Climate Change Adaptation: Great Lakes region examples

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Credits: IPCC 2007, Photos – Photography Plus, Julie Craves

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October 21, 2010
Freshwater Future CC Workshop, Detroit


Climate
is changing

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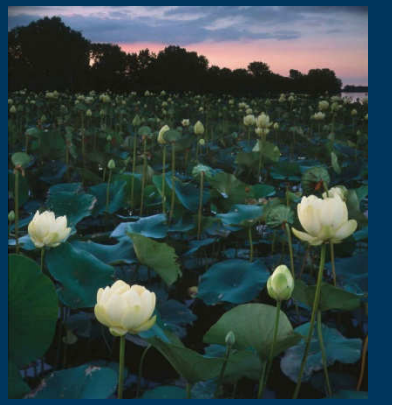
Climate change adaptation goal:



Promote and implement solutions to make people and species less vulnerable to climate impacts by increasing the resilience of the natural systems on which they depend.

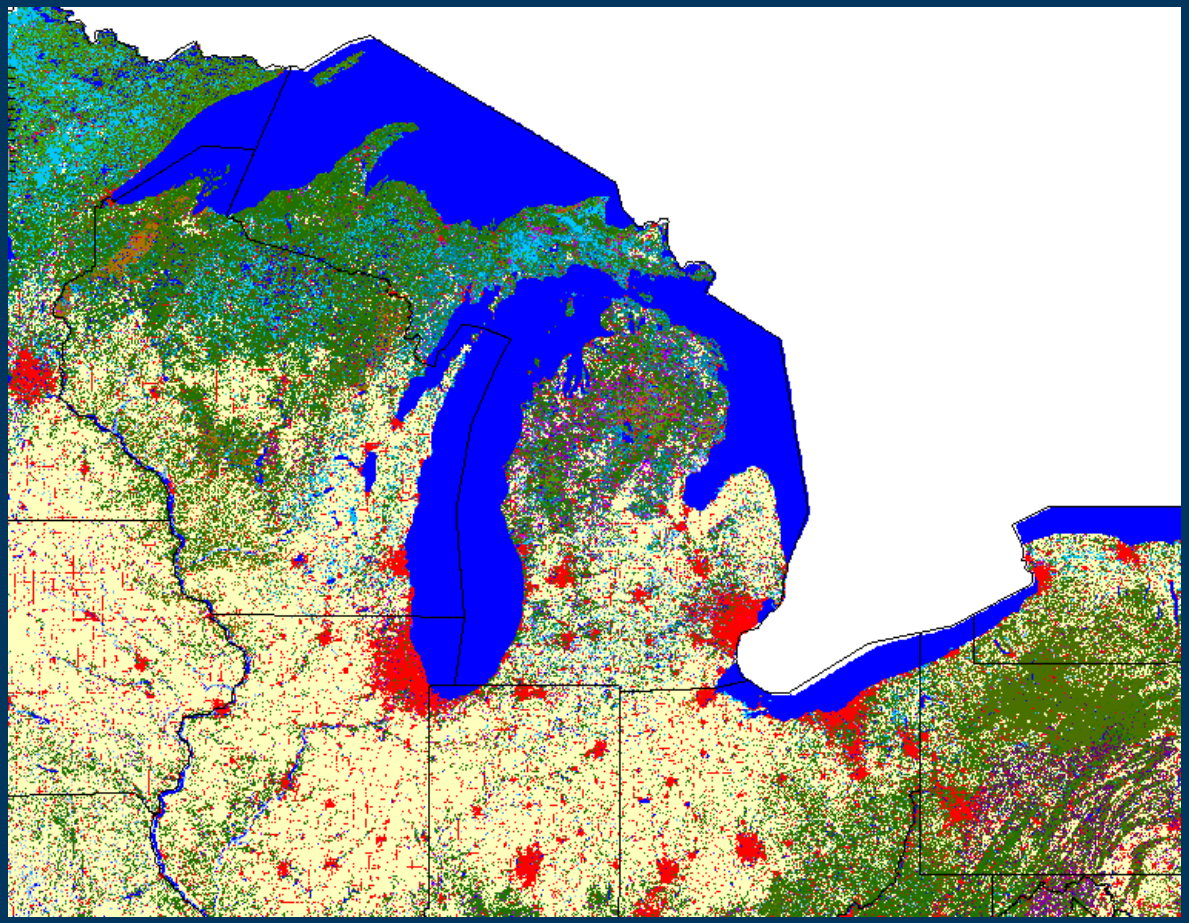
Flavors of adaptation potential: (after Klausmeyer and Shaw 2009)

Intrinsic: Species-specific traits that facilitate an adaptive response (i.e., mobility, temperature tolerance).

Extrinsic : The potential for facilitation of species adaptation within a region that derives from availability of climate refugia, migration pathways, etc., and includes factors that can be enhanced by management action.

Management : The ability of a management system to facilitate adaptation, given institutional, regulatory, etc., constraints.

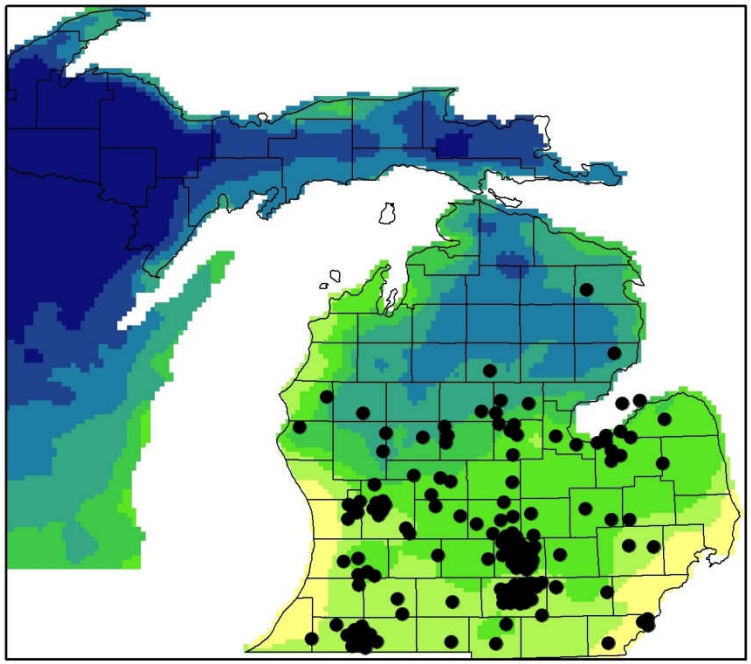
Context is key!



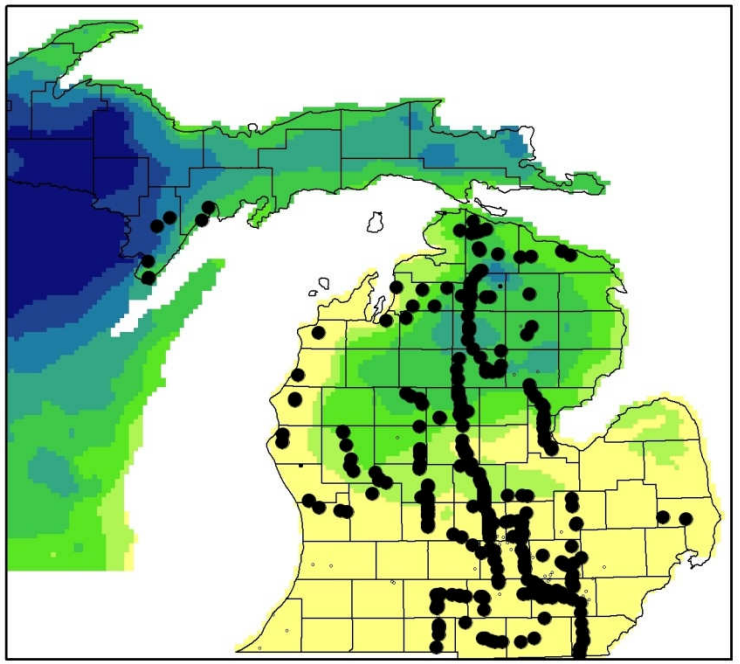
Source: USGS Gap/NBII Land Cover Viewer, 2010

- Habitat loss & fragmentation
- Invasives
- Pollution
- Altered hydrology
- Altered disturbance regimes
- Resource extraction

