

Climate Ready Great Lakes



Climate Ready Great Lakes

Project Goal:

To build Great Lakes coastal communities' capacity necessary to prepare and develop climate change adaptation plans for their communities.



Project Background

- Mini-grant submitted by the NOAA Great Lakes Regional Collaboration Team and the Great Lakes Sea Grant Network
- NOAA and Sea Grant partnered with masters students from the University of Michigan's School of Natural Resources and Environment
- Developed three specialized training modules designed to prepare leaders of coastal communities in the Great Lakes to develop climate change adaptation plans for their communities

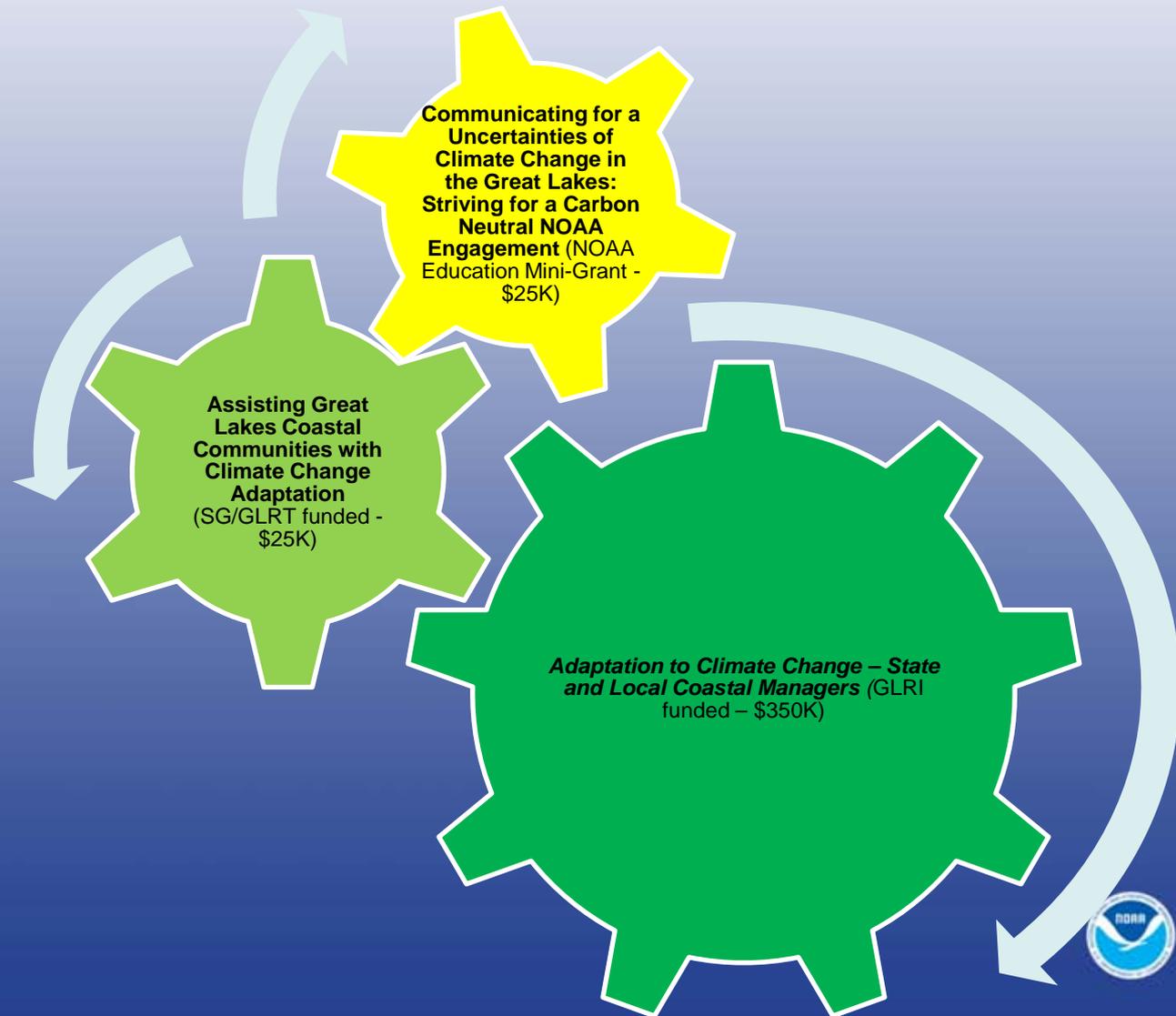


The Three Modules Are...

- 1) Climate Impacts: What am I adapting to?
- 2) What is a Climate Adaptation Plan?
- 3) What tools are available to help me adapt?



NOAA and Sea Grant: Great Lakes Climate Adaptation Gears and Building Blocks



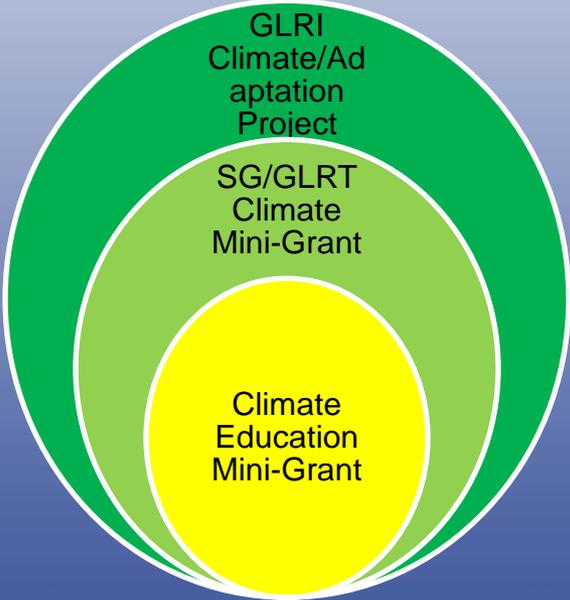
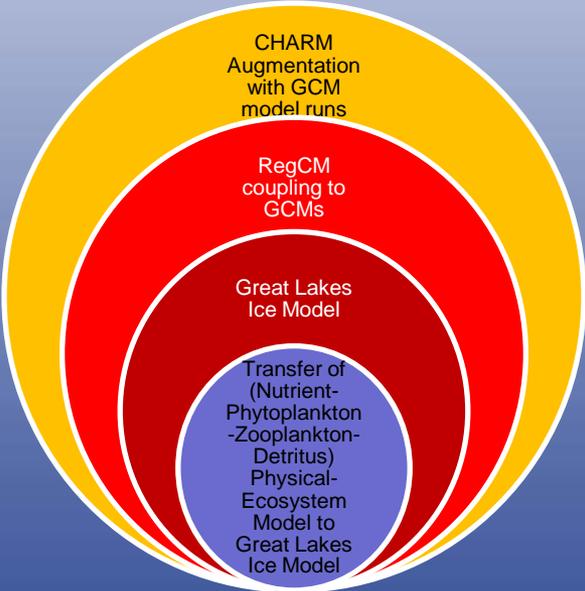
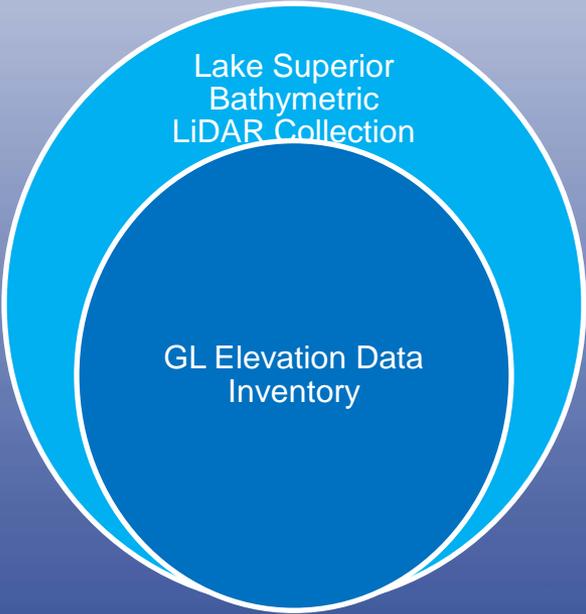
FY10 GLRI Climate Project Roadmap



Baseline Monitoring,
Data, and Research

Regional Downscaling
*

Education, Outreach,
Communication, and
Capacity Building



*NOTE: There is also collection of observed climate data to support the regional downscaling project.

Support of NOAA Mission

- **NOAA 2011 Annual Guidance Memo**
 - NOAA's long-term strategy for climate adaptation and mitigation
- **NOAA Next Generation Strategic Plan**
 - Objective: A climate-literate public
 - Objective: Resilient coastal communities
- **National Ocean Policy: Areas of Special Emphasis**
 - Resiliency and Adaptation to Climate Change and Ocean Acidification



Methodology



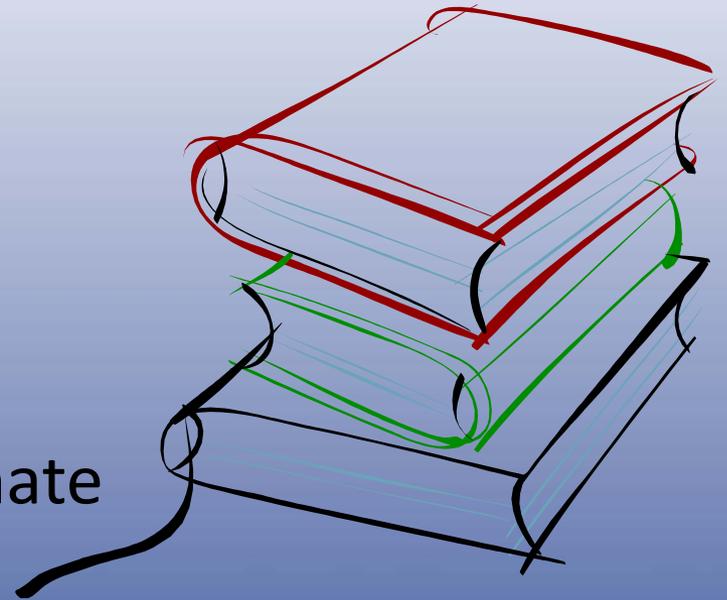
Working Groups

- Literature Review
- Tools Inventory
- Needs Assessment
- Module Teams
 - What are Coastal Communities adapting to?
 - How to create an adaptation plan?
 - What tools are available to users?
- Marketing
- Pilot
- Evaluation
- Budget



Literature Review Categories

- Climate Change Impacts
- Needs Assessments
- Vulnerabilities and Risks
- Adaptation
- Scientific Uncertainty and Climate Change Communication
- Regional, State and Local Policies
- Tools



Tool Inventory

The handout provides a more detailed description of each tool and is categorized according to types of tools.

EXAMPLE:

Coastal County Snapshots

<http://www.csc.noaa.gov/digitalcoast/tools/snapshots>

Coastal County Snapshots is an interactive web-based tool that allows users to access information related to floodplains and flood zones in their area. Once the tool is launched, users click on a state within the United States, and then click on their county, if available (data is not available for every U.S. county). Then, users have access to county demographics within the floodplain, including population, infrastructure, and environment.

- Keywords: Flood hazard; County-specific data
- Cost: None
- Training/Time Requirements: None
- Other Requirements/Notes: None



Needs Assessment

- Identified current training and information needs of natural resource managers and community planners in Great Lakes Coastal Communities
- Used as a tool to improve content of modules
- Used as justification for funding future projects



Pilot

- Alpena, MI – NOAA Great Lakes Regional Collaboration team
- Ann Arbor, MI – Feedback from Sea Grant Extension Agents



Module 1: What am I adapting to?

Understanding the impacts of
climate change in the Great Lakes

Presentation Goals

- To provide information on climate change in the Great Lakes based on peer-reviewed science
- To provide examples of ways that communities are preparing for a changing climate.

