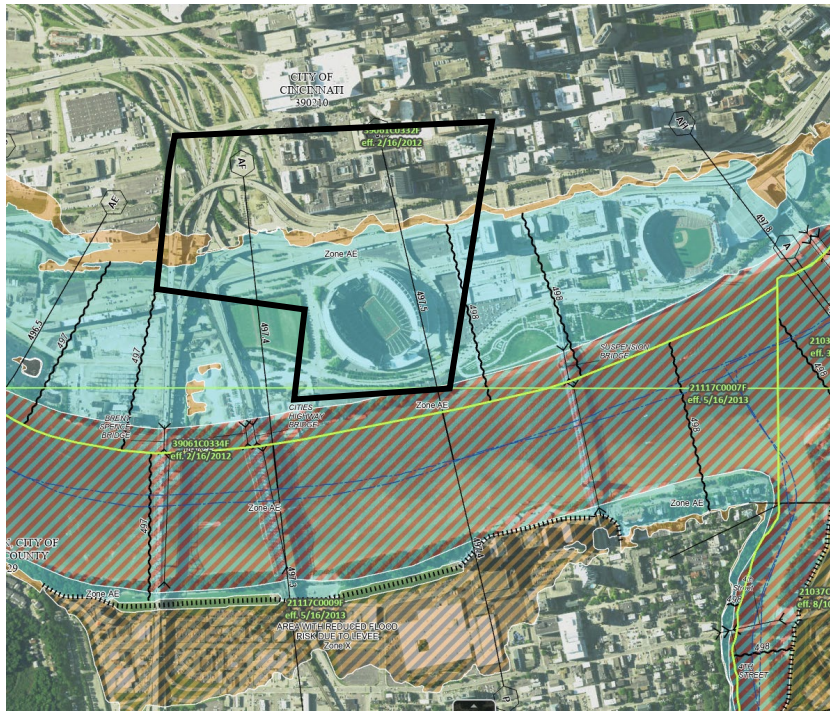
Accessing FEMA Flood Maps

3 Users can overlay the brownfield site and the FEMA flood hazard maps in GIS to see if the site is in the 100- or 500-year floodplain



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Climate Change & Lake Levels

- Lake levels are driven primarily by:
  - Precipitation
  - Runoff
  - Evaporation

- Earlier thawing of winter ice coupled with increased precipitation and warming have increased lake levels in the Great Lakes

- Impacts due to more variable lake levels include flooding and shoreline erosion

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Great Lakes Resource: NOAA Lake Level Viewer

Select a lake from this drop down

Select different layers (e.g., **society** shows the social vulnerability of nearby communities)

Use these arrows to move the water level indicator up and down

Example Strategies to Reduce Flood Impacts Through Brownfield Redevelopment

- Incorporate green infrastructure (e.g., green roofs, rain gardens, bioswales).
- Elevate structures out of floodplains.
- Use nature-based solutions to increase flood water storage capacity (e.g., widen natural flood plains, protect and expand wetlands, restore streambank vegetation).

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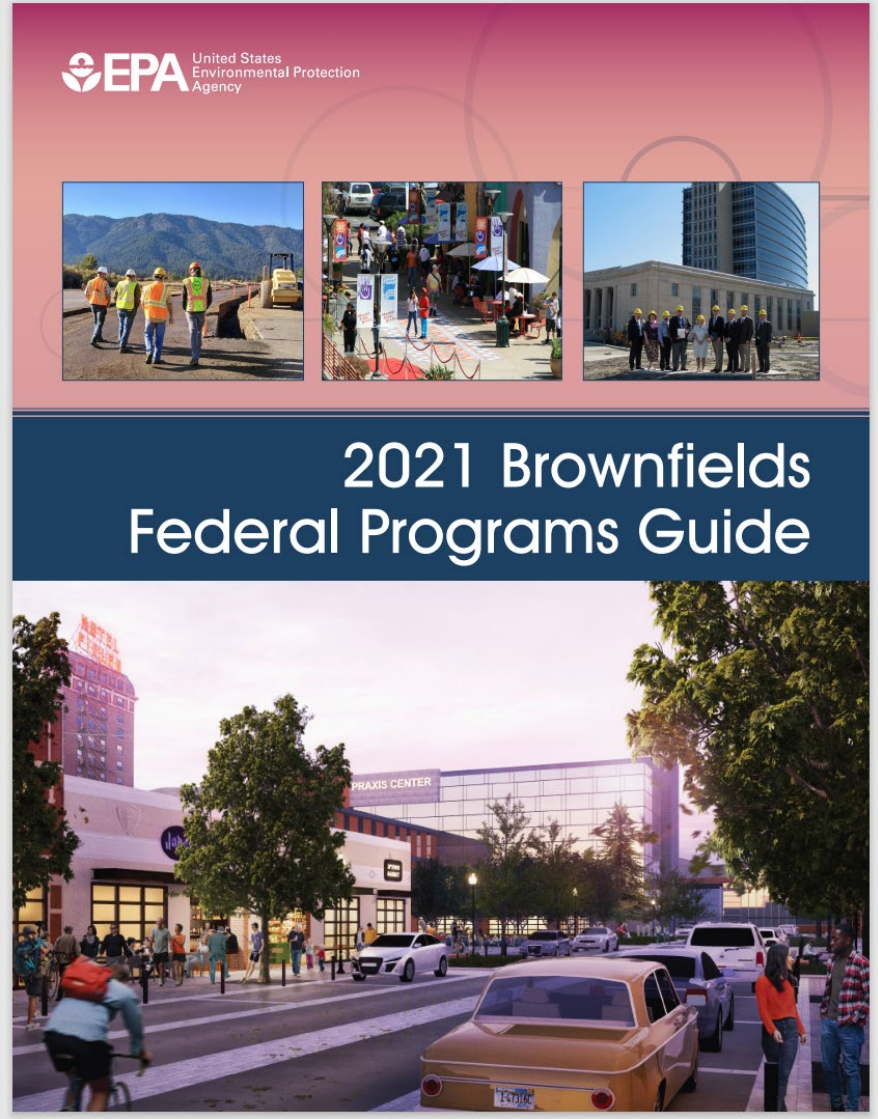
Exercise