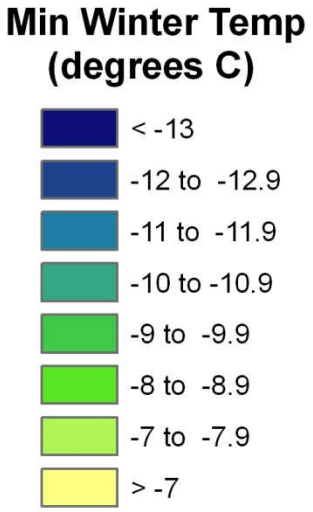
Connectivity



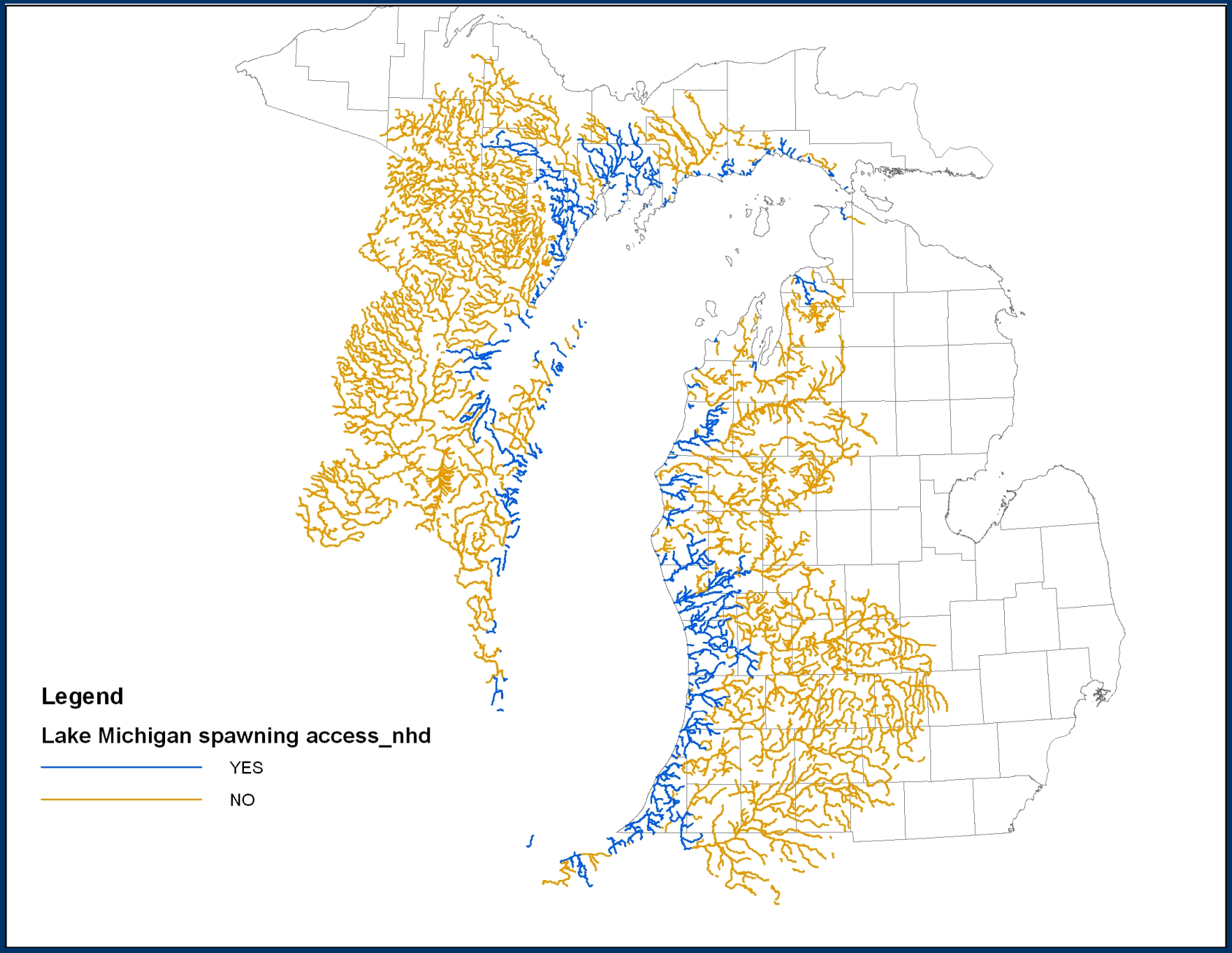
1968



2006-2008



Common opossum distribution (Myers et al. 2009), linked with ClimateWizard temperature data


Legend
Lake Michigan spawning access_nhd
YES
NO

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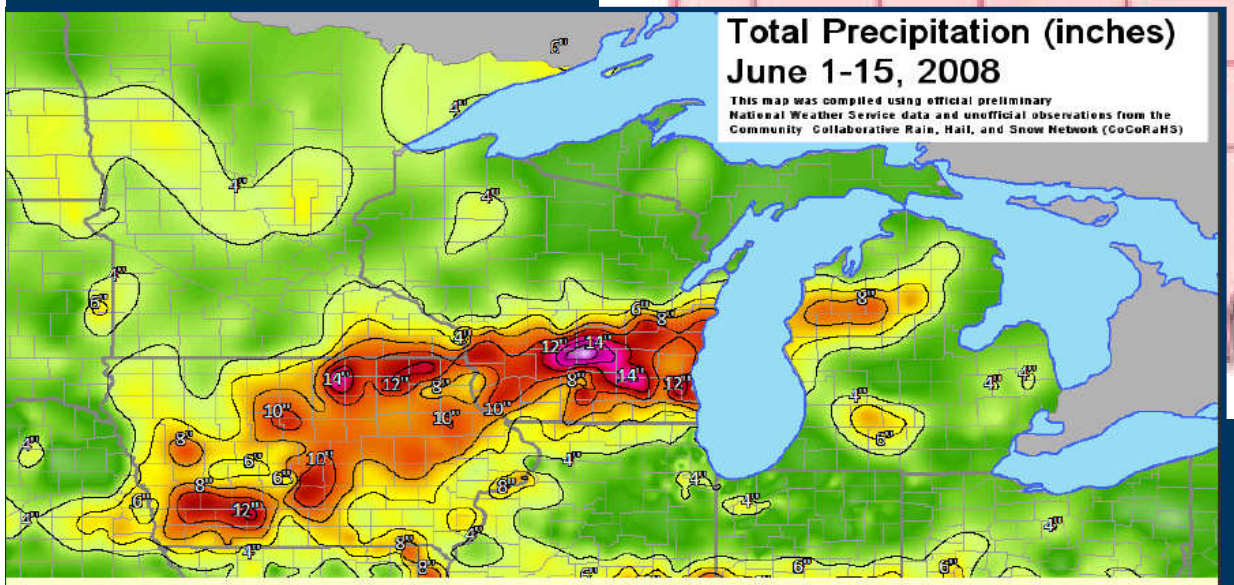
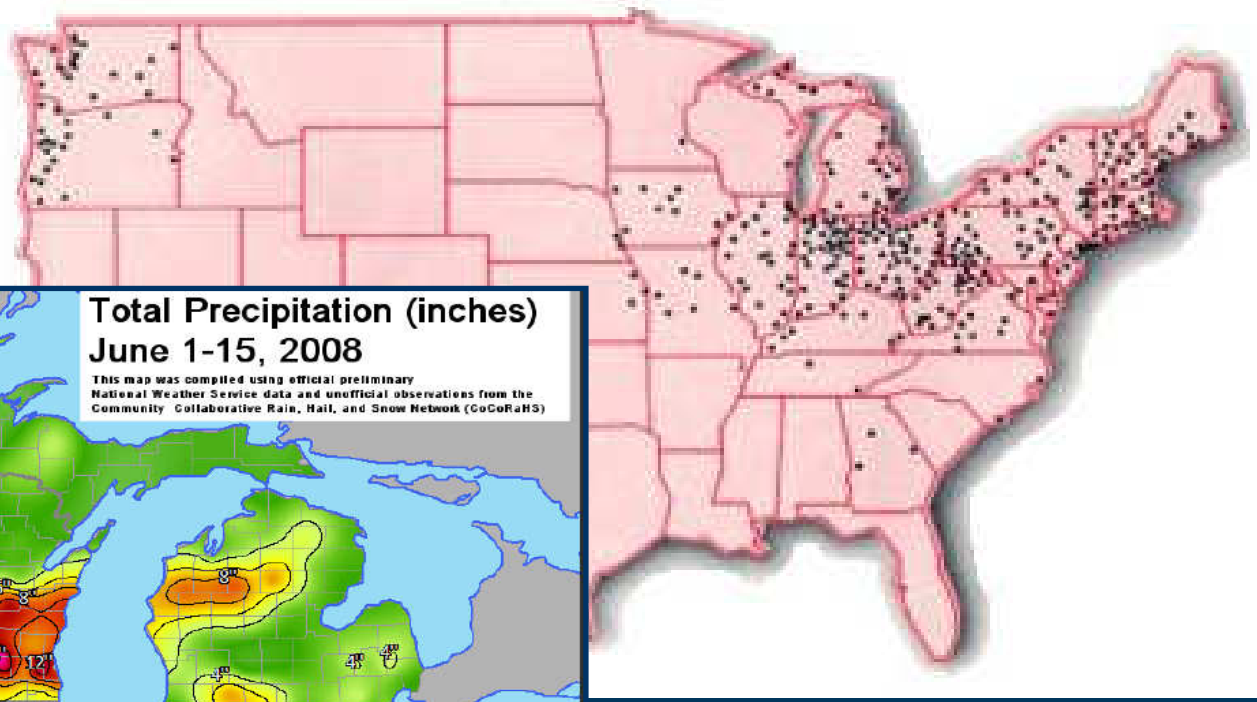
Highlights well-known problems!