Climate Ready Great Lakes

This training should help you to...

- Understand that climate change is a relevant issue for planning professionals
- Understand that there will be similarities and differences between climate change impacts observed at regional (Great Lakes) and global scales.
- Identify at least one climate change impact specific to the Great Lakes that will affect issues within your profession.



Climate Ready Great Lakes

Part I: Fundamentals of Climate Change

Climate Science

Observed and Projected Global Changes

Climate Change in the Great Lakes Region

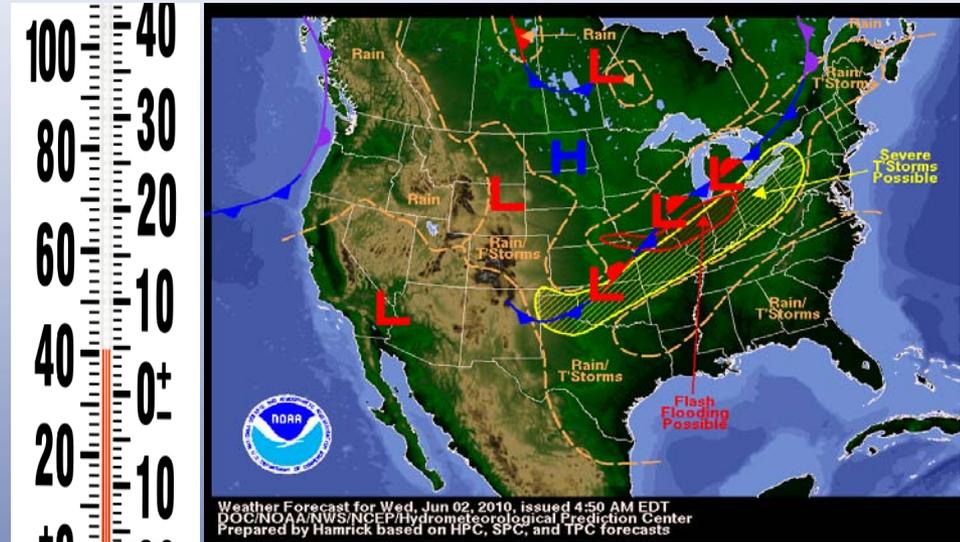
Weather and Climate

Weather is the state of the atmosphere at any given time and place (temperature, humidity, precipitation, cloudiness, wind, etc.)

W
E
A
T
H
E
R

Climate is the set of meteorological conditions that prevail in a particular place or region over a long period of time.

C
L
I
M
A
T
E



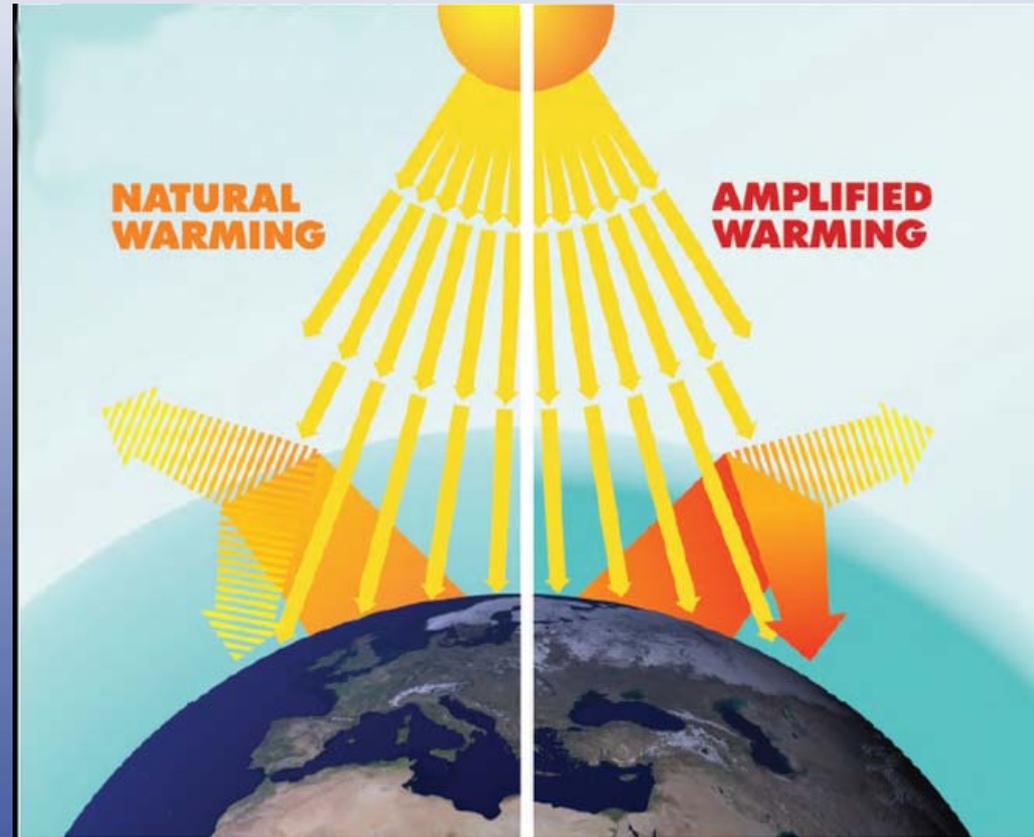
Global Climate Change: The Science

The Greenhouse Effect,

... is a vital process which helps Earth retain an appropriate amount of heat from the sun.

Greenhouse Gases such as Carbon Dioxide and Water Vapor absorb heat and then re-emit heat back to the Earth's surface (like a blanket).

As we increase greenhouse gas in the atmosphere, more heat is retained, resulting in an overall warming pattern.



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Part I: Fundamentals of Climate Change

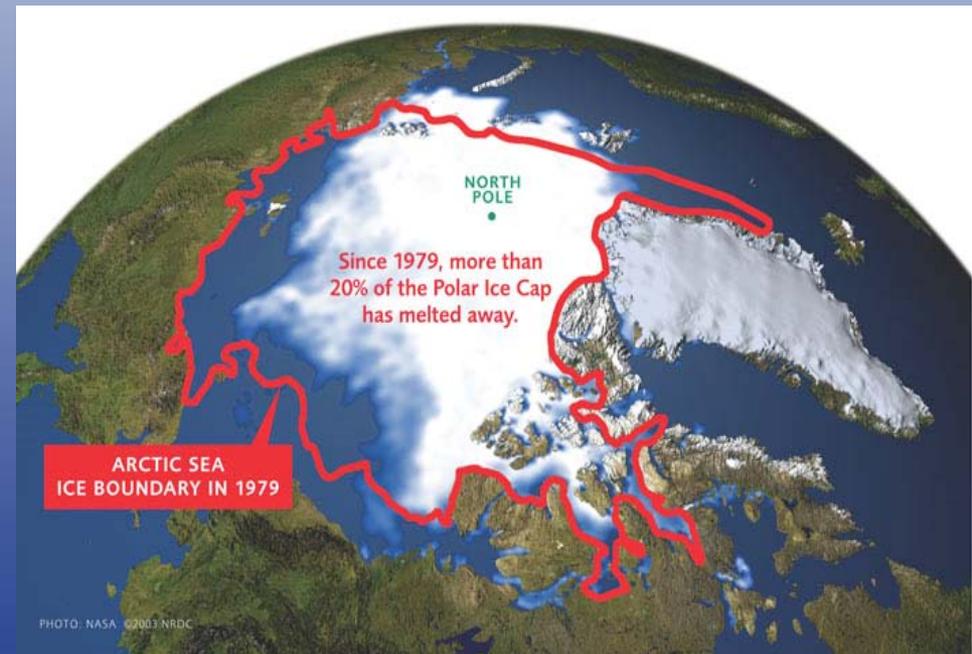
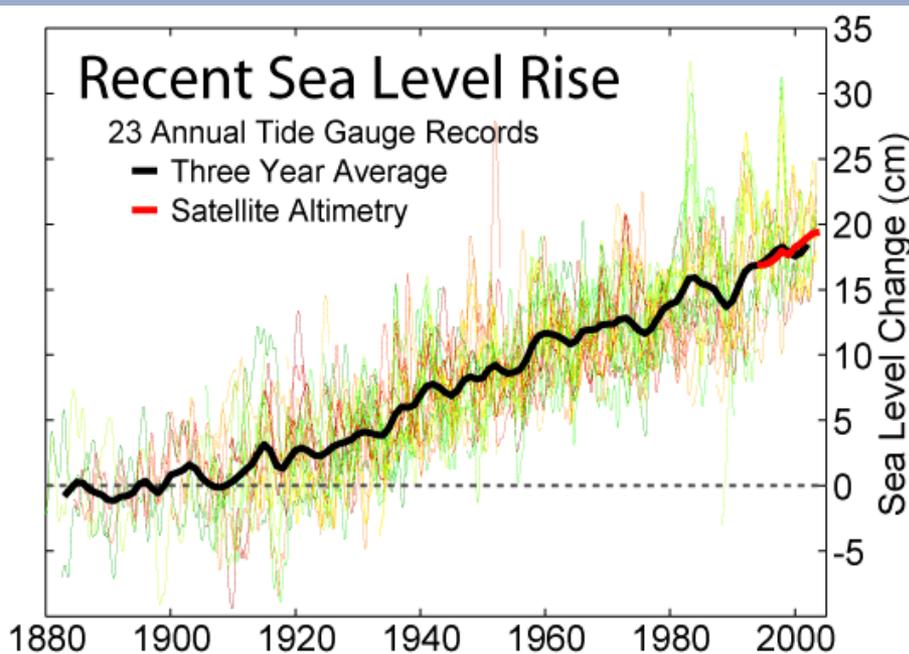
Climate Science

Observed and Projected Global Changes

Observed and Projected Great Lakes Region Changes

Global Climate Change: The Observations

- Global Sea-Level has risen between 4 and 8 Inches over the past century.
- Arctic Sea Ice has decreased nearly 10% in its areal extent each decade between 1973 and 2007.
- Climatologists have observed increases in northern latitude precipitation while observing decreases in southern/ subtropical regions.

