

Climate Change in the Chicago Wilderness Region

Dr. Kimberly Hall

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

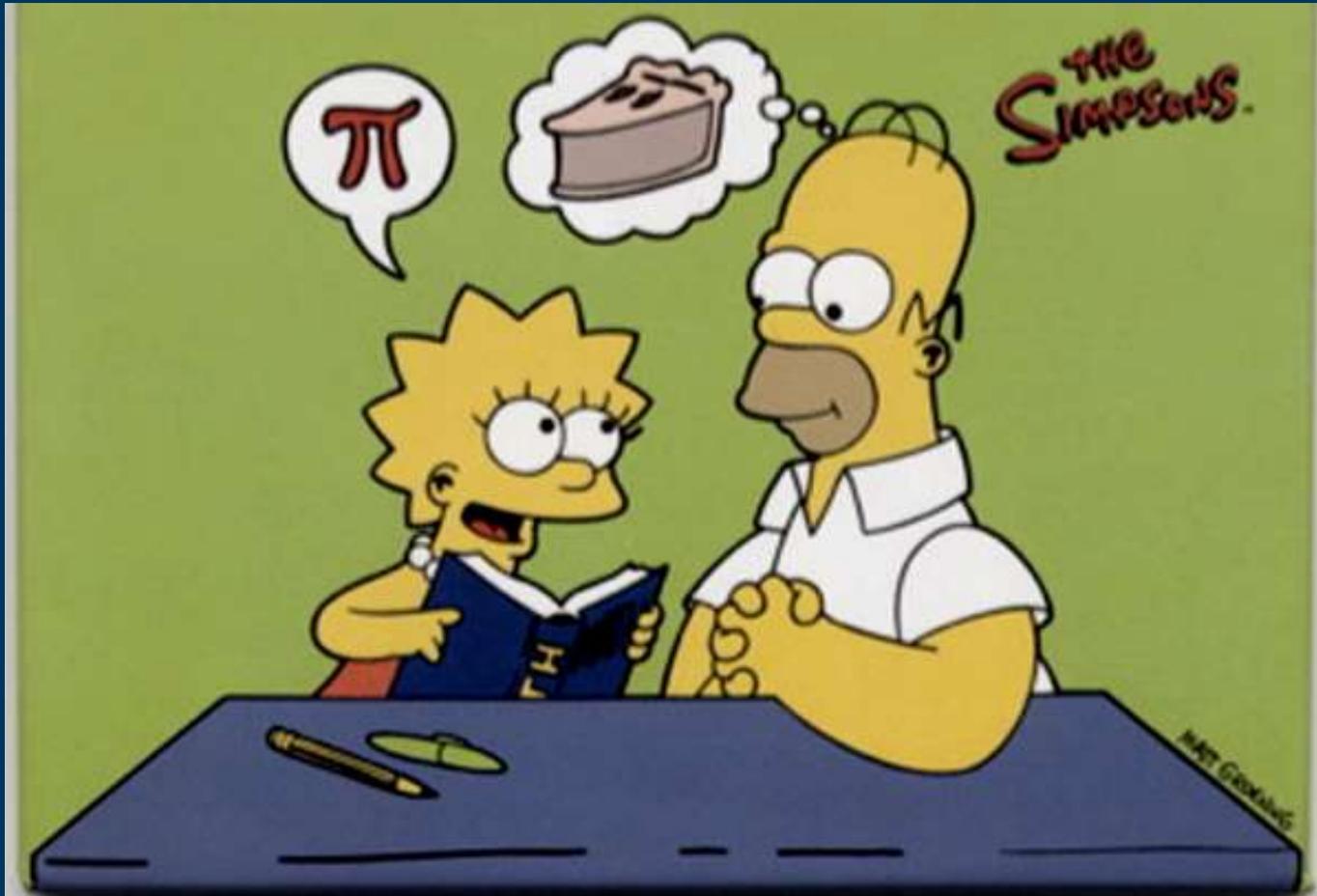


The Nature Conservancy's Mission

**To preserve the plants,
animals, and natural
communities that
represent the diversity
of life on Earth by
protecting the lands
and waters they need
to survive.**



Terminology...