Develop a list of strategies to reduce flooding impacts through brownfield redevelopment.

Resources and Needs

Financial & Technical Assistance



- 2021 Brownfields Federal Programs Guide
  - Includes financial and technical assistance resources provided by federal agencies for brownfields and land revitalization projects
  - Funding opportunities are grouped by the relevant phase of the project (e.g., planning, assessment, etc.)
  - An updated guide will be released in August 2023

- Program updates and new programs under IIJA and IRA that are related to brownfields are also listed on the EPA website

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Federal Guides & Resources to Evaluate Remedial Options to Improve Resiliency and Efficiencies

- EPA Cleanup Technology Site
  - Information about innovative treatment, characterization, and monitoring technologies (includes Green Remediation and Sustainable Resilient Remediation)
- Implementing Stormwater Infiltration Practices at Vacant Parcels and Brownfield Sites
  - Guide to determine the appropriate stormwater management practices to implement at a site
- EPA Climate Adaptation Website
  - Various resources to support adaptation, including examples of adaptation plans and the Adaptation Resource Center (ARC-X)
- EPA Smart Growth: Flood Resilience Checklist
  - Checklist to determine if your community is prepared for a possible flood; includes strategies to improve flood resilience
- EPA Green Infrastructure Wizard (GIWIZ)
  - Repository of EPA-sourced Green Infrastructure tools and resources for sustainable water management and community planning decisions
- U.S. Climate Resilience Toolkit
  - Provides online tools and information to learn about potential climate hazards and vulnerability, as well as case studies of building resilience
- EPA EnviroAtlas
  - Provides geospatial data, easy-to-use tools, and other resources related to ecosystem services, their chemical and non-chemical stressors, and human health

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Exercise

What resources/knowledge would be useful for **grantees/applicants** to have when planning for and implementing climate resilience in brownfields development?

- Data and information
- Resources
- Connections/partners

Thank you!

Questions? Please contact:

Ashley Green, EPA Region 5
green.ashley@epa.gov

FEMA Flood Zone Codes (cont.)

High Risk Areas

1. **Zone A** are areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage
2. **Zone AE** are base floodplains where base flood elevations are provided
3. **Zone A1-A30** are the numbered base floodplains where the FIRM shows a BFE
4. **Zone AH** are areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1-3 feet
5. **Zone AO** are river or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet
6. **Zone AO** are river or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet

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FEMA Flood Zone Codes (cont.)

7. **Zone AR** are areas with a temporarily increased flood risk due to the building or restoration of a flood control system
8. **Zone A99** are areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements

High Risk Coastal Areas

1. **Zone V** are coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves.
2. **Zones VE, V1-30** are coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves, including a detailed base flood elevation levels

Undetermined

1. **Zone D** are areas with possible but undetermined flood hazards

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Heat Impacts on Outdoor Workers

Outdoor workers are more exposed to extreme heat and associated health impacts.

NIHHIS provides various tools and information to help protect outdoor workers from heat illness, including:

- Maps of seasonal outlook and current heat advisories
- Heat and humidity forecasts
- Resources on risk factors and recommended heat exposure safety standards

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