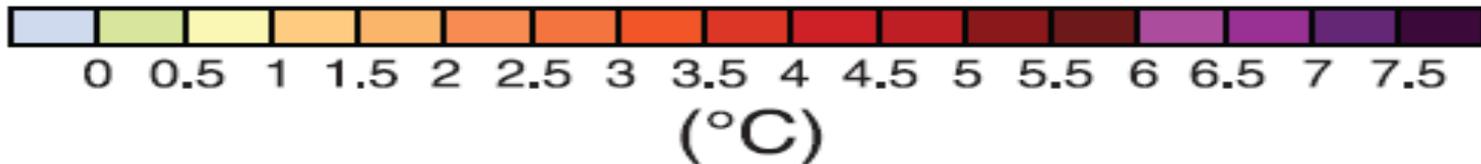
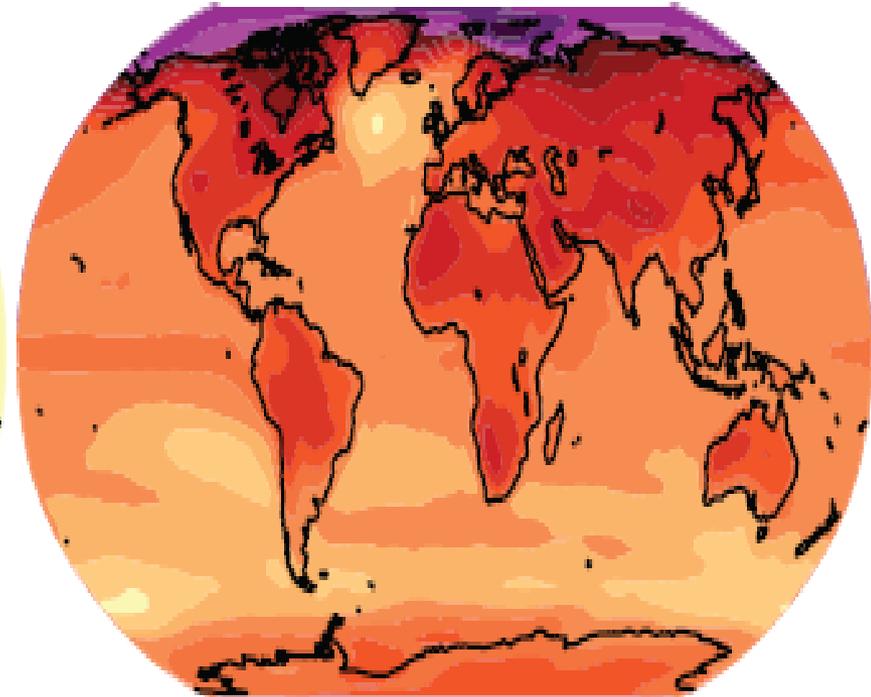
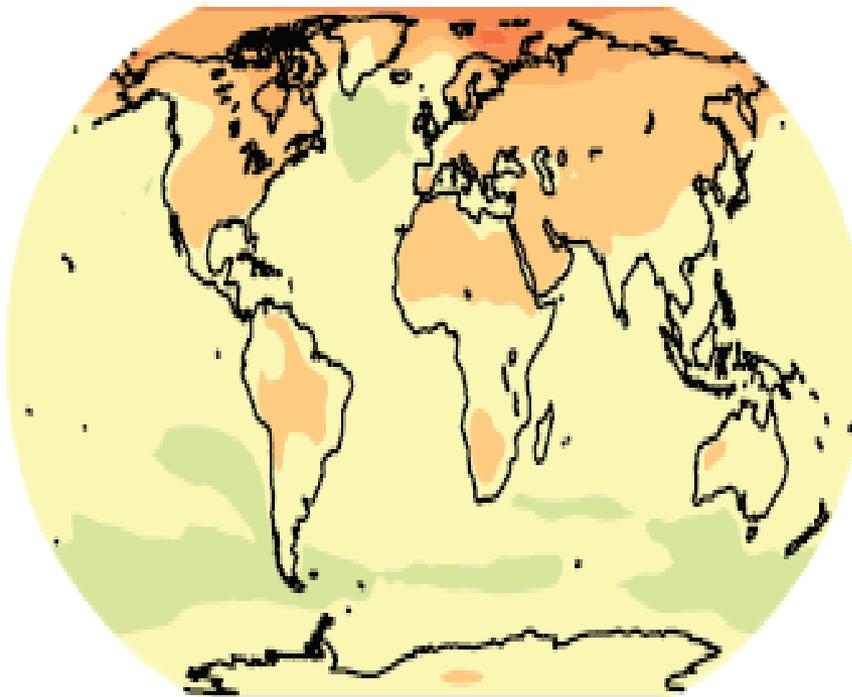


Global Climate Change: The Projections

2020-2029

2090-2099

A1B



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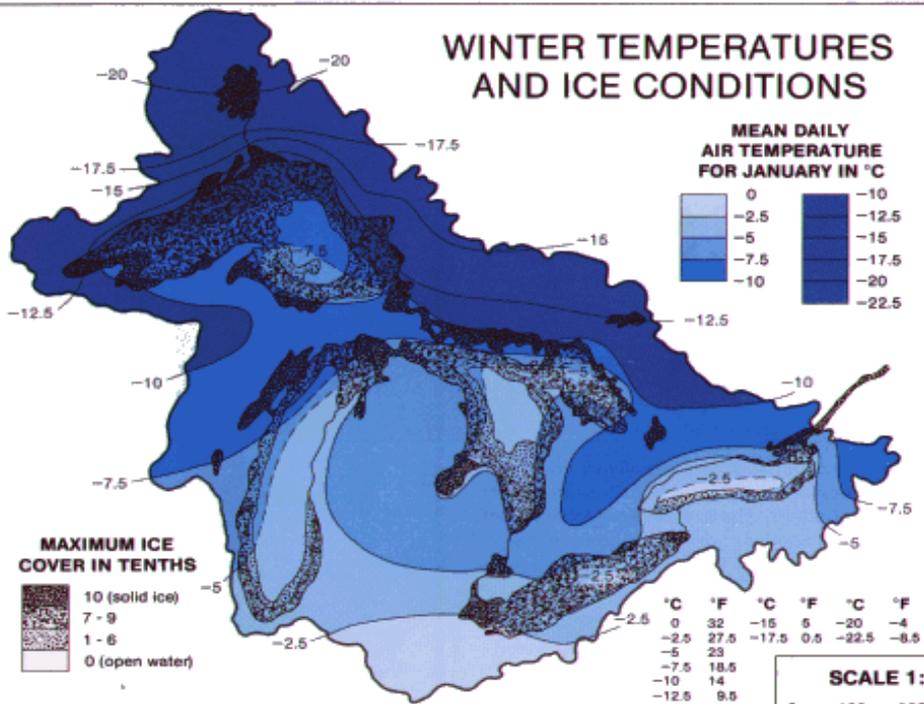
Part I: Fundamentals of Climate Change

Climate Science

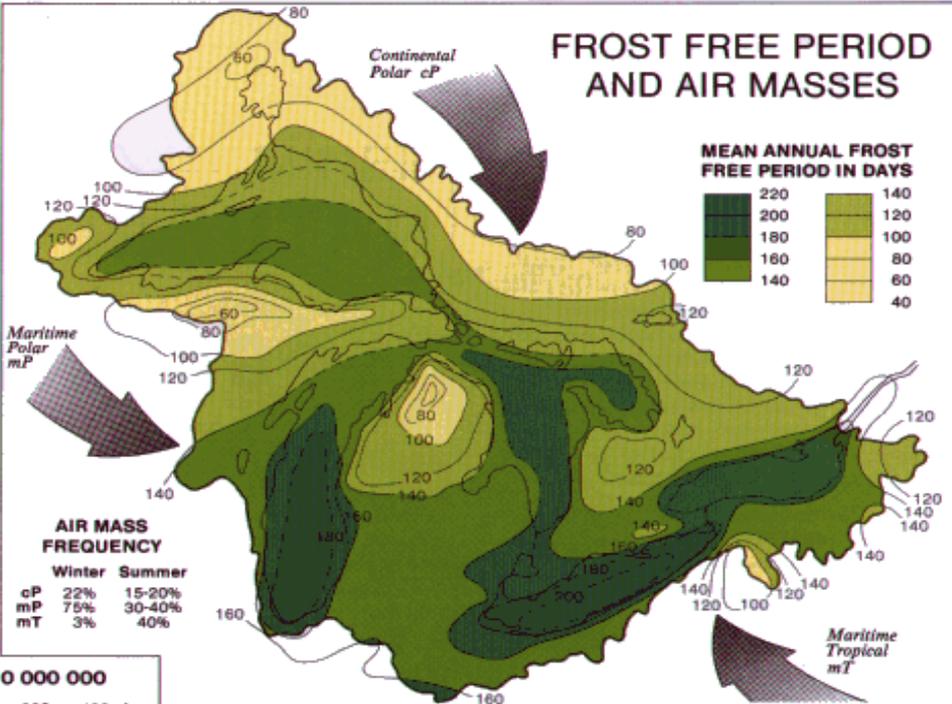
Observed and Projected Global Changes

Observed and Projected Great Lakes Region Changes

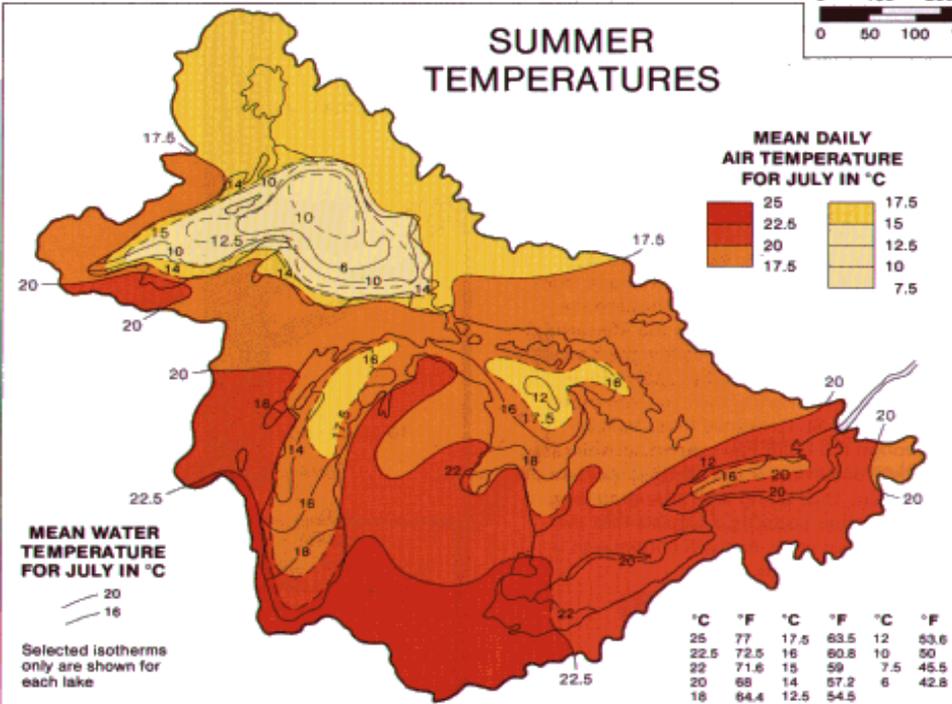
WINTER TEMPERATURES AND ICE CONDITIONS



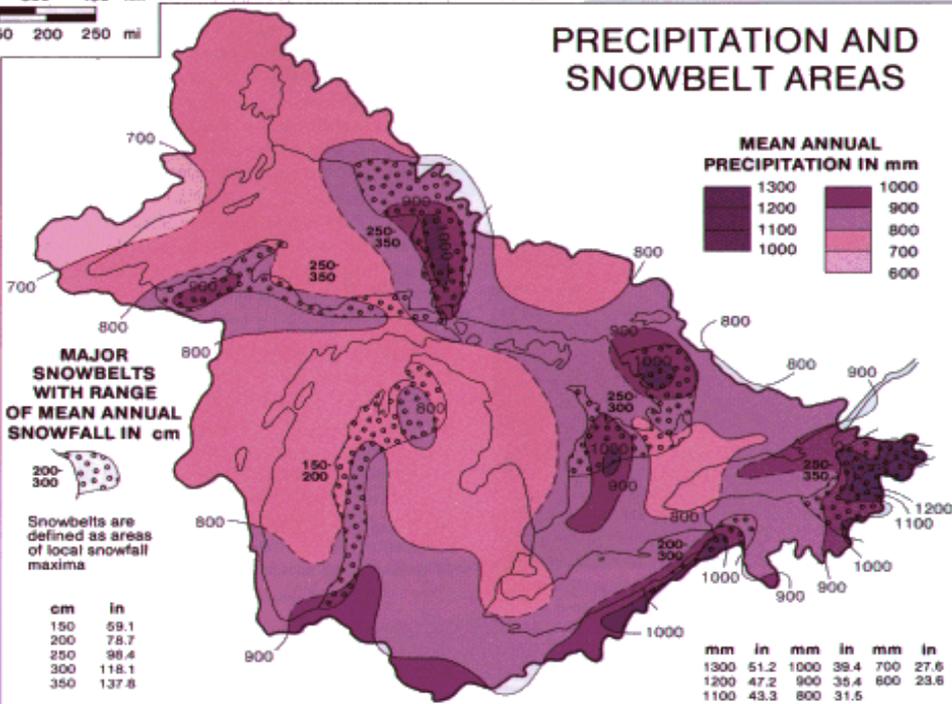
FROST FREE PERIOD AND AIR MASSES



SUMMER TEMPERATURES



PRECIPITATION AND SNOWBELT AREAS



Climate Change in The Great Lakes Region: Projected Changes in Climate

Temperature Change - 20th & 21st Centuries

Observed 20th



Temperatures in the Midwest have increased, with the largest observed changes for the region in Minnesota and the Upper Peninsula of Michigan. Model scenarios suggest further increases over the 21st century from near 5...F (Hadley model) to more than 10...F (Canadian model).