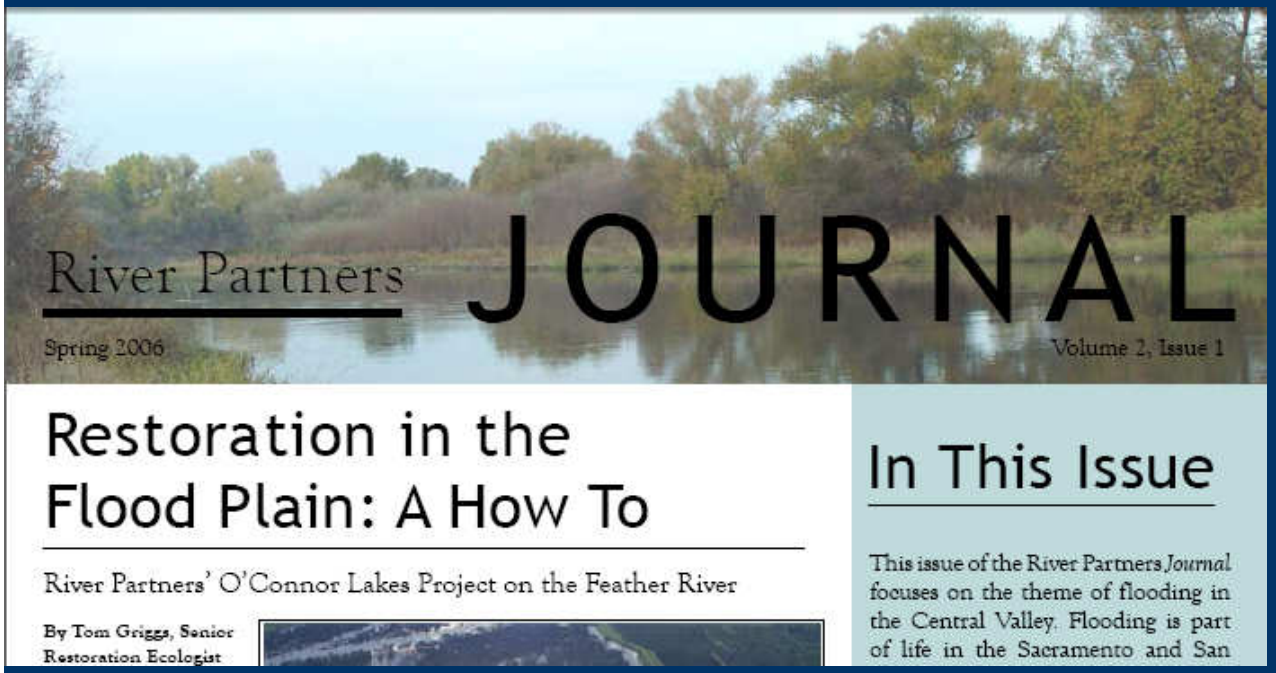


2,500 wells tested; 28% contaminated
161 POTWs diverted 90 million gallons raw sewage
38 river gauges broke records
810 square miles of land flooded
$34M in damage claims paid

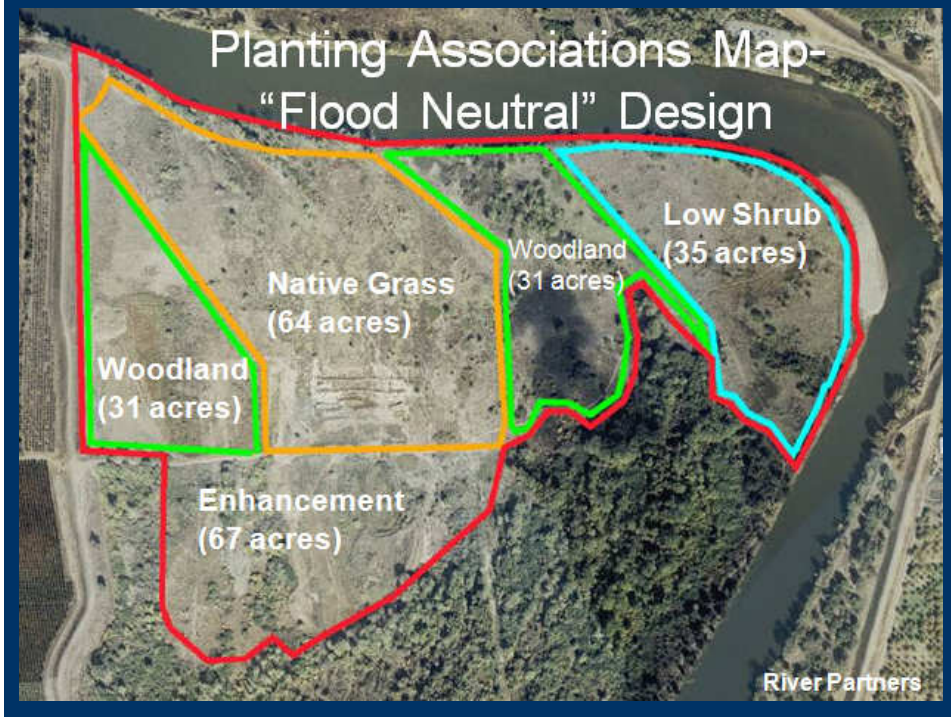
Source: FEMA, WEM

Combined sewage/stormwater treatment plants (EPA)

Flood damage - image courtesy of WICCI



And for many, we have solutions!



Roadmap

- **Three examples**
- **Two tools**
- **A sampling of more projects in the Great Lakes region**

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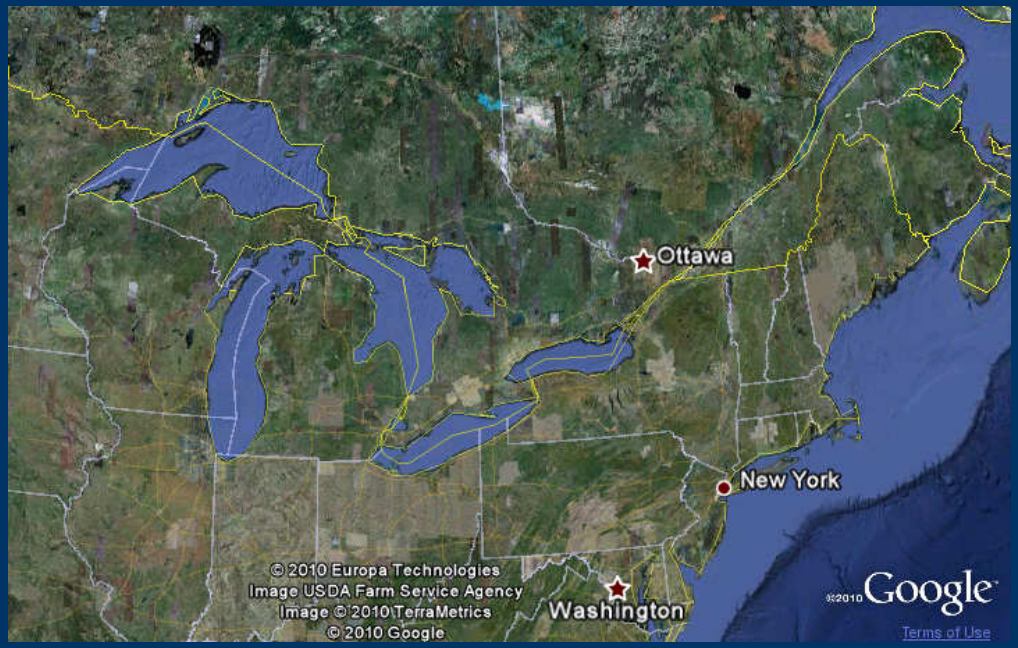
What are we adapting to?

- **Increases in air & water temps**
- **Increased intensity of storm events**
- **Increased drought stress, lake level drops**



Example 1: Jump start with expert opinion

Workshop with regional experts: "BIG LIST"

- *What are the key impacts & opportunities to address?*
- *When do we need new or highly modified strategies?*

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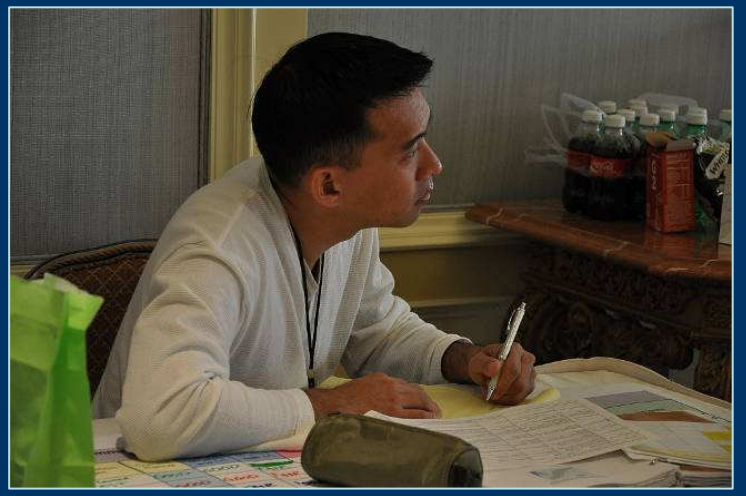
Top four concerns for protecting aquatic biodiversity:

- Increased storm volume & intensity will increase non-point source pollution (agriculture, stormwater…).
- Drops in lake levels will stress coastal systems, expose new land and drive changes in coastal margin land use.
- Increased drought stress and lake level drops will increase extraction pressure.
- Climate change will drive changes in human land use that will threaten more intact northern systems.