Mitigation and Adaptation

Mitigation – Reduce the build up of greenhouse gases in the atmosphere and slow the rate of climate change.

Adaptation – Adjustments in human or natural systems that promote persistence/function under changed climatic conditions.

CC threatens many species and systems, and interacts with key stressors.

Protect our investments and avoid wasting resources.

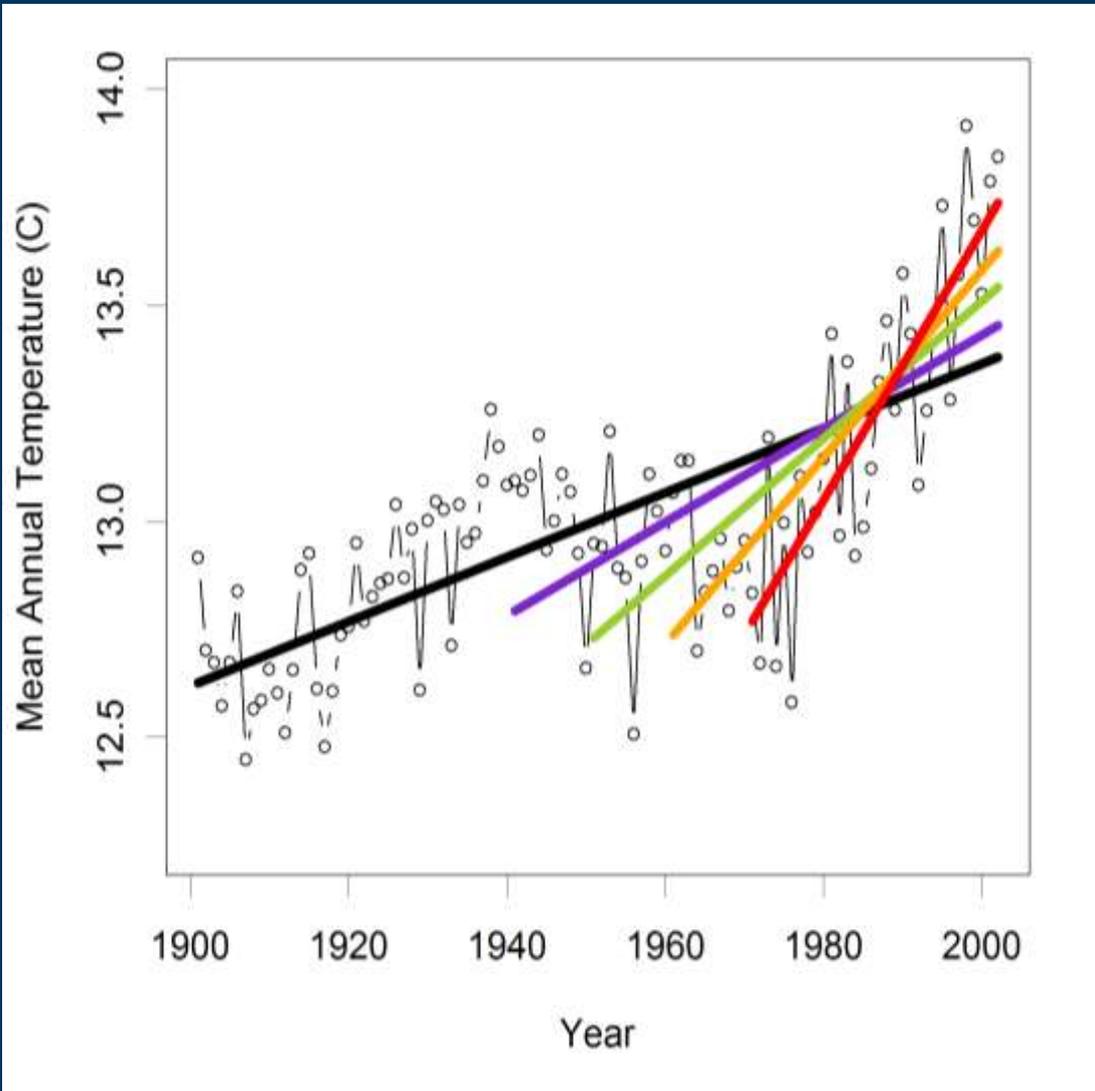
Goals: Anticipate impacts AND human responses in time to act. Find “Win-Win” solutions that benefit humans and nature.