Canadian Model 21st

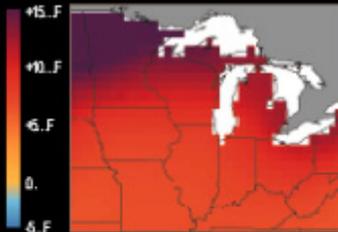


Hadley Model 21st



Winter Minimum Temperature Change 21st Century Average

Canadian Model



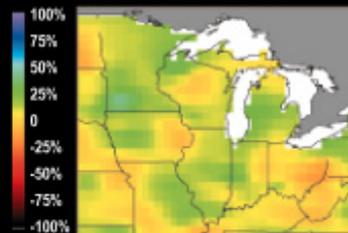
Hadley Model



Both climate models indicate that the northern part of the Midwest will experience the largest increases in winter temperatures. The Canadian Model suggests the greatest increases, approaching 15...F in Minnesota and the Upper Peninsula of Michigan.

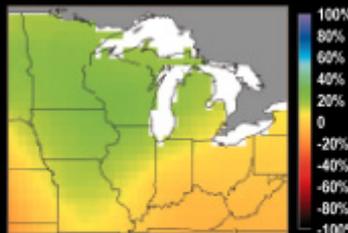
Precipitation Change - 20th & 21st Centuries

Observed 20th



On average, Midwest precipitation over the 20th century has increased.

Canadian Model 21st



Hadley Model 21st



The Hadley model indicates that this trend will continue, resulting in increases of about 25% from the present. The Canadian model suggests that these increases will be confined to the northern and western parts of the region.

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Part II: Climate Change Impacts in the Great Lakes



Lake Levels

Ice Cover



Severe Weather

Ecosystem Changes



Human Health & Economy

CLIMATE CHANGE IMPACTS



Lake Levels

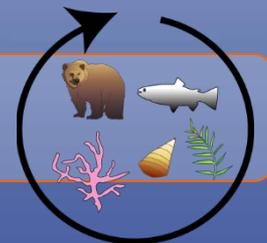


Ice Cover



Severe Weather

Ecosystem Changes



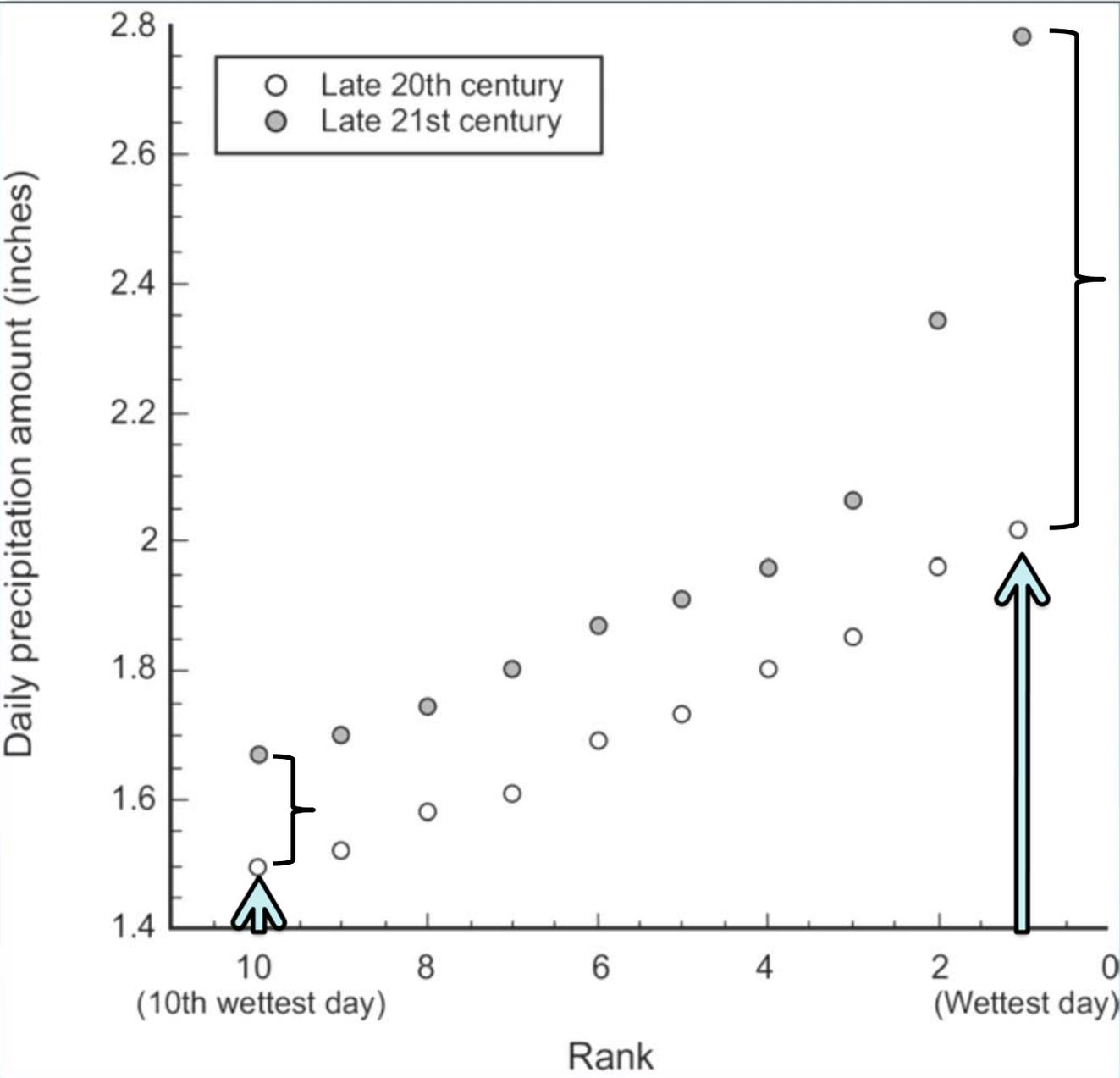
Human Health and Economy



Severe Weather

- Relationships between climate change and local scale weather are complex
- Complexities limit long-range predictability of predominant weather patterns
- However, we can make some generalized projections...
- Climate change will likely result in more extreme weather events, including:
 - Flooding
 - Drought





Frequency of late winter to early summer heavy rain/flood events could increase



Severe Weather: Flooding

More
Frequent

More
Severe

More
Damaging



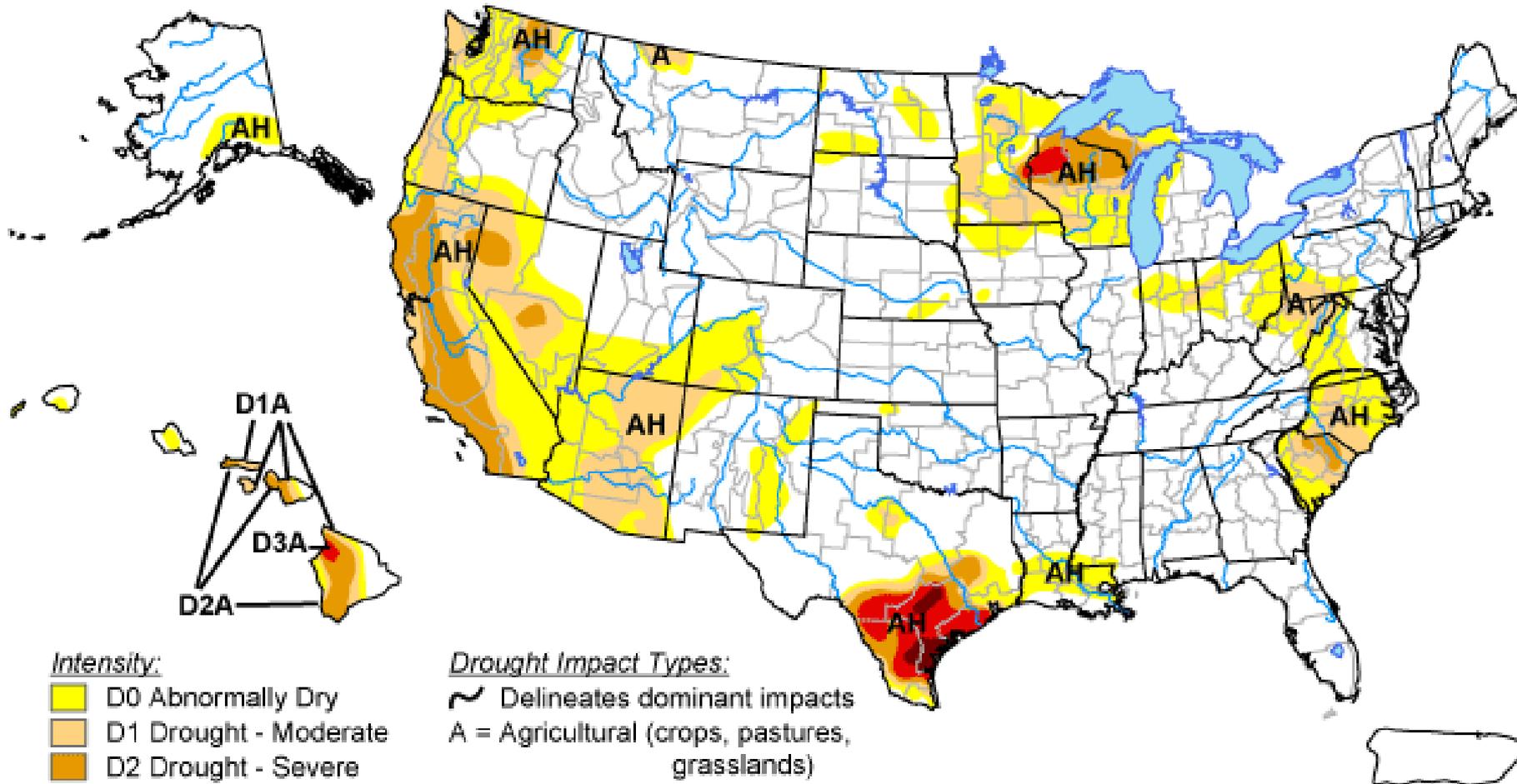
Milwaukee, Wisconsin
Summer 2010



U.S. Drought Monitor

September 22, 2009

Valid 8 a.m. EDT



Intensity:

-  D0 Abnormally Dry
-  D1 Drought - Moderate
-  D2 Drought - Severe
-  D3 Drought - Extreme
-  D4 Drought - Exceptional

Drought Impact Types:

-  Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



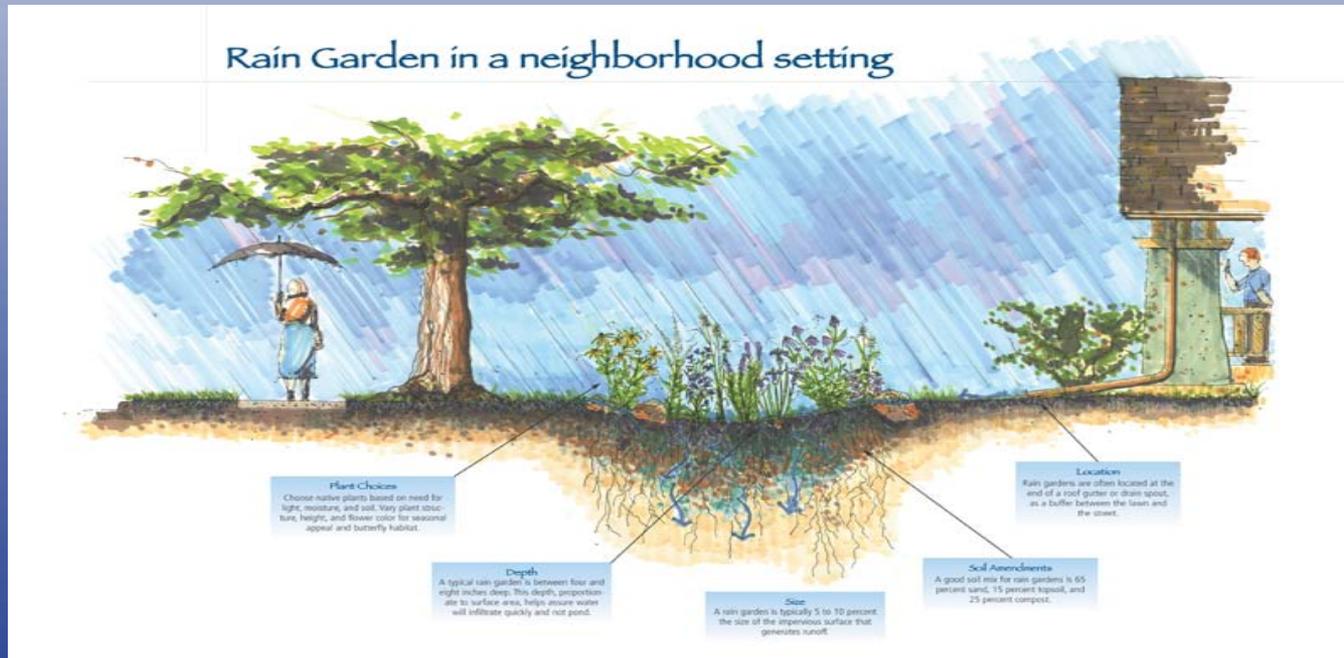
Released Thursday, September 24, 2009

Author: David Miskus, JAWF/CPC/NOAA

www.drought.gov

Case Study: Milwaukee, WI

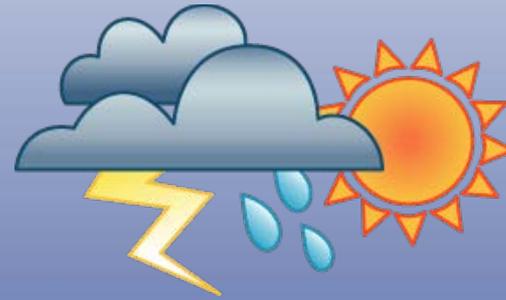
- Public/Private partnership to promote green infrastructure.
- Comprehensive watershed management approach that helps address cross-jurisdictional issues.
- Projects include a land acquisition program, promoting downspout disconnection, and installing rain gardens.



Severe Weather Summary

- Likely increase of heavy precipitation events

- More severe
- More frequent
- More damaging



- Likely increase of drought due to warmer temperatures between rain events

Module 2 addresses the question:
What is an adaptation plan?

Planning Processes and
Strategies for Climate Change
Adaptation

Outline of the Module

Part I: How to develop an Adaptation Plan

- A step-by-step overview of a planning process
 - Adaptable to different communities

Part II: Strategies for Adaptation

- Describes measures to address impacts to:
 - Stormwater, Floods, Drought, Infrastructure, Ecosystems, Urban Heat
- Incentives and Resources



What is an Adaptation Plan?

A climate change adaptation plan:

- Identifies and assesses the impacts that are likely to affect the planning area;
- Develops goals and actions to best minimize these impacts; and
- Establishes a process to implement those actions.



Perennial Raingarden

Five Themes of Successful Planning

1. Build adaptive capacity
 - Change human systems
 - Change infrastructure
2. Embed climate-readiness in routine planning processes
3. Look for win-win actions
4. Take incremental steps
 - Set up phased projects
5. Be aware and flexible
 - continually incorporate new data



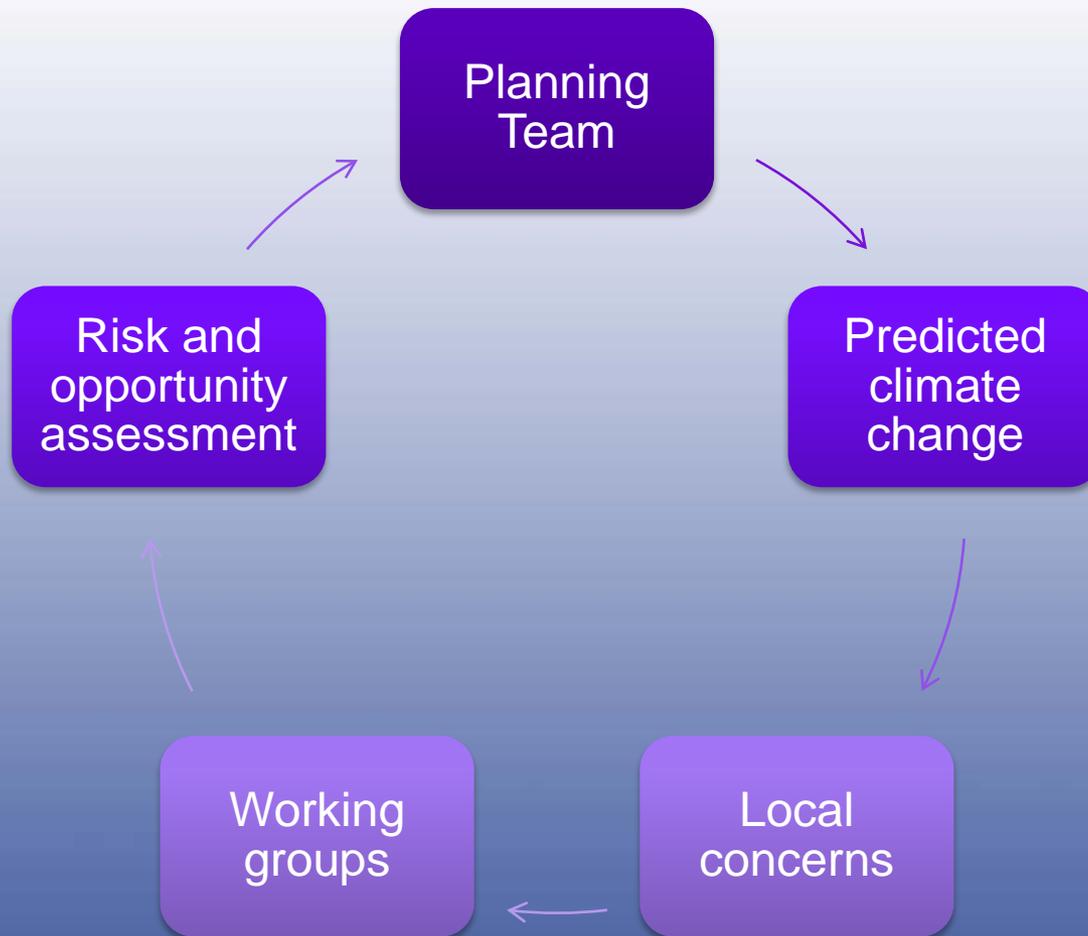
Steps in a Planning Process

1. Establish the planning process

2. Assess vulnerability and opportunities

3. Create an adaptation strategy

4. Design a process for plan implementation and maintenance



2. Vulnerability & Opportunity Assessment

Sample of Chicago's Prioritization

Table 3.1 (cont)

Impact	Risk	Timing **	Construction, Buildings & Property	Tourism	Environment	Fire	Fleet Management	Housing	Human Services	Emergency Management	Police	Public Health	Streets and Sanitation	Transportation	Water Management	Parks and Open Space	Storm Water Management
Increase in heat related deaths	High	Now	x	x		x		x	x	x	x	x		x		x	
Increase in heat related hospitalization	High	Now				x			x	x	x	x					
Increase in health impacts due to "water-in-basement" incidents	High	Near	x			x				x		x	x		x		

3. Create an Adaptation Strategy

Cost Benefit Analysis Example

Green Bay Municipal Sewer District

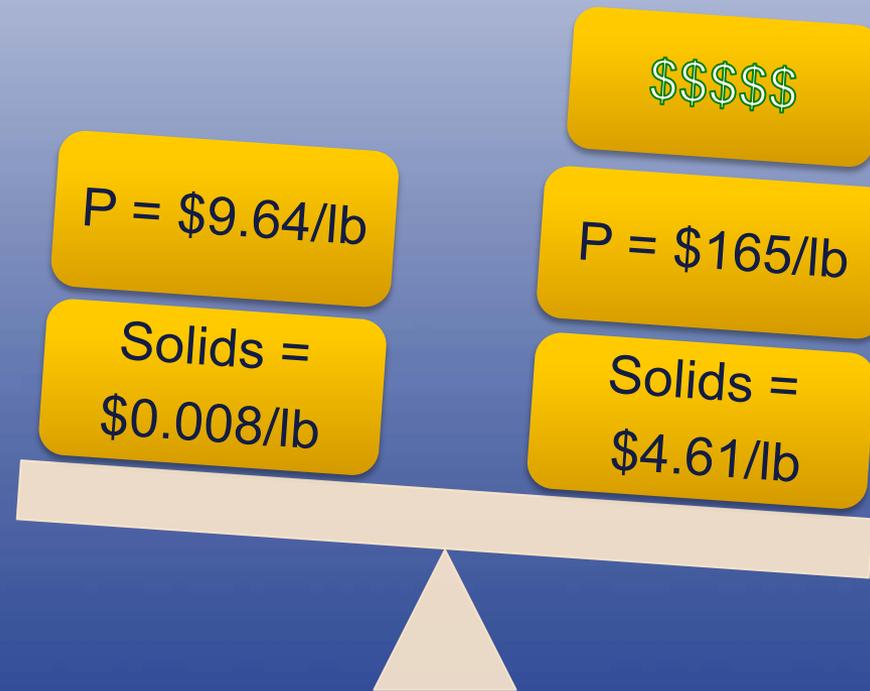
- Goal: reduce water pollution
- Issue: phosphorus and suspended solids