Example 2: Work with peer groups using a common framework

TNC's Climate Clinic

- 20 conservation projects
- 150 participants
- Shared plan format



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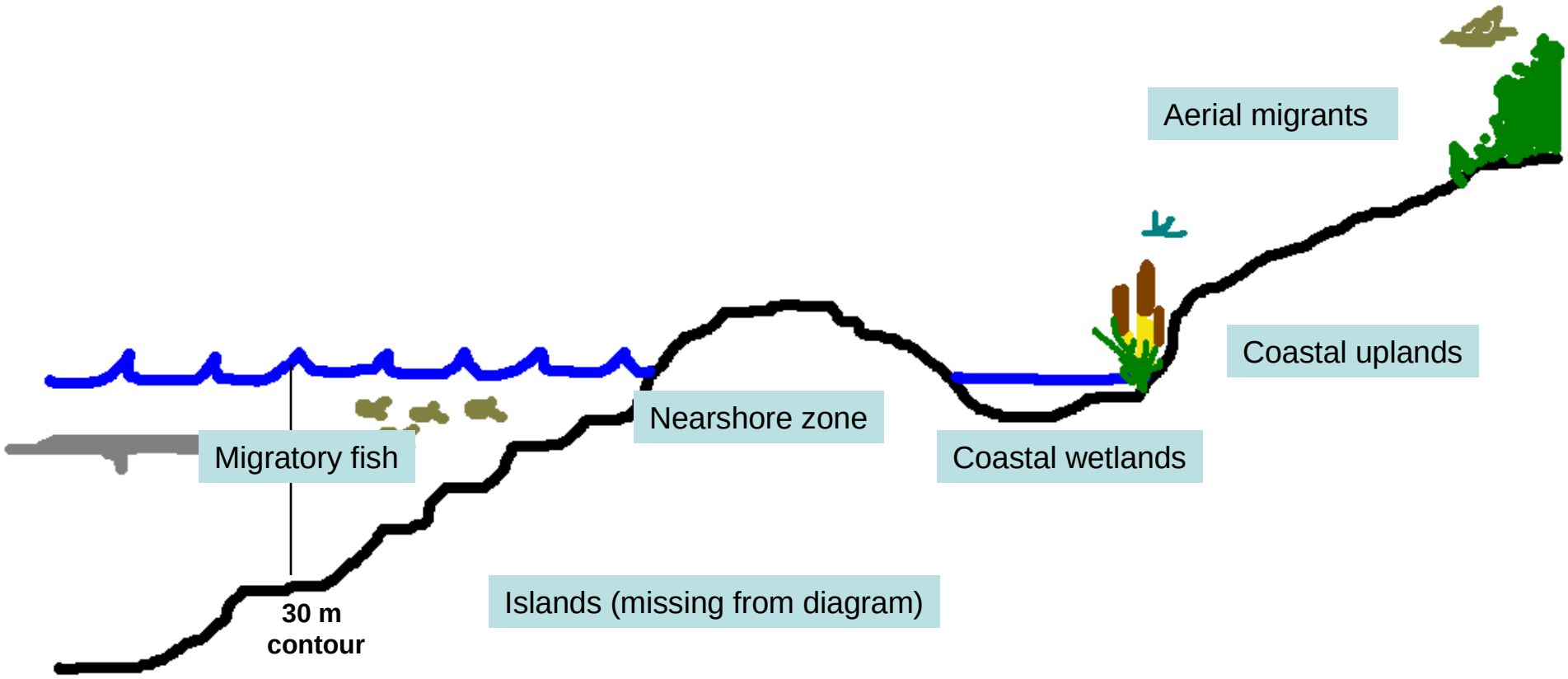
Approach

- Estimate exposure to climate change
- Evaluate sensitivities/impacts
- Create system diagrams
- Create and revise “hypotheses of change”
- Evaluate conservation strategies



Lake Ontario/Huron Ecosystem (North America, Great Lakes)