Roadmap

- Climate change overview.
- What changes in species have been observed/predicted?
- How do we assess vulnerability?
- How do we update conservation?

Key concern: *The RATE of change*



Start year:

1901

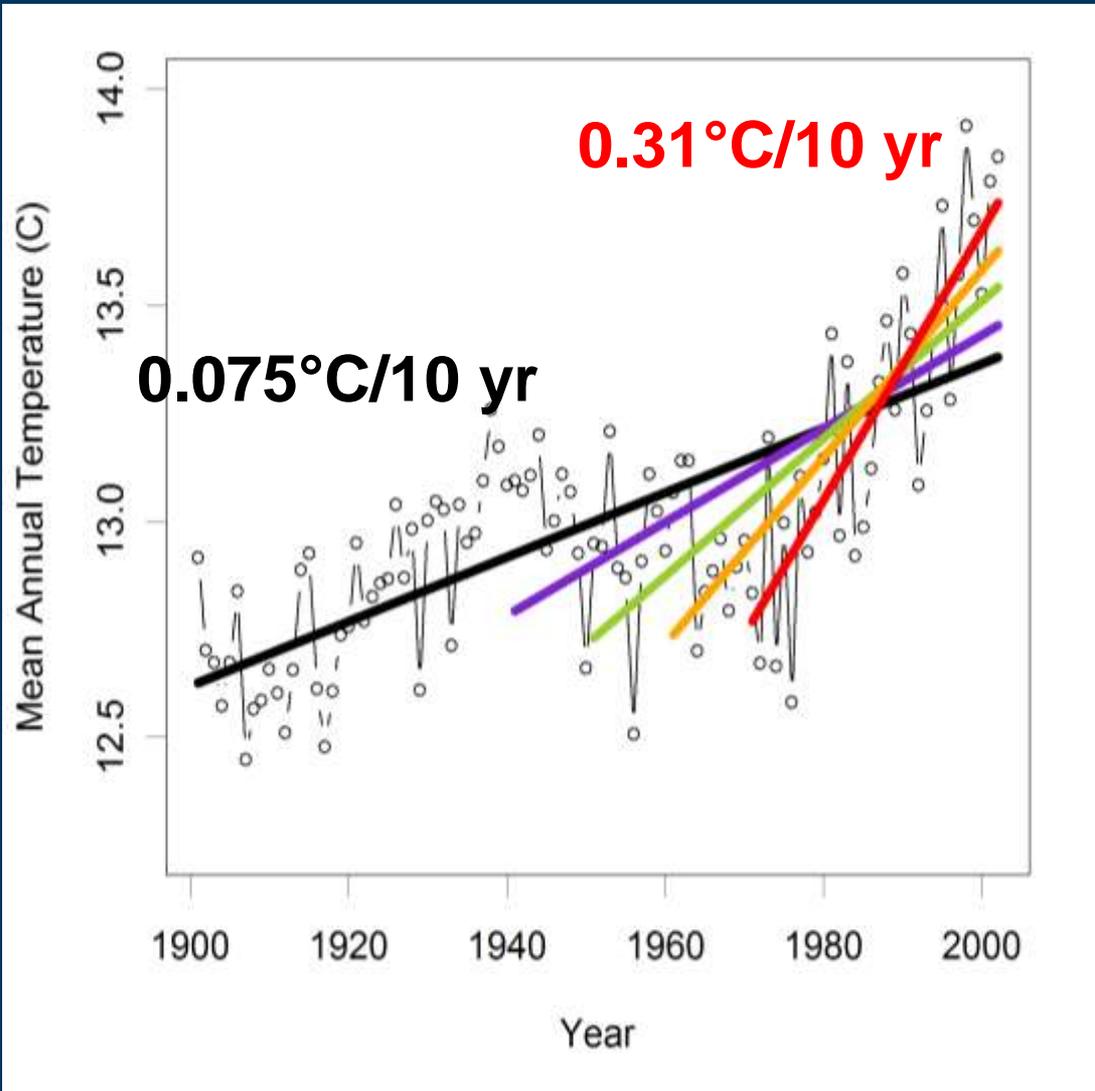
1941

1951

1961

1971

Key concern: The RATE of change



Start year:

1901

1941

1951

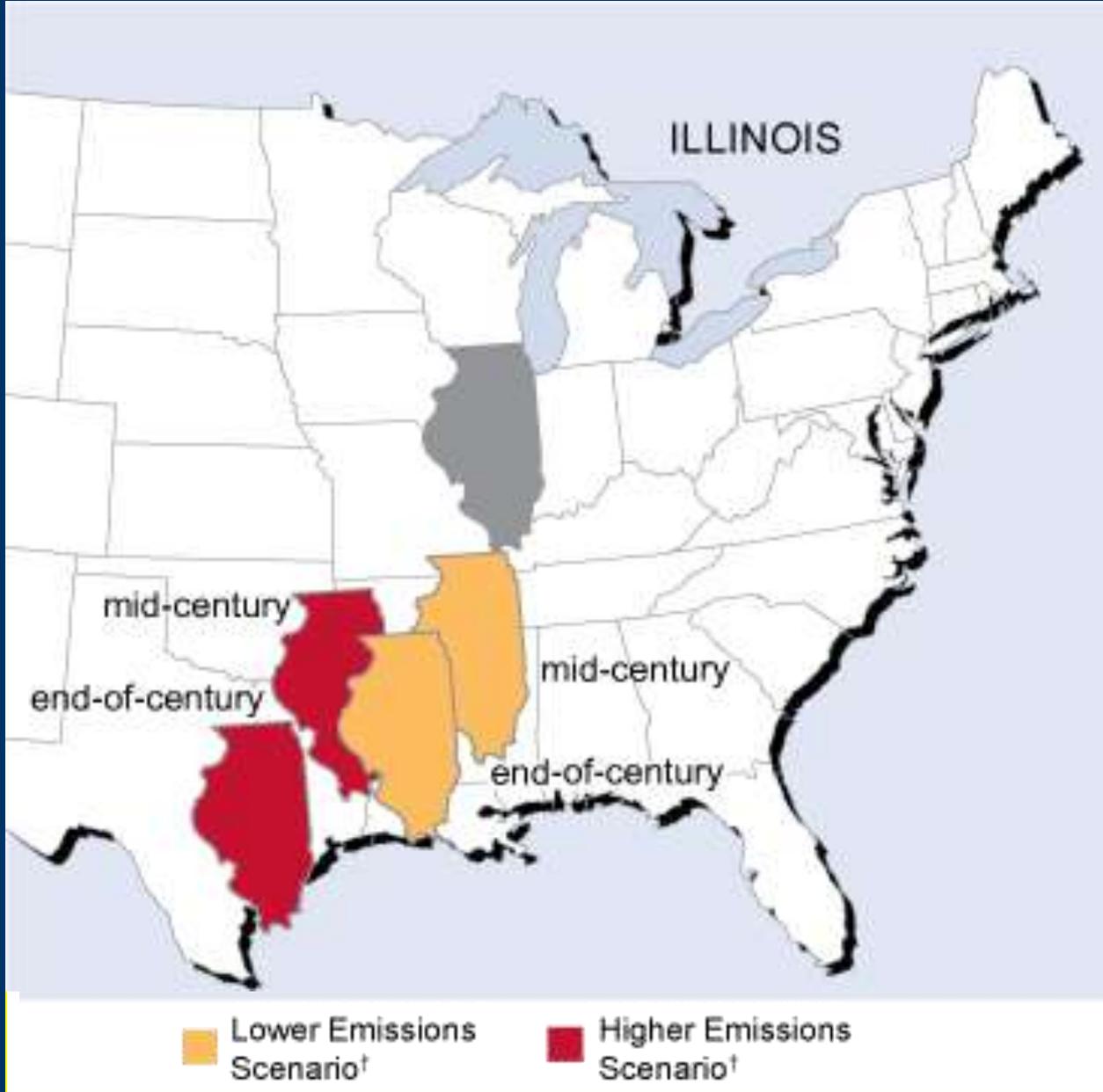
1961

1971

What are we adapting to?