Green Bay Municipal Sewer District

Control upstream

Treat at plant



4. Implementation

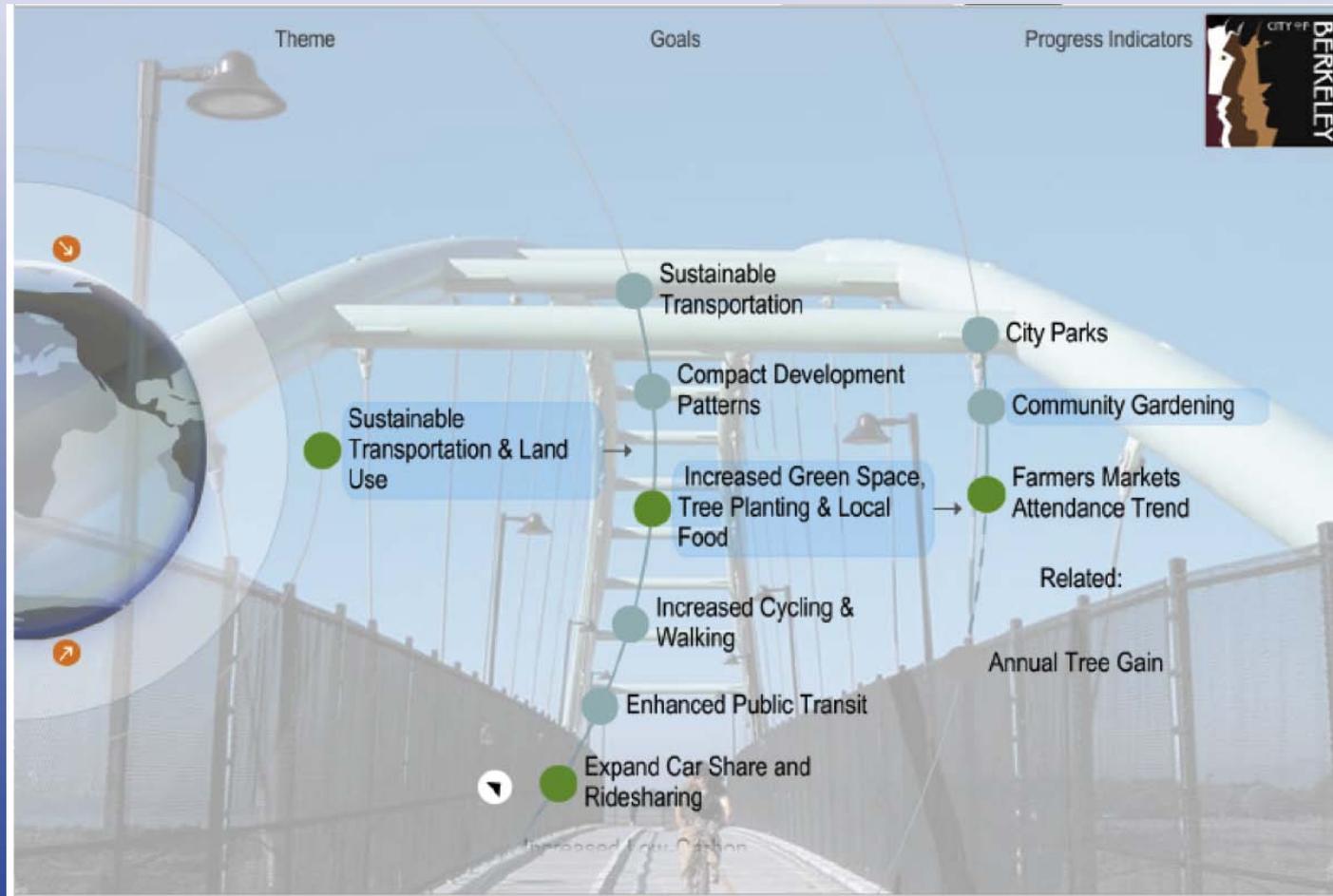
Determine the outcome/goal

Determine the primary actors

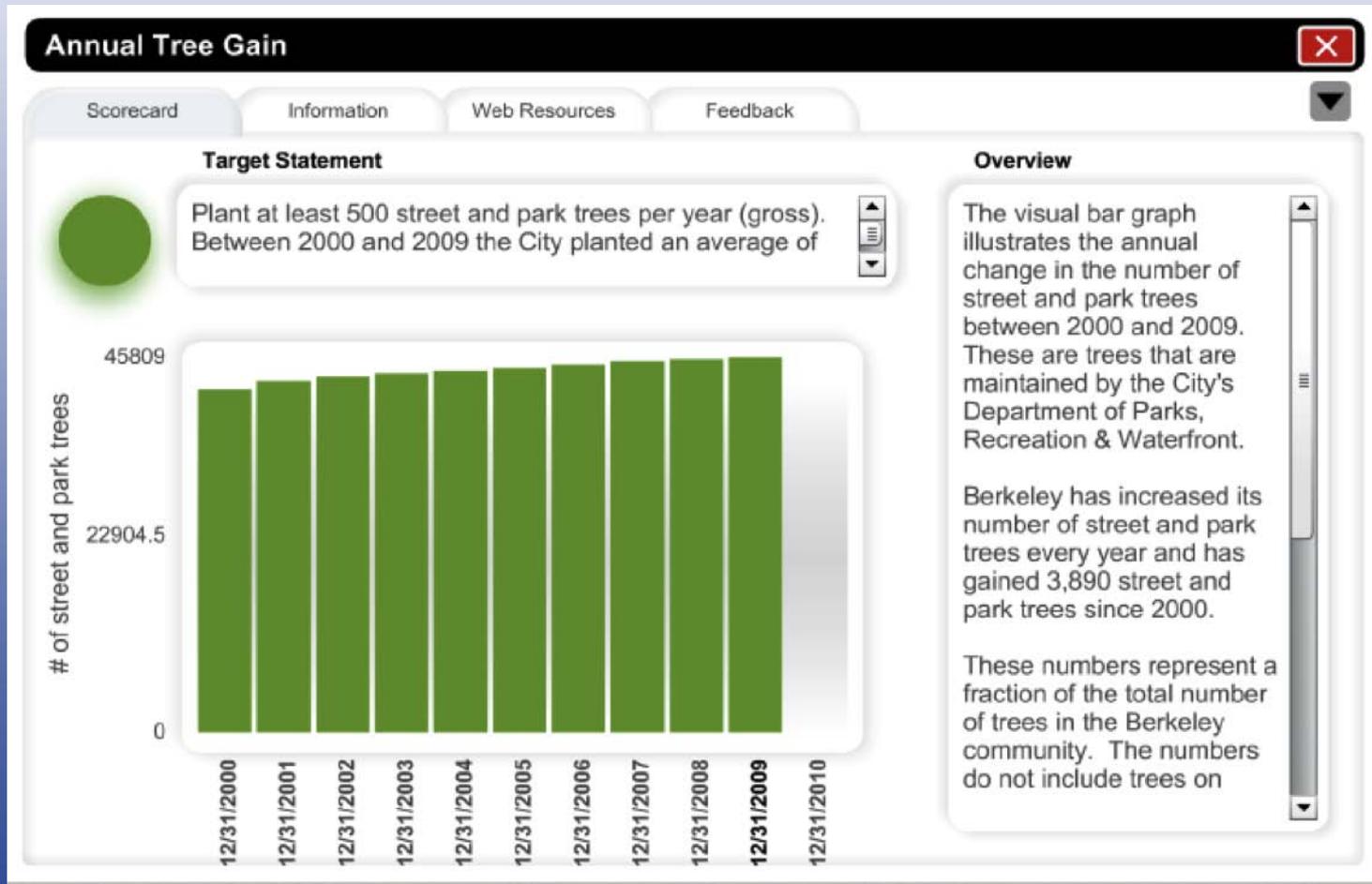
Determine the timeline

Determine the resources/budget implications

4. Implementation: benchmarks See-it Website, Berkeley, CA



Charting progress of Tree Planting



Summary of Planning Process

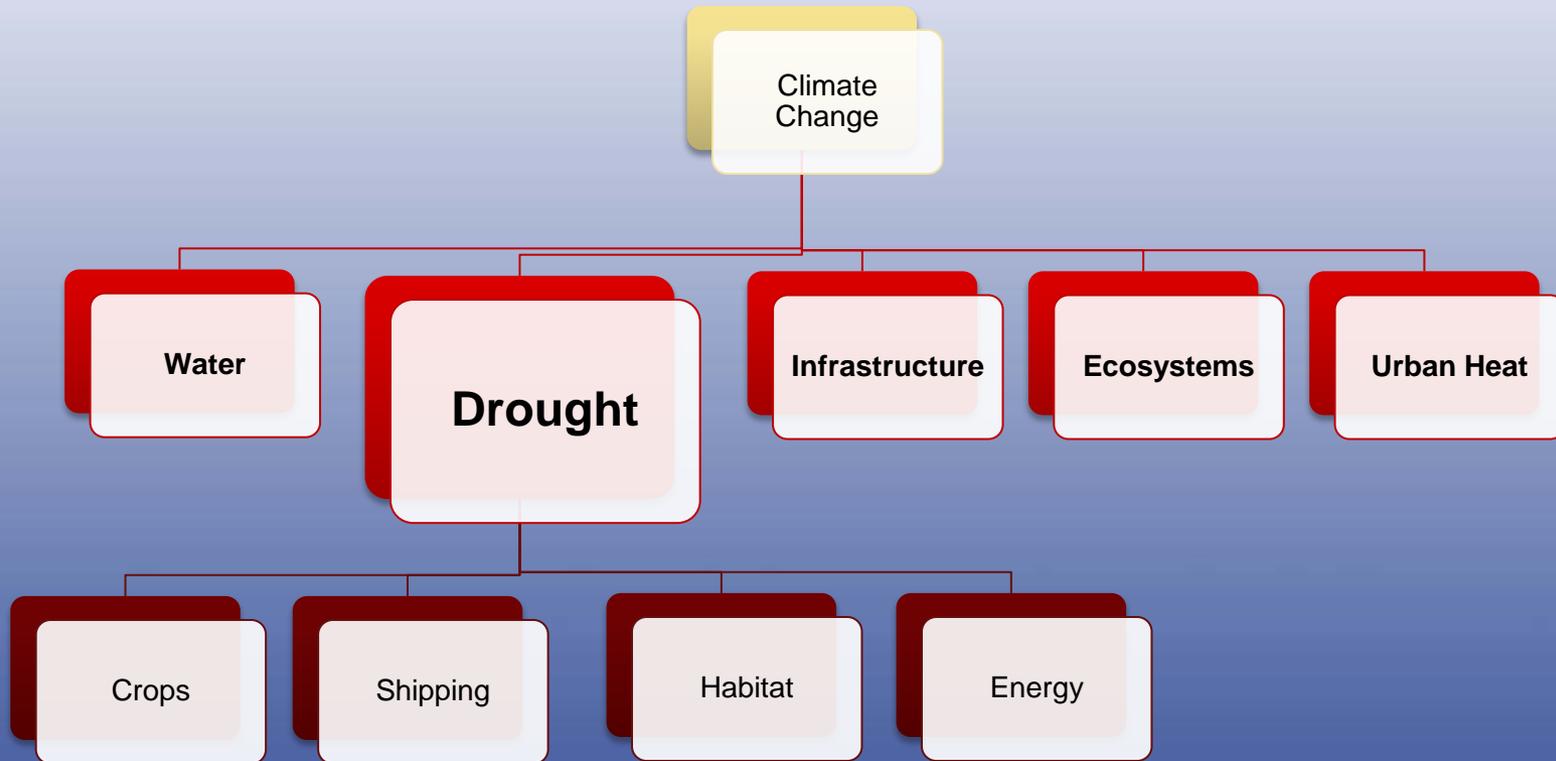
Stages:

1. Establishing process
2. Vulnerability assessment
3. Selecting strategies
4. Implementation

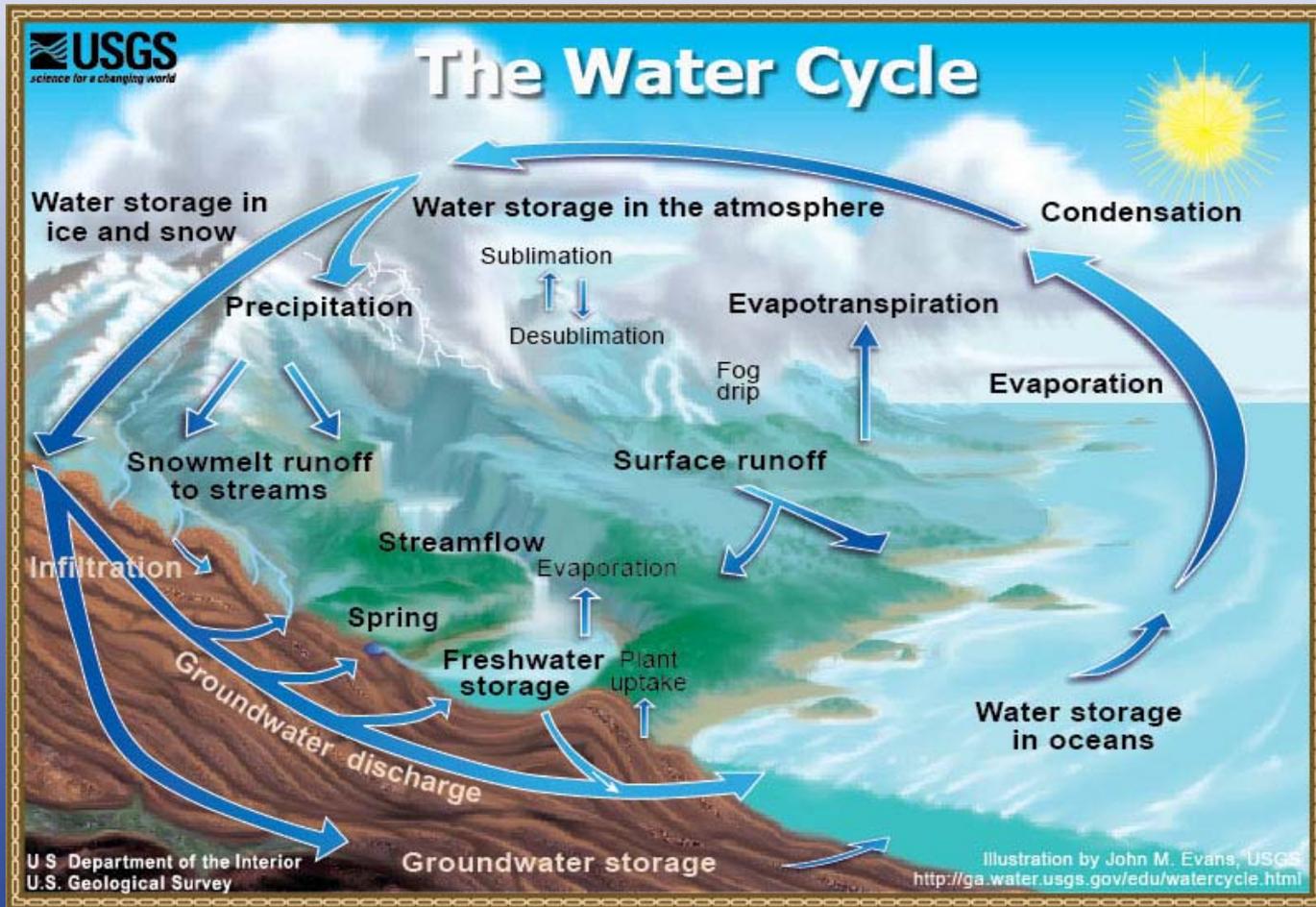
Themes: Anticipating, Flexibility, and
Connecting to existing programs



Climate Ready Great Lakes



Drought: Lack of Precipitation Disrupts Hydrological Cycles



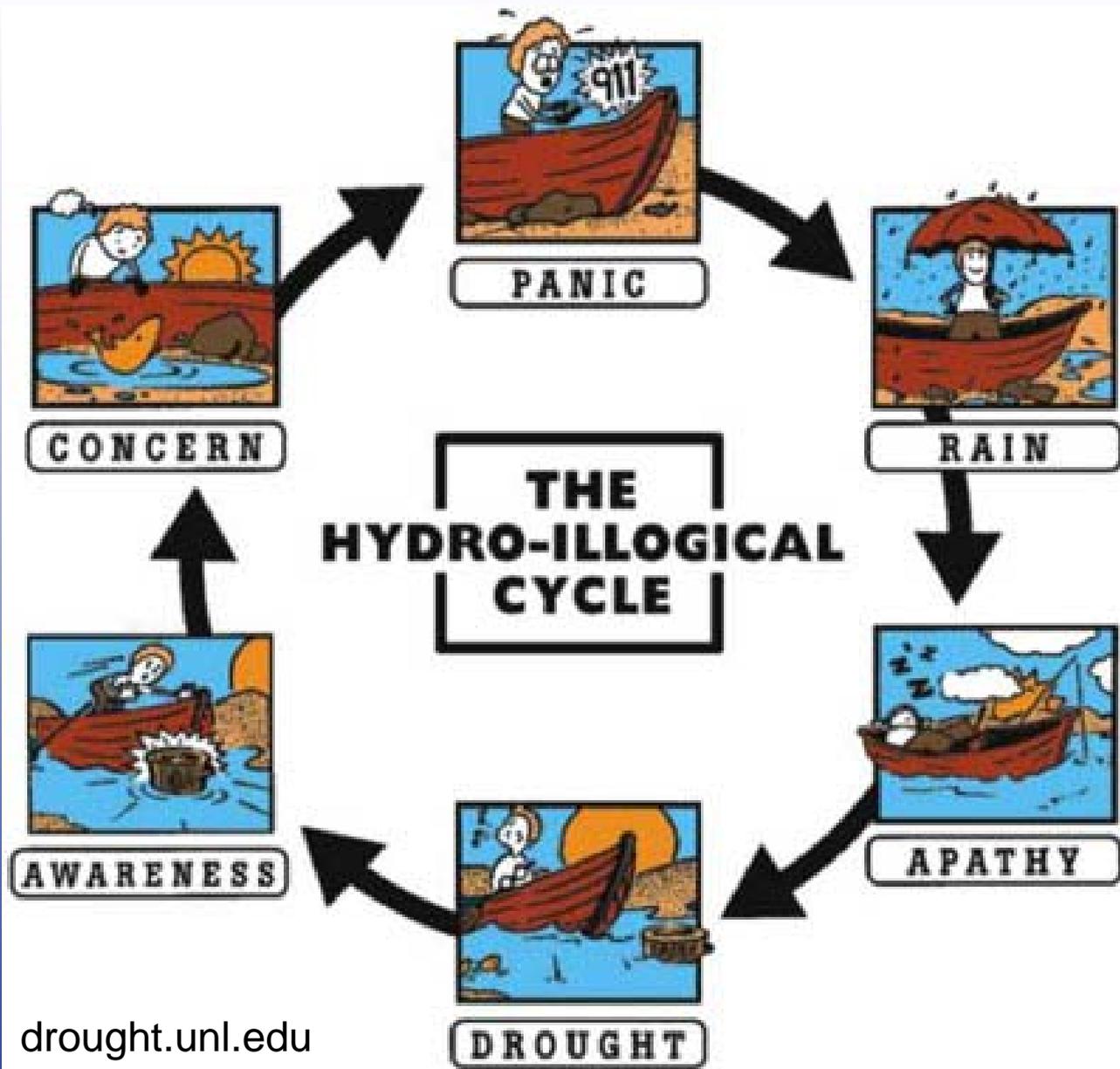
1988: Drought in the Great Lakes Region

- Timing of precipitation led to drought
- Below-average snowfall in the winter of 1987-88
 - Light spring runoff
 - Reduced groundwater recharge
- Below-average precipitation for first part of the year
 - Driest period in March-July
- Unusually hot May-June

Effects of 1988 drought

- Crop production dropped 29%-49%
 - Corn, soy, sorghum, wheat, oats, barley
- Shipping bottlenecks and load reductions
- Groundwater pumping restrictions
- Water conflicts spiked
- Energy production fell





drought.unl.edu



Drought Plans = Contingency Plans

- Criteria trigger phase in and phase out of actions
- Structures for information flow
- Mechanism to assess impact
 - On economy and environment
- Mechanism for equitable water allocation
- Plan to increase conservation

Set Up Contingencies

- Establish levels of drought and related response
- Monitor conditions:
 - NOAA provides regular data on weather and water levels in the Great Lakes basin



Play your part, be water smart!

Wise Water Use



Water your yard and outdoor plants early or late in the day to reduce evaporation



Take shorter showers - five minutes or less is best.



Get an Energy Star labeled washing machine. Wash only full loads.



Put faucet aerators on sink faucets.



Install new toilets that use less than 1.6 gallons per flush.



Use plants that require less water.



Turn off the water while soaping hands and brushing teeth.



Turn off sink faucet while scrubbing dishes and pots.



Use low flow showerhead.

Use a shut-off nozzle on your hose.



Mulch around plants to hold water in the soil.



Use a broom, not a hose, to clean driveways and walkways.

Save it, or do without it!

Side Benefits of Conservation

Realize benefits even without drought:

- Reduced water and sewer bills
- Postpone/eliminate need for new supplies
- Higher streamflow for fish and wildlife habitat
- Improved water quality
- More water for agriculture, power generation, transportation, and recreation



Case Study: Quakertown, PA

Problem with wells in 1980

→ Conservation ordinance in 1981

→ Requires efficient fixtures in all new construction & remodels



Photo from Quakertown Water Dept webpage

Drought Planning Summary

- Climate change → increased variability
- Contingency plans
- Conservation





Climate Ready Great Lakes Worksheet 2: Choosing Strategies

You have seen a range of adaptation strategies related to some of the following topics: stormwater management, flood and drought prevention, infrastructure, ecosystem resilience, and urban heat.

Take the three climate impacts you identified in Worksheet 1 and place them in the numbered boxes in this chart. Choose strategies that can mitigate each of these impacts. The box on the right gives a partial list of strategies.

E.g. If stormwater management is a concern, maybe you would select green infrastructure as one promising strategy.

Some sample strategies:

- green infrastructure
- land use planning
- stream buffers
- tree planting
- water conservation
- zoning
- regulatory changes
- energy distribution
- light-colored roofing
- ecosystem restoration

Climate change Impact	1.	2.	3.
What strategy can help mitigate the impact? <i>How</i> does it reduce the problem?			
What other climate impacts does this strategy address?			
What data do you need to determine how effective this strategy would be in your area? Where might you acquire that data?			
What agencies or organizations would be responsible for implementing this strategy? (Name as many as you can think of.)			
Are there ways to share costs? E.g. through joint projects?			

Each section ends with a worksheet.

Participants apply the information to their own communities.



Great Lakes Climate Change Module 3

Climate Change Adaptation Tools Available to Great Lakes Communities

Module 3 Goals

Participants will:

- Know what tools and resources are available for adaptation planning
- Have some ability to select and use tools and use them effectively



By the End of the Training...

Participants will:

- Know what tools and resources are available for adaptation planning
- Know how to access tools and resources
- Demonstrate ability to select a tool that fits their goal and targeted climate impact



Module 3 Outline

Part I: Introduction to Tool Use and Selection

- What is a Tool?
- Why Use Tools for Adaptation Planning?
- Choosing a Tool
 - Define Your Goal; Identify Climate Impacts; What Resources are Available?
- Using Tools Effectively
 - Learning Tool Mechanics; Understanding Tool/Data Origin; Utilizing Technical Assistance; Finding Effective Data



Module 3 Outline

Part II: Survey of Available Tools

- Community Outreach Tools
- Education, Training, and Support Tools
- Data Websites
- Analysis Tools and Systems
- Other Informational Websites
- Visualization Tools



Analysis Tools and Systems

Analysis tools and systems can help users determine possible effects of decisions, changes, or hazardous events on communities and/or environmental systems

Climate Change Adaptation Planning Applications for Analysis Tools and Systems

These tools can be used in different steps of the planning process

- Early on to identify hazards
- Later on in the process, for assistance with adaptation strategies



Tools

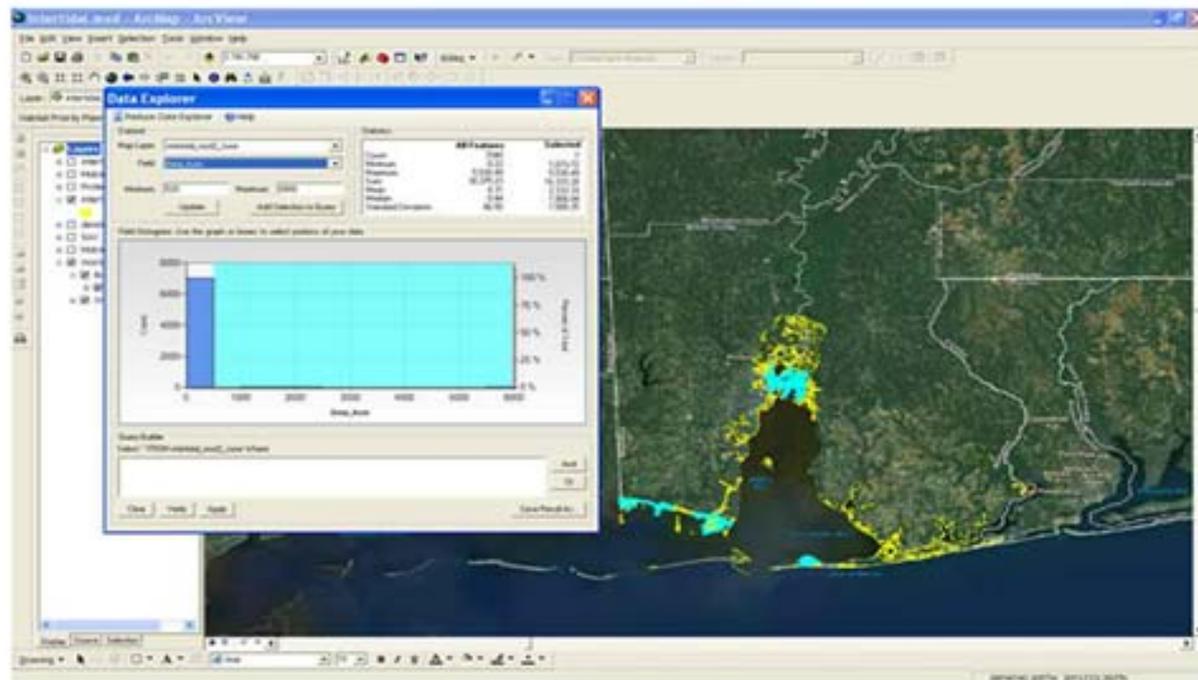
Habitat Priority Planner

NOAA Coastal Services Center



Overview

This tool aids in making decisions about habitat conservation, restoration, and land use planning. The Habitat Priority Planner takes away much of the subjective nature of the process by providing a means of obtaining critical habitat analyses that are consistent, repeatable, and transparent. The program allows users to easily test various ideas and "what if" scenarios on the fly, making it the perfect tool to use in a group setting.



Features

Inventories specific habitat or land-use types relevant to the site in question

Assesses target habitat or land-use type conditions with a process that automates the pre-packaged spatial analysis metrics

Analyzes "what if" scenarios such as the impact of new development or how restoration might change overall habitat function; participants can quickly and easily set the parameters—and change them as needed

Gets people involved thanks to the fast, interactive environment this easy-to-use system provides

Creates maps, reports, and data tables to enhance communication and the decision-making process

Habitat Priority Planner (HPP)

Factsheet

- **Description:**
 - Land use decision tool
- **Cost:**
 - None
- **Training/Time Requirements:**
 - Intermediate GIS experience plus one-day training course
- **Other Requirements/Notes:**
 - Requires Microsoft .NET and Microsoft .NET support for ArcGIS, ArcMap 9.2 or 9.3, and Spatial Analyst. Raster or vector land cover data and other data layers required



Climate Change Adaptation Planning Applications for HPP

Habitat Priority Planner

can be used to:

- Identify present habitats and land use type
- Examine effects of different land use scenarios



http://www.arborengineering.com/land_use.html

Great Lakes HPP Case Studies

Two Great Lakes Region watersheds were selected to use for habitat restoration projects:

- Buffalo River watershed
- St. Joseph River drainage basin



<http://www.glc.org/raptest/clintriv.html>

Buffalo River Watershed Management Project

Environmental concerns include:

- Water Quality
- Pollution
- Habitat Degradation

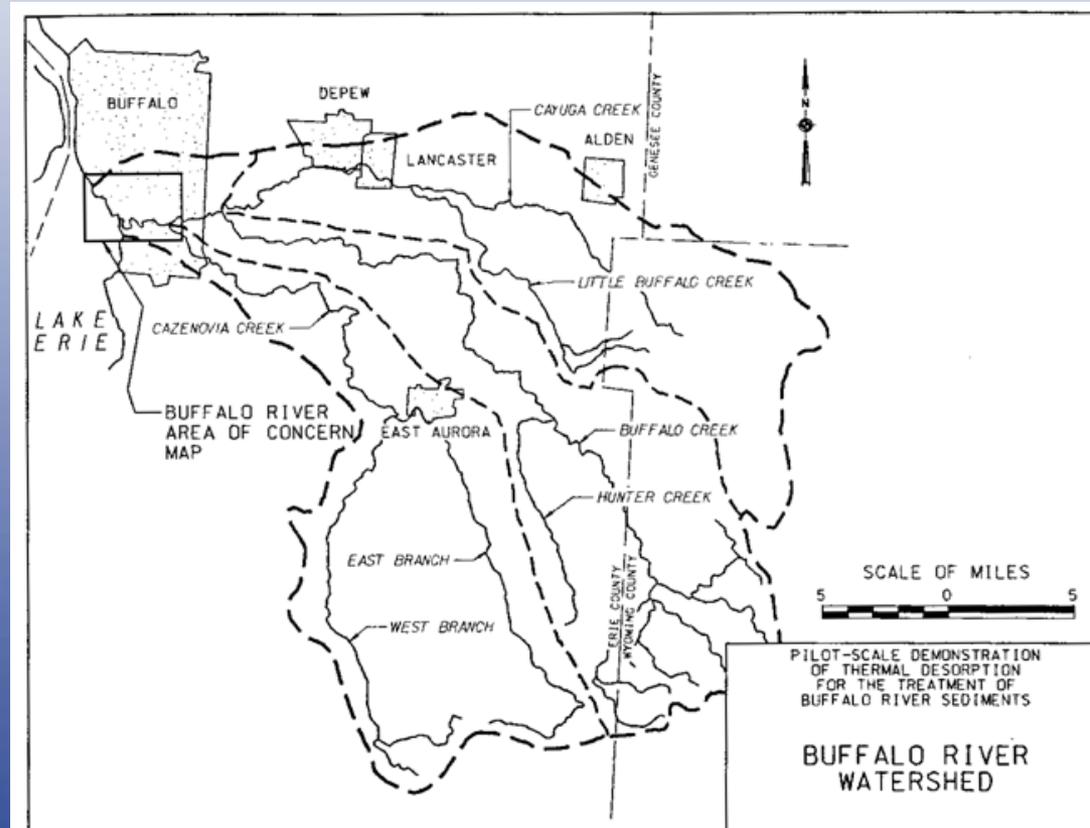


<http://bnriverkeeper.org/programs/buffalo-river-remedial-action-plan/issues-affecting-the-aoc/>

Buffalo River Watershed Management Project

Habitat Priority Planner identified:

- 1,416 acres of land that may be suitable for wetland restoration
- 300 acres that could be converted to green space



<http://www.epa.gov/greatlakes/arcs/EPA-905-R93-005/fig1.gif>

Additional Analysis Tools and Systems

- CITYgreen
- Coastal Ecosystem Restoration
- Roadmap to Adapting to Coastal Risk
- FEMA HAZUS
- i-Tree v3.0
- Impervious Surface Analysis Tool
- NatureServe Vista
- Nonpoint-Source Pollution and Erosion Comparison Tool (N-SPECT)



<http://www.itreetools.org/>



<http://www.natureserve.org/>

Great Lakes Climate Adaptation Tool Handout

Introduction

This handout is a compilation of tools and resources that can provide assistance to Great Lakes coastal communities in their climate change adaptation efforts. Each resource or tool was selected based upon potential applicability to the Great Lakes region and usefulness in climate change adaptation. City planners can use these tools and resources to facilitate action on numerous levels. A few applications for the tools include decision-making support, improving communication with the public, understanding risk and vulnerability to various climate change scenarios as well as predict future scenarios for planning and goal implementation.

Tool complexity and application varies but all can be adjusted to fit Great Lakes communities. Some tools are computer software programs while others are methods, databases or web applications. The tools are broken down into six categories for easy reference: community outreach tools; education, training, and support tools; data websites; other informational websites; analysis tools and systems; visualization tools. There is also supplementary contact information listed at the end of the handout with information on state and regional climatologists and climatology offices.

Community Outreach Tools

In general, community outreach tools help decision makers communicate with the public and interpret policy/decision making processes so that solutions are accessible to the public at large. The following Role playing tool facilitates climate change discussions among stakeholders to show the varying perspectives from many different sectors (business owners, environmental professionals, politicians, and others). Other tools in this section assist with various planning challenges. These tools are applicable throughout the climate change adaptation planning process, but should be used heavily at the beginning of the process to gain community support

Module 3 Handouts

- Great Lakes Climate Adaptation Tool Handout
- Tool Application Spreadsheet
- How do I Choose the Right Tool?



Module 3 Handouts: Tool Application Spreadsheet

CLIMATE IMPACTS	Stormwater Management	Flood Hazard Reduction	Drought	Building/City Infrastructure	Shoreline Infrastructure	Transportation	Energy	UHI/Human Health	Air a Wat Qual
TOOL NAME									
Building Coast-Smart Communities: A Role Play Exercise	X	X	X	X	X	X	X	X	X
Environmental Planning for Small Communities (TRILOGY)	X	X	X	X	X	X	X	X	X
Green Communities	X	X	X	X	X	X	X	X	X
CAKE	X	X	X	X	X	X	X	X	X
Coastal Inundation Toolkit	X	X		X	X				
Coastal Services Center Modules	X	X	X	X	X	X	X	X	X
EBM	X	X	X	X	X	X	X	X	X
Great Lakes Weather and Climate	X	X	X						
National Estuarine Research Reserve Training	X	X	X	X	X			X	X
Sea Grant Training: Ohio State University Webinars									X
Coastal County Snapshots		X							
GLIN	X	X	X	X	X	X	X	X	X
Historical Maps and Charts	X	X	X	X	X	X	X	X	X
MyEnvironment								X	X
NOAA Digital Coast	X	X	X	X	X	X	X	X	X
NOS Data Explorer	X	X	X		X				
BASINS	X	X	X						X
CITYgreen	X	X		X			X	X	X
Coastal Ecosystem Restoration									
CVAT	X	X		X				X	X
FEMA HAZUS		X		X					
Habitat Priority Planner				X					
i-Tree v3.0	X	X		X					X
Impervious Surface Analysis Tool	X	X							X
NatureServe Vista				X		X	X		
Lake Superior Duluth Streams.org	X	X							X
NatureServe Website									
NOAA Coastal Climate Adaptation	X	X	X	X	X	X	X	X	X
NOAA Coastal Service How-to-Guide	X	X	X	X	X	X	X	X	X
NOAA Climate Services Portal	X	X	X	X	X	X	X	X	X
NOAA State of the Coast				X	X				X
CanVis	X	X	X	X	X	X	X	X	X
Climate Wizard	X	X	X	X	X	X	X	X	X
Visualizing Coastal Erosion					X				



Climate Ready Great Lakes Module 3: How do I choose the right tool?

1. Define the Goal/objective that you are trying to achieve. Below write an adaptation goal that is relevant to your specific locality. How does this relate to other adaptation efforts in your city?

Goal:

Relation to other adaptation efforts:

2. Review the climate impacts spreadsheet. Write down the tools that can assist with the climate impact that you are trying to mitigate. List the category next to each tool. Later, you will be able to determine the appropriate use for the tools that you selected.

Climate Impact	Tool Name

Module 3 Handouts

- Great Lakes Climate Adaptation Tool Handout
- Tool Application Spreadsheet
- How do I Choose the Right Tool?



Climate Ready Great Lakes