Coastal wetlands

Reduced ice cover

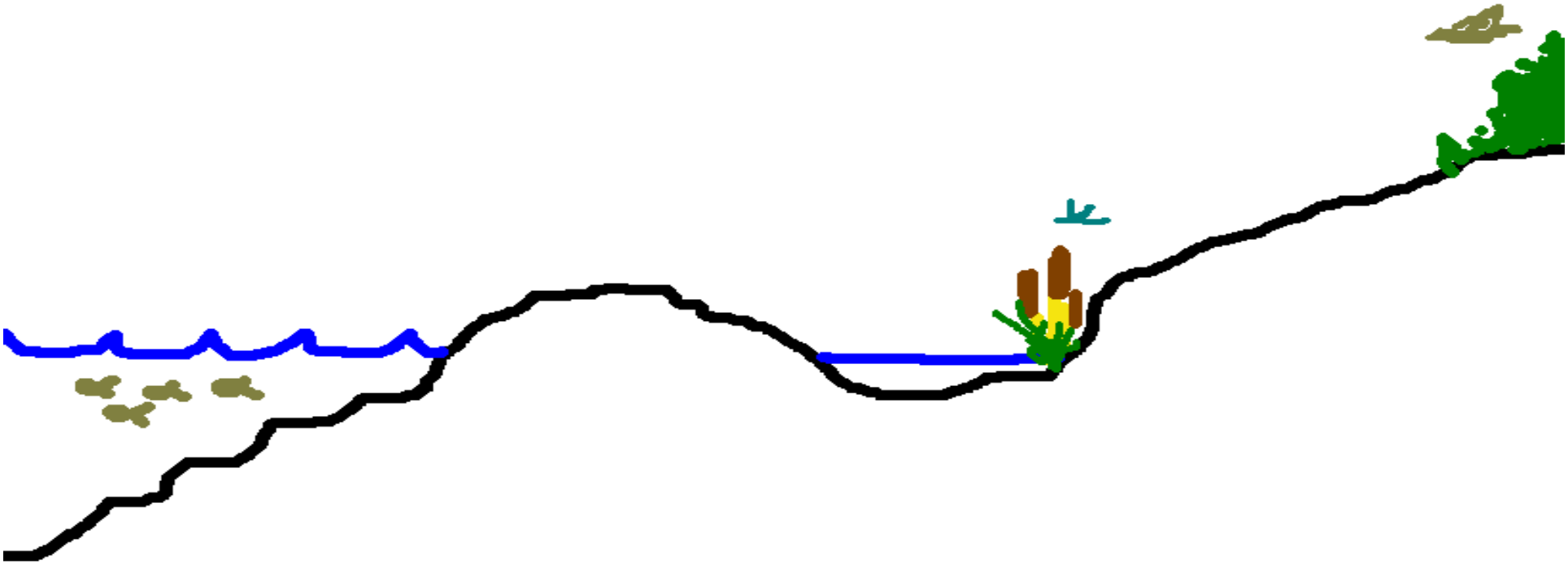
Changes in wind

Lake level drop

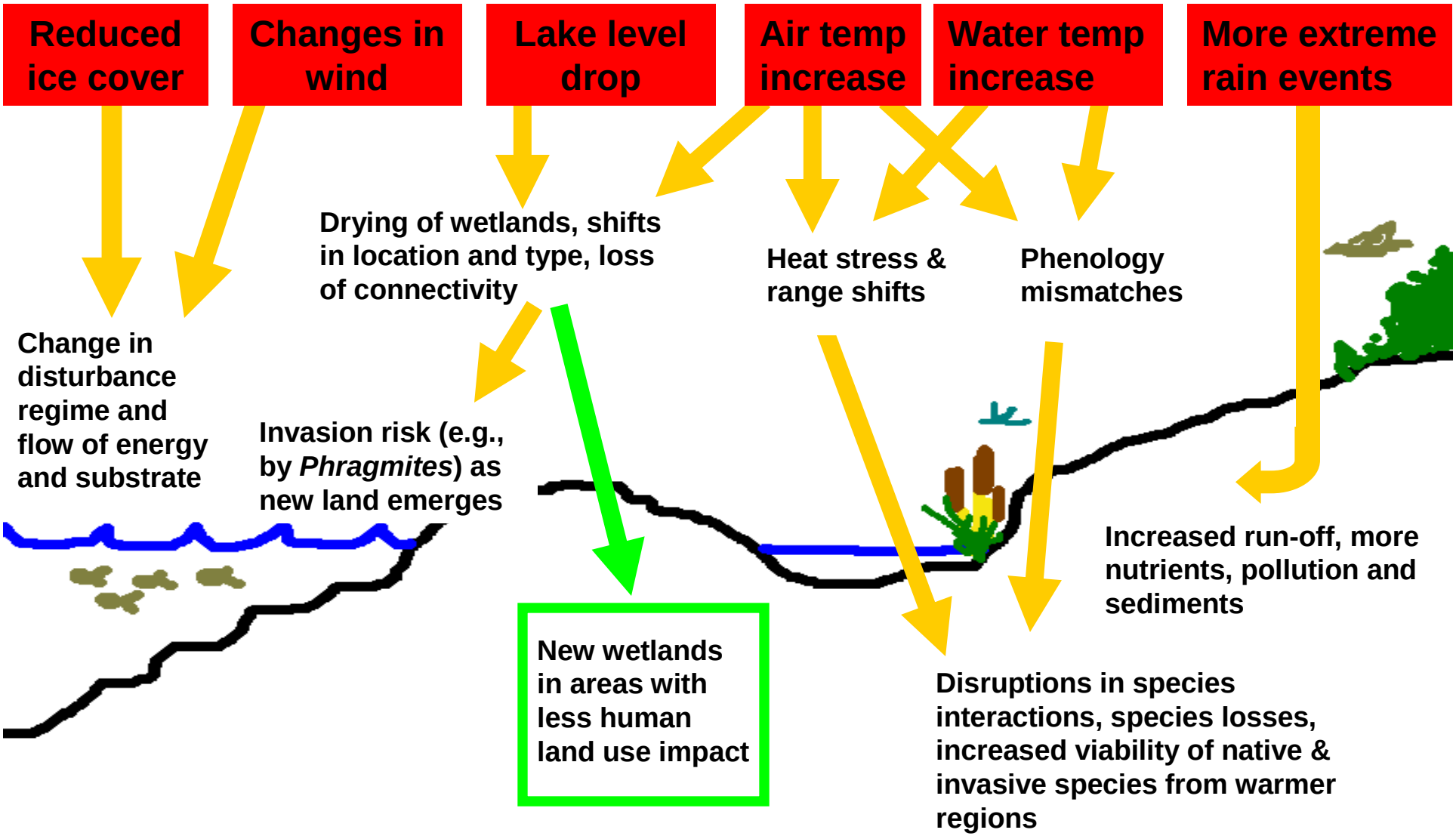
Air temp increase

Water temp increase

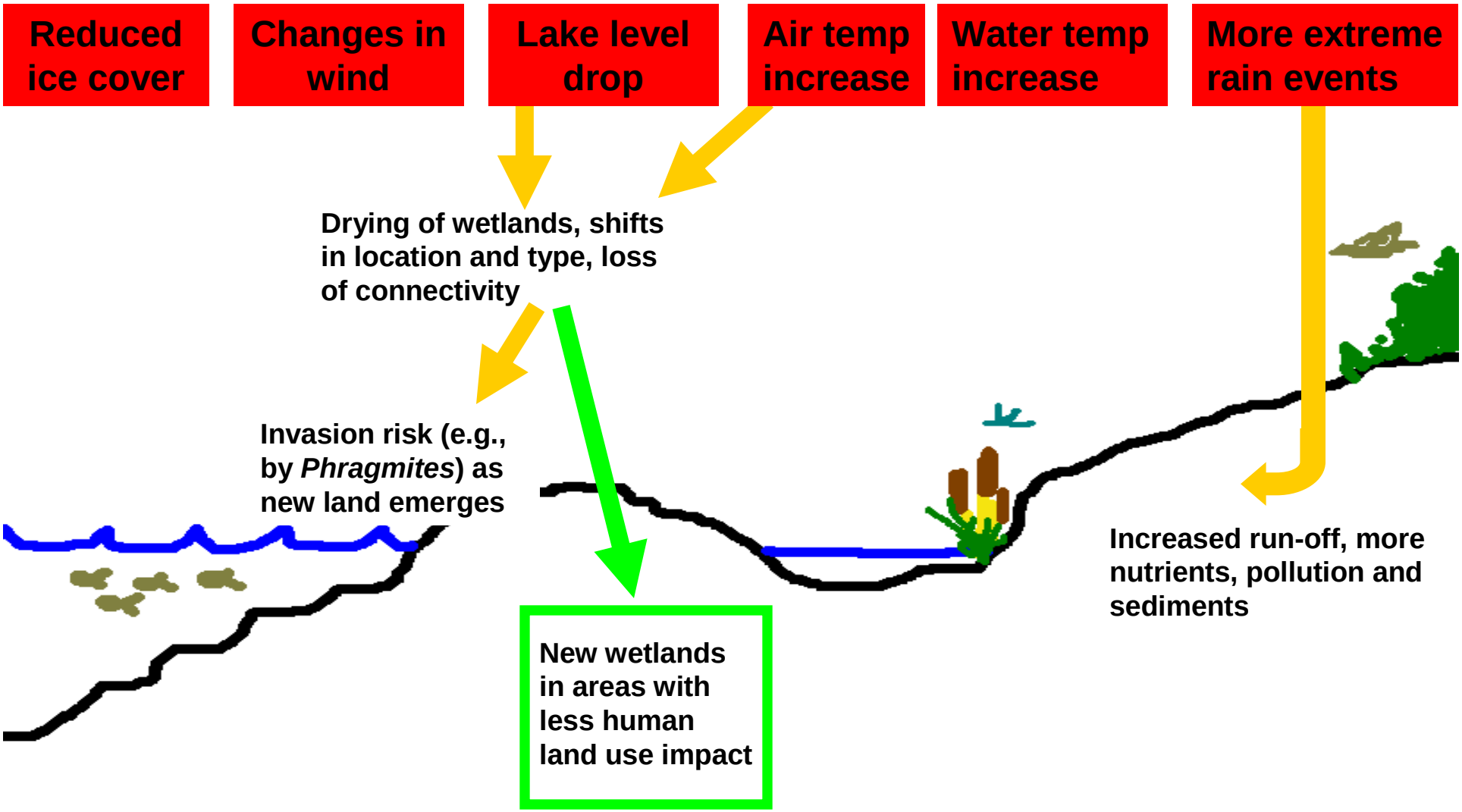
More extreme rain events



Coastal wetlands



Coastal wetlands



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Focal hypothesis of change 1

HoC: Increased temperatures

→ increased evaporation

→ lower lake levels

→ loss of coastal wetlands

Outcome: new strategies focused on water level regulation (Great Lakes Compact)

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Focal hypothesis of change 2

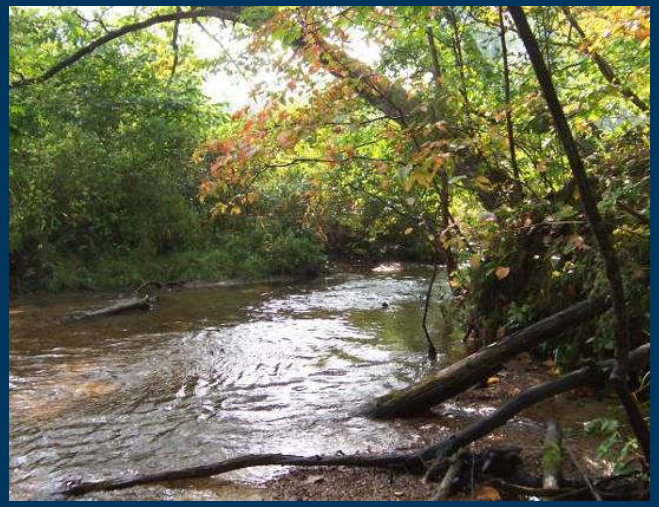
HoC: Increasing extreme precipitation

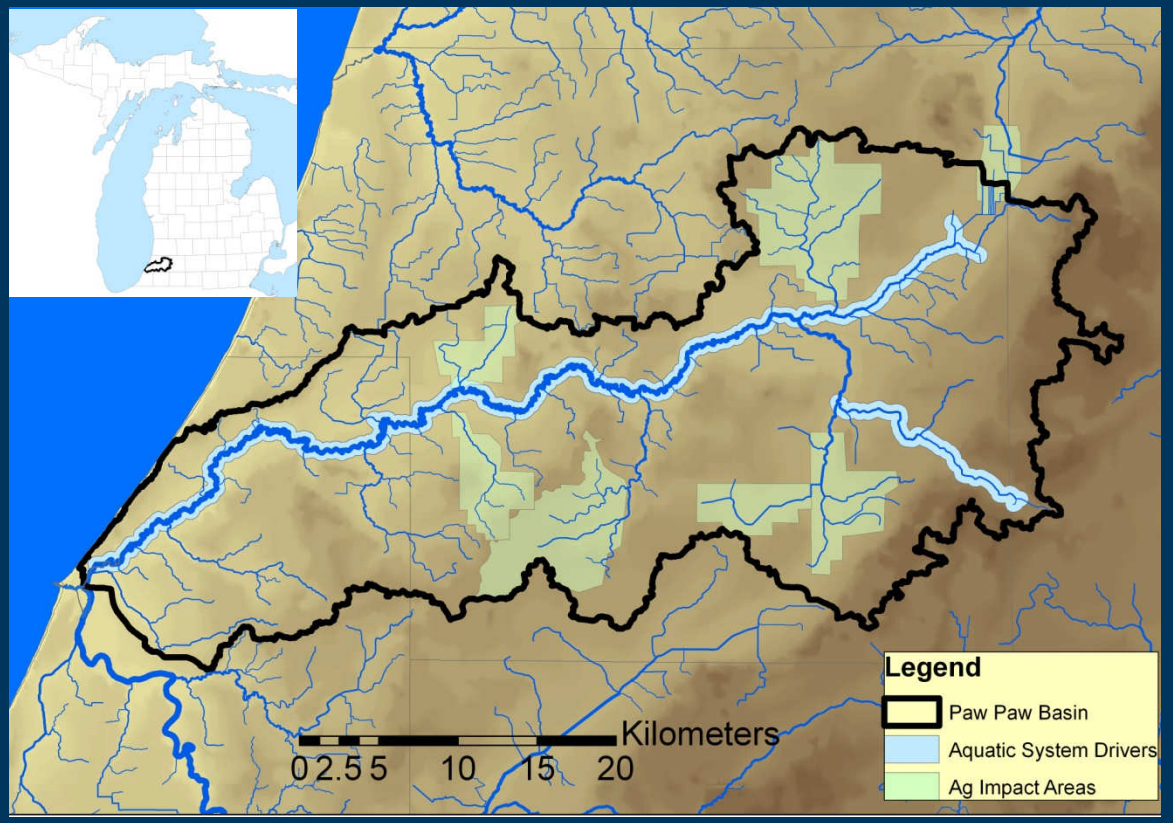
- → **increased run-off**
- → **increased sediments and nutrients in nearshore from farms**

Outcome: test & revise current agriculture-focused strategies – are they robust and directed at the right places?