Temperature (average):

- **+ 3.6 - 4.2 °C (6.5 – 7.6 °F) by 2080**
- **Most increase in winter min & summer max**
- **More extreme heat events**
- **Longer growing season (week since 1950s)**



US National Assessment 2009;
courtesy of D. Wuebbles

Regional changes in precipitation

**More rain in winter/spring
(high uncertainty).**

**Increases in extreme
rain events (+30%),
drier periods in between.**

**Flooding; more runoff
from farms & urban areas
into freshwater systems**



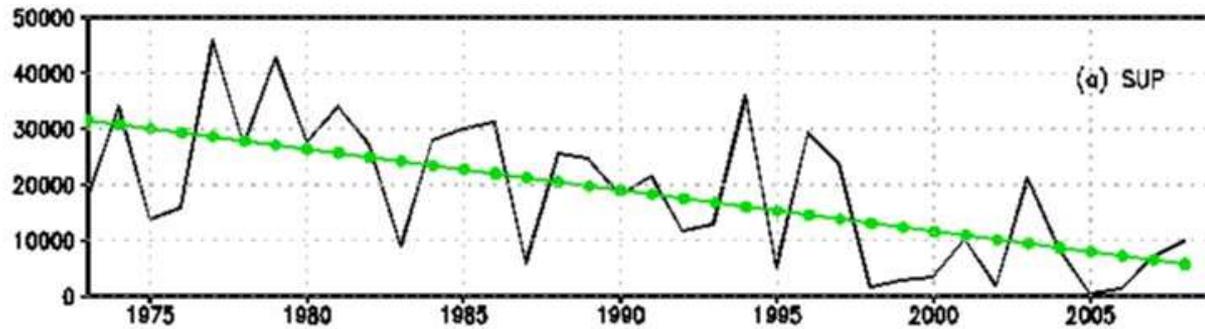
Regional changes in precipitation

For most models, higher temperatures override any increases in precipitation:

- **Increases in drought stress**
- **Changes in flow regimes**
- **Increased fire risk**
- **Great Lake level declines**