Example 3: Testing strategies

- **Freshwater Targets: Paw Paw Mainstem & East Branch**
- **Stresses include sedimentation and altered hydrology**





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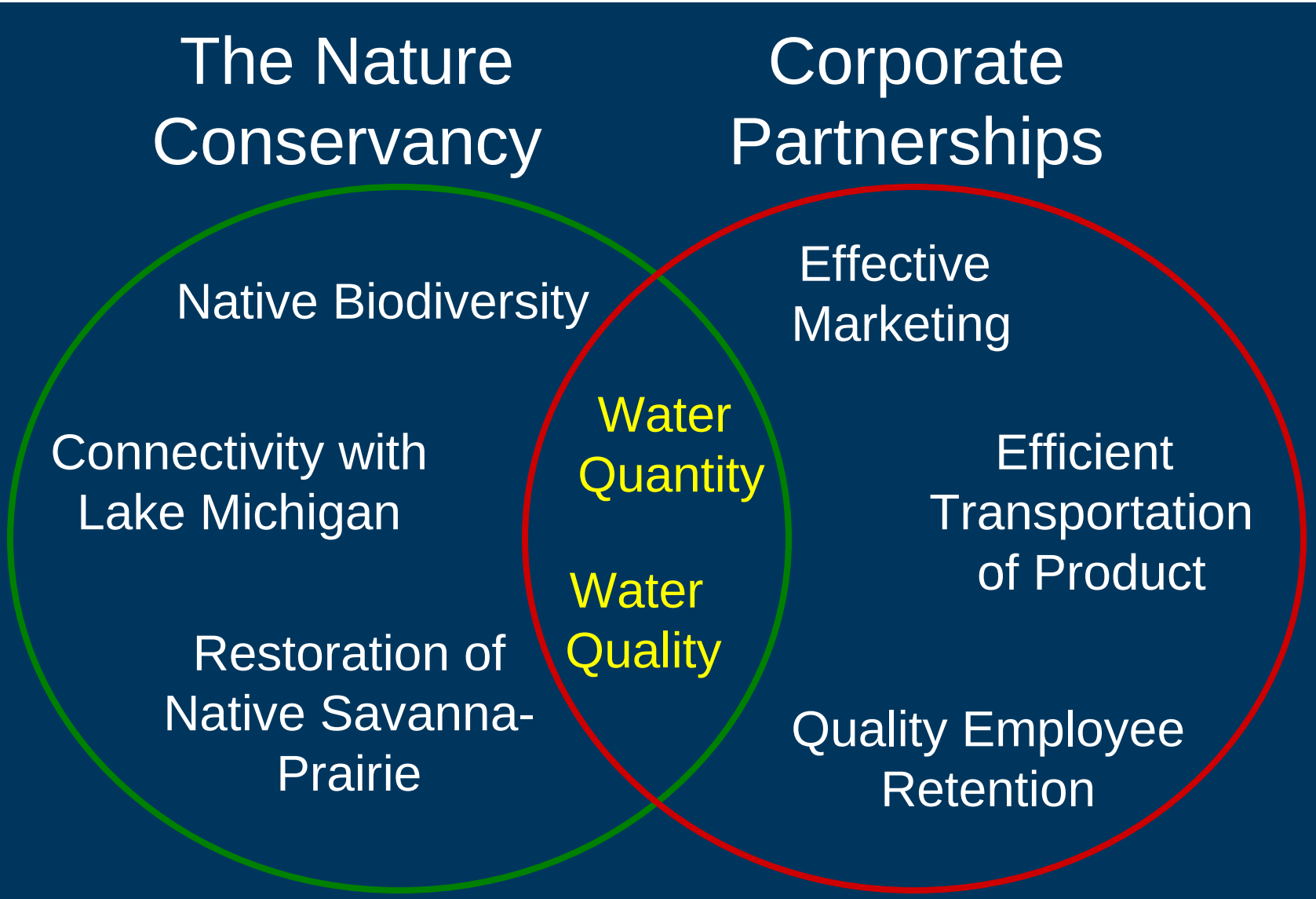
Strategy context



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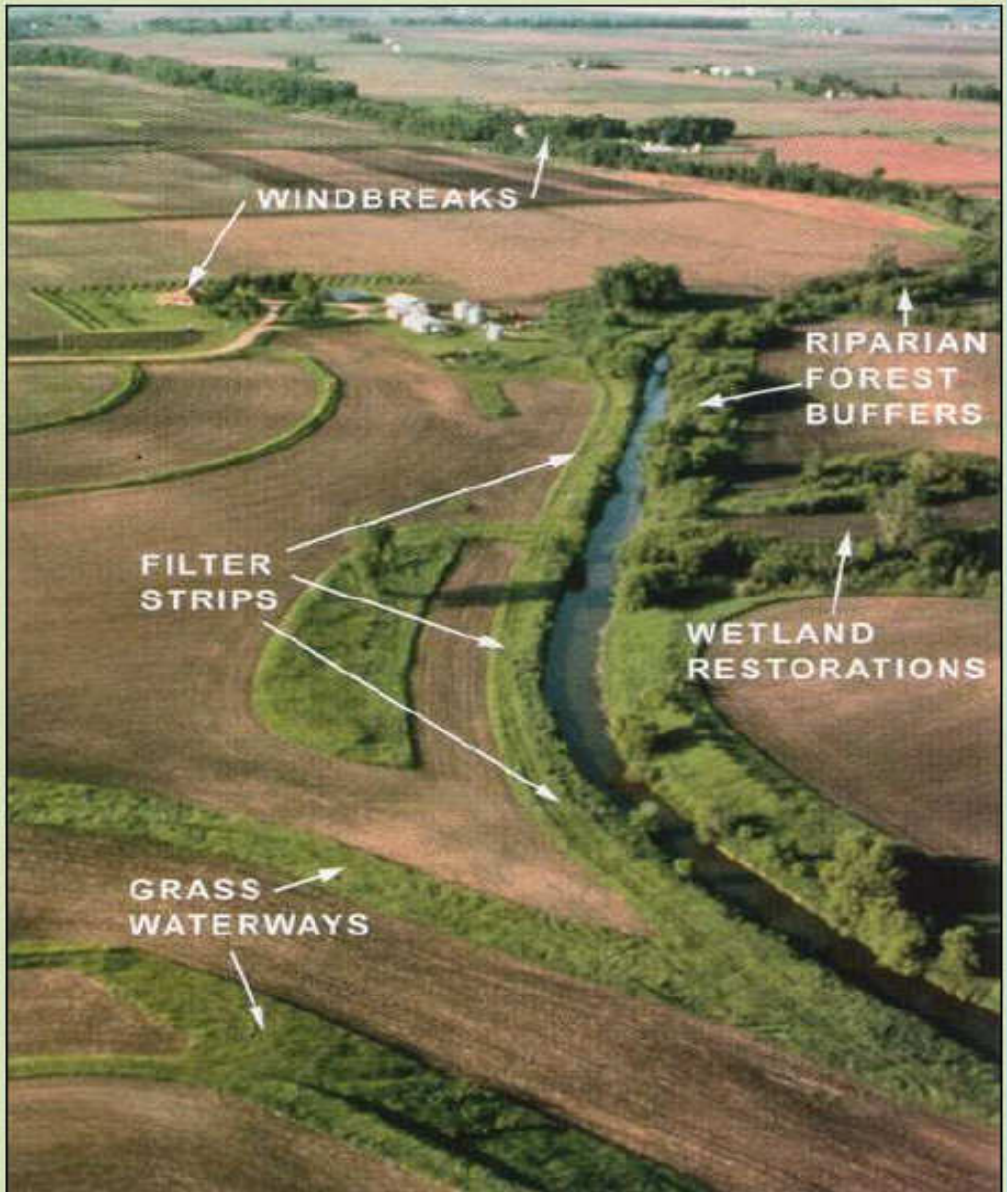
Where do we prioritize investments in agricultural best management practices?



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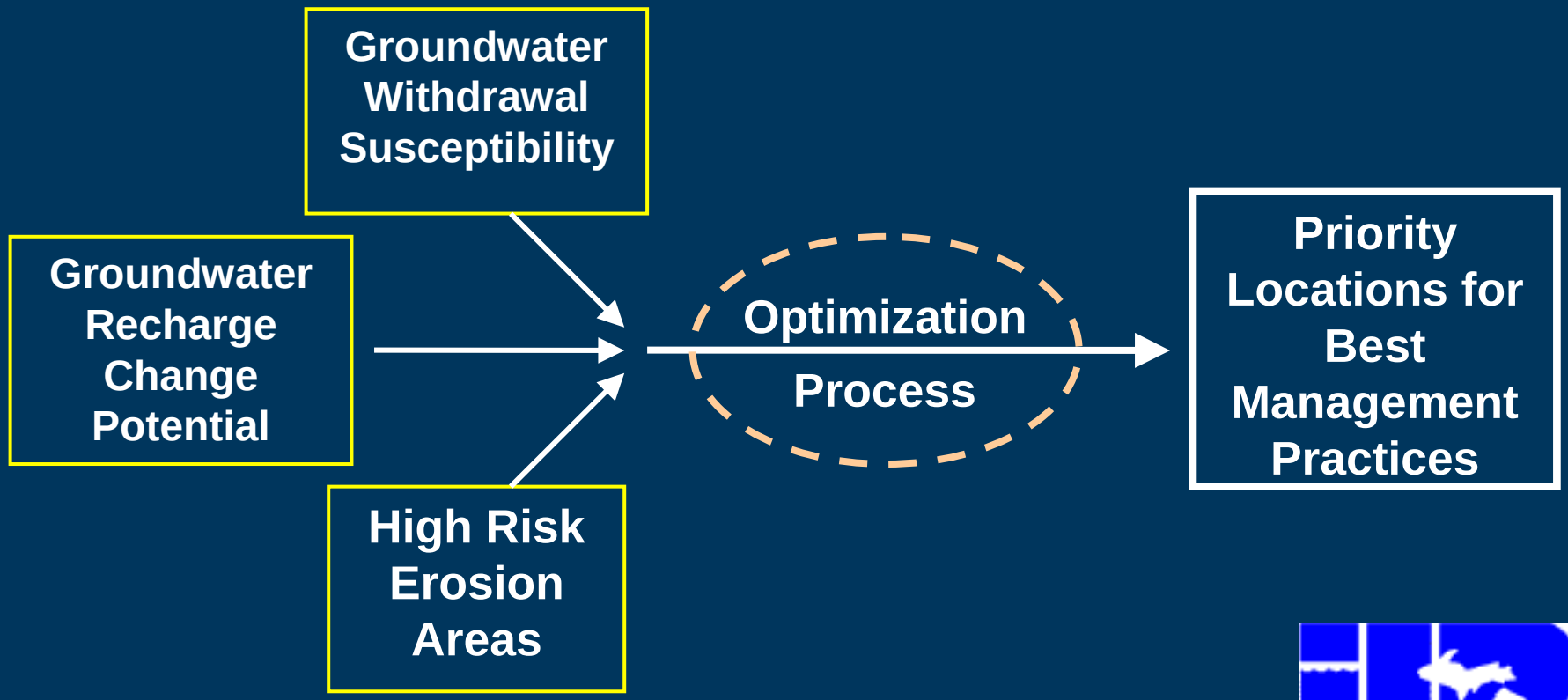
Prioritization of agricultural best management practices



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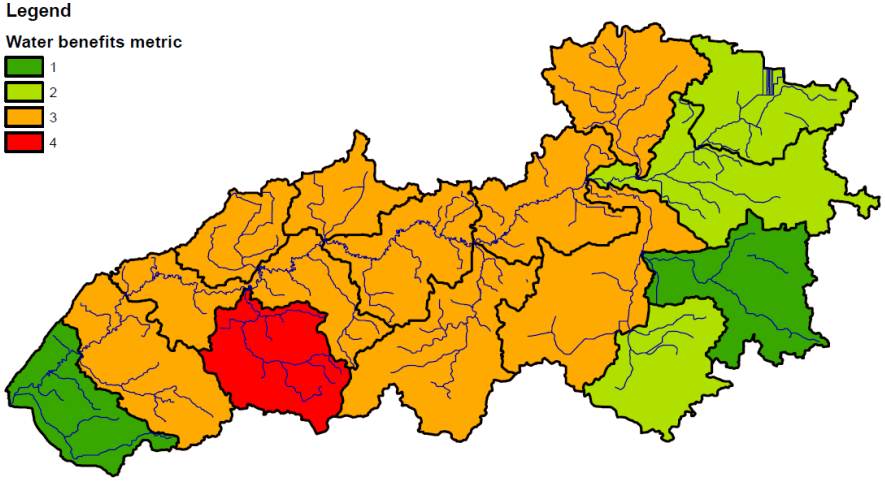
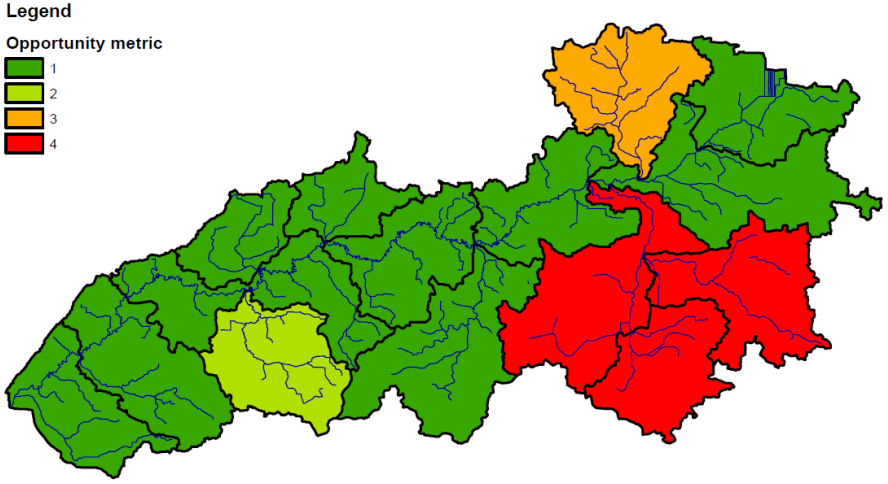
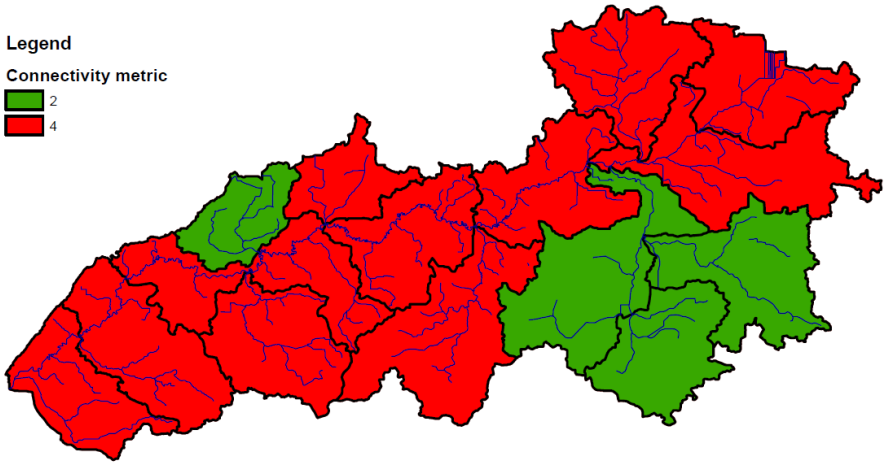
Paw Paw Priority Ag BMP Subwatersheds
Water Quantity and Quality Benefits



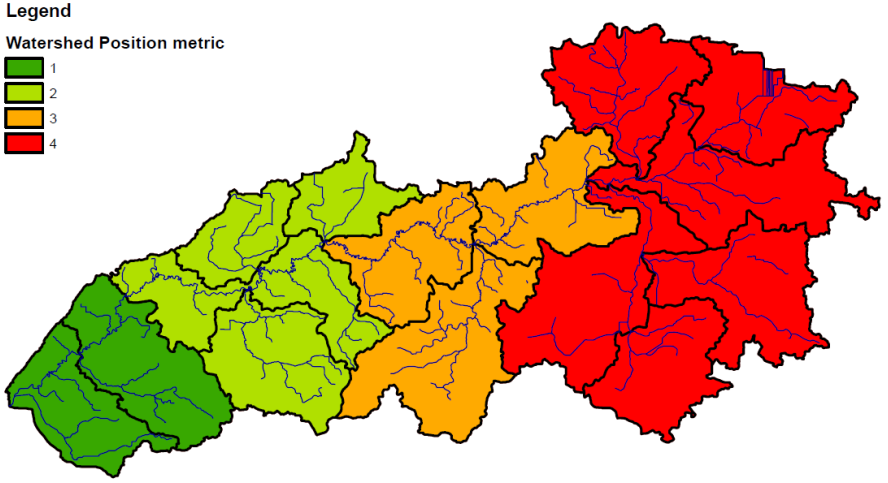
Paw Paw Priority Ag BMP Subwatersheds
Conservation Opportunity



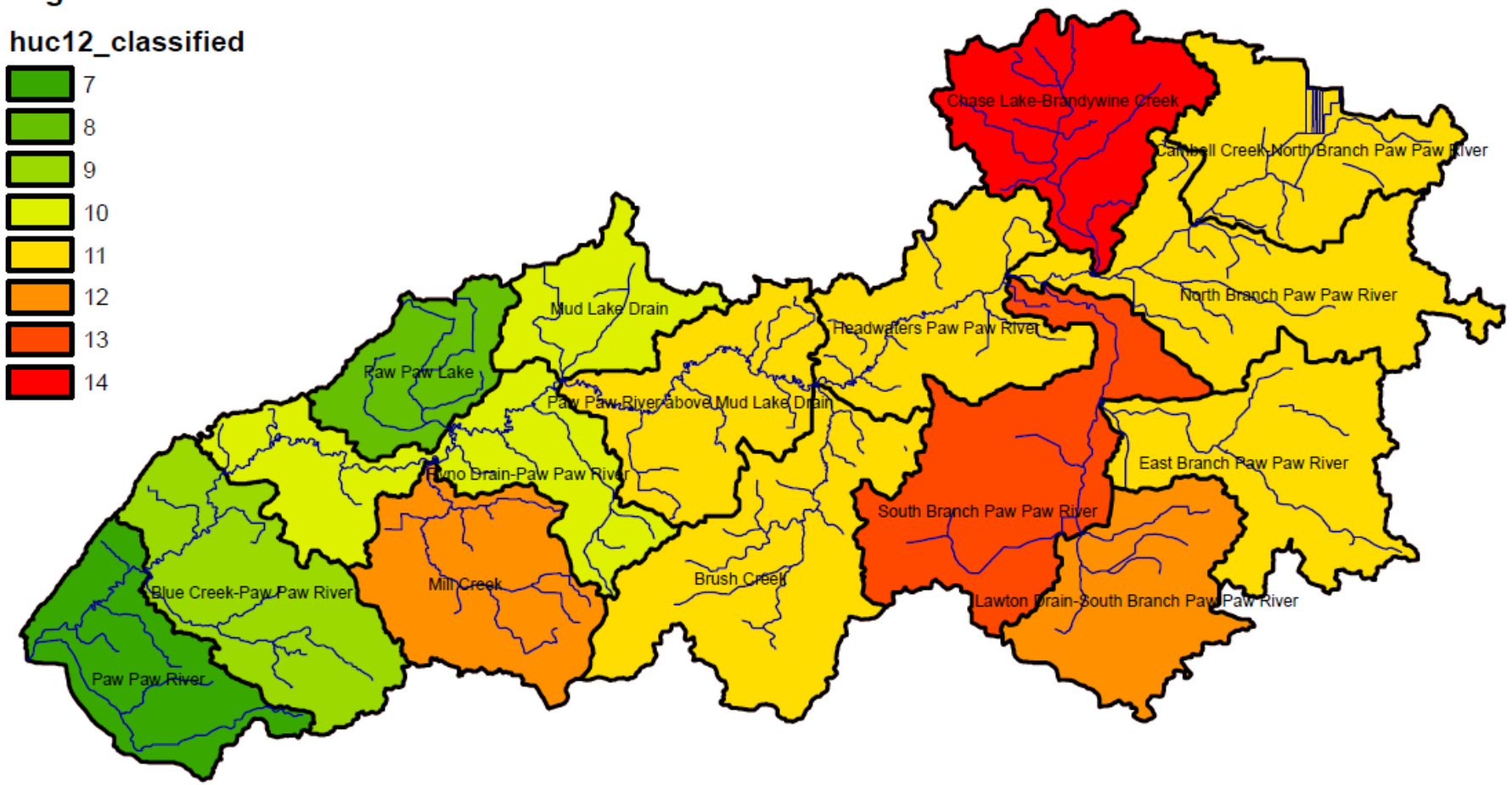
Paw Paw Priority Ag BMP Subwatersheds
Connectivity to Mainstem