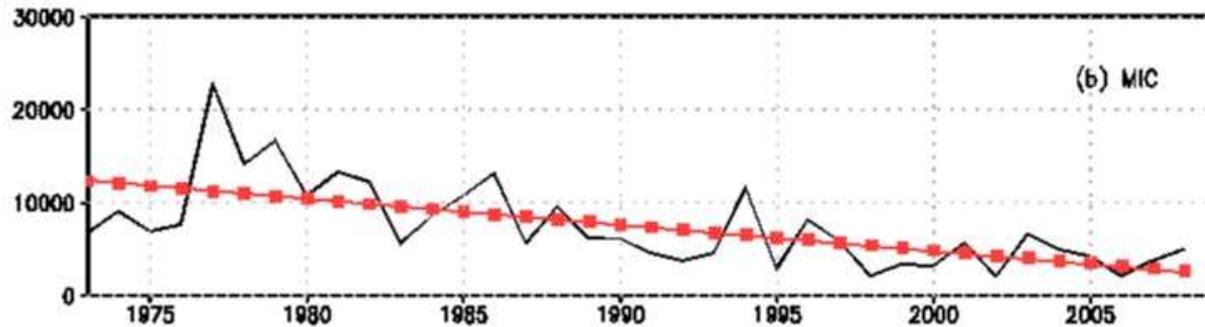


Upper Lakes Ice Cover, 1972/73 - 2007/08

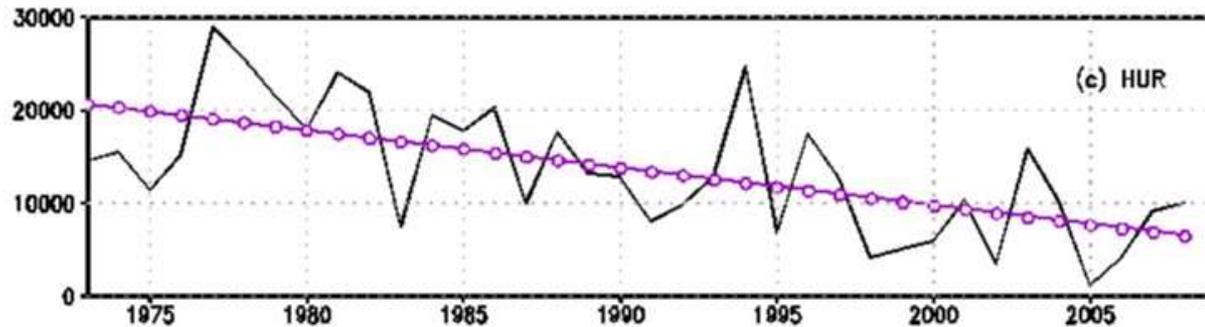


Wang et al.
2009, in prep
(NOAA
GLERL)

-2.34%
per year



-2.25%
per year



-1.98%
per year

Figure courtesy of Dr. Jia Wang, NOAA/GLERL

Lake changes (July – Sept), 1979-2006

	Air T (°C/10 yr)	Surface Water T (°C/10 yr)	Start of Strat. season (days/10yr)
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Superior	0.8 - 1.4	1.0 - 1.6	4.2 - 7.3
N. Michigan	0.7	0.8	5.8
S. Michigan	0.4	0.5	14.0

Changes in winds and currents

Reduced air/water temperature gradient enhances the strength of wind & currents



NASA Earth Observatory

L. Superior summer wind increasing 5% per decade (Desai et al. 2009)

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Temperature and Biology



- Shapes species life histories.
- For insects, reptiles, fish, etc., strongly influences metabolic rate/energy balance.
- Acts as a “cue” for timing of many seasonal events (e.g., insect emergence).
- Influences oxygen levels in water

Species responses & concerns



© Roy
Ann Sim



**Source: Price
and Glick 2002**

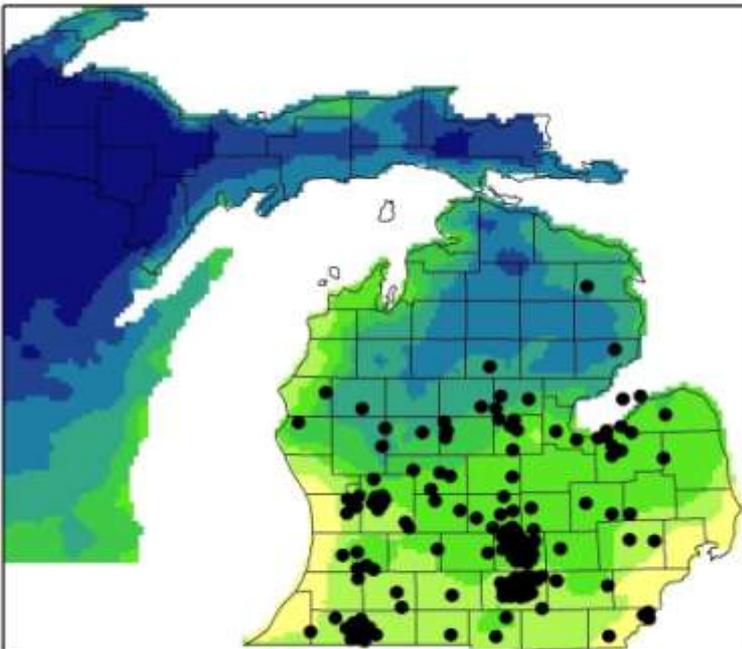
- Range shifts & lack of connectivity
- Phenology (timing) shifts & mismatches