Paw Paw Priority Ag BMP Subwatersheds
Watershed position



Paw Paw Priority Ag BMP Subwatersheds
With consideration of potential water quantity & quality benefits, watershed position, connectivity, and opportunity



What's the "savvy" score?

- Is the prioritization robust to climate change?
  - Changes in run-off
  - Changes in freeze-thaw patterns
  - Lengthening of growing season…
- Can we promote more BMPs by helping farmers adapt?
- Can we engage more businesses and apply the approach in other watersheds?

NatureServe

Climate Change Vulnerability Index

Steve Young

Bruce Young, Elizabeth Byers, Kelly Gravuer, Kim Hall, Geoff Hammerson, Alan Redder, Kristin Szabo

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Target audience: Wildlife Action Plan teams

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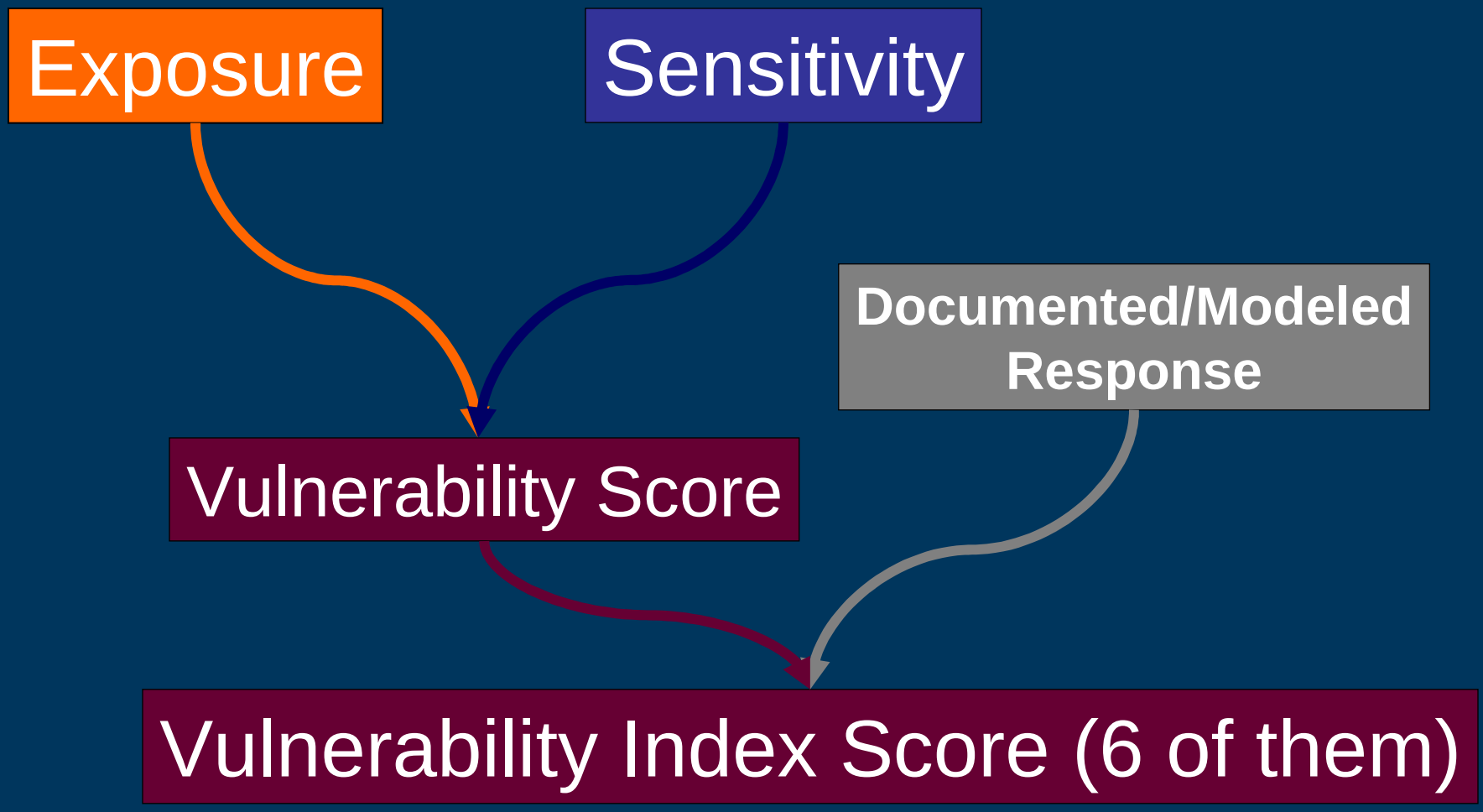
How the CCVI works:



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A great way to learn…..

Section C: Sensitivity *(Generally applies across the range of a species)*

Mark an "X" in all boxes that apply.

Effect on Vulnerability							Factors that influence vulnerability *(* at lea*
Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown	
						X	1) **Dispersal ability**
							2) Predicted **sensitivity to temperature** and **precipi**
							a) Predicted **sensitivity to changes in temperatur**
						X	i) **macro** sensitivity
						X	ii) **micro** sensitivity
							b) Predicted **sensitivity to changes in precipitatic**
						X	i) **macro** sensitivity
						X	ii) **micro** sensitivity
						X	c) Dependence on a **specific disturbance regime**
						X	d) Dependence on **ice, ice-edge, or snow-cover h**
						X	3) **Physical habitat specificity**
							4) **Reliance on interspecific interactions**

Calculator | Results Table | A. Climate Exposure | B. Climate-Indirect | C. Sp-spec | D. Docum | License

Draw | AutoShapes

Currently being used for assessments of "species of greatest conservation need" in IL, WI & IA (WAPS) and for MI coastal species & rare plants.

"Fuzzy Set" Approach from Green Bay

Climate change factors addressed:

AWT: Increasing Air and Water Temperatures

S: Seasonality (Decreasing Winters, Earlier Spring)

PR: Precipitation (Higher in Spring and Fall)

PE: Periodicity of Extreme Events (More Frequent)

LWL: Lower Record and Average Water Levels

SWF: Shifting Wind Fields During Summer from SE

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How will each component influence threats?

Table 5 – Composite Matrix of Team Results

Threat	Climate Change Components					
	AWT	S	PR	PE	LWL	SWF
Agriculture Runoff	1 2 0 0	(-1/+1)1 1 1	2 2 2 2	2 2 2 2	1 0 2 0	1 0 1 0
Inv Species (Carp)	1 2 1 2	1 1 1 1	0 0 0 1	1 0 0 1	0 0 1 -1	0 0 1 0
Residential Development	1 1 1 0	1 1 1 1	0 0 0 2	1 0 -1 2	0 1 2 0	0 0 0 0
Dams and Dikes	0 0 1 0	1 0 0 0	2 2 1 0	2 2 2 -1	1 0 1 0	0 0 0 0

4 teams, 2 = strong increase,
-2 =strong decrease

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Produces a Climate " Weight" for each threat

Table 8 – Weights for Climate Change Analysis

Threat	Weight
Agricultural Runoff	2.3
Invasive Species (Carp)	1.7
Residential Development	1.7
Dams and Dikes	1.8
Invasive Species (Zebra and Quagga Mussels)	1.3
Invasive Species (Phragmites, Buckthorn)	1.5
Transportation Infrastructure	1.5
Urban Runoff	2.3
Industrial Waste	1.5
Sewage Effluent	1.8
Dredging	1.7

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Regional Work on Adaptation

- **Notre Dame "Adaptation Collaboratory"**
- **Update to Chicago Wilderness Biodiversity Recovery Plan (first draft out)**
- **USFS Climate Change Demonstration Forest - Testing a workbook of adaptation tactics for 13 forest associations**
- **NOAA/Sea Grant Coastal Community Adaptation outreach**
- **Great Lakes RISA, Great Lakes LCC, WICCI…**

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Take home messages

Start simple, start where you are – just start!

Learning may be easiest to see if you start by modifying a well-documented plan.

Be alert for opportunities for multiple benefits, and anticipate human responses.

Major opportunity to improve conservation…

- Adaptive management – monitoring!
- Landscape scale
- Regional collaborations

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Acknowledgements

GAYLORD & DOROTHY DONNELLEY FOUNDATION

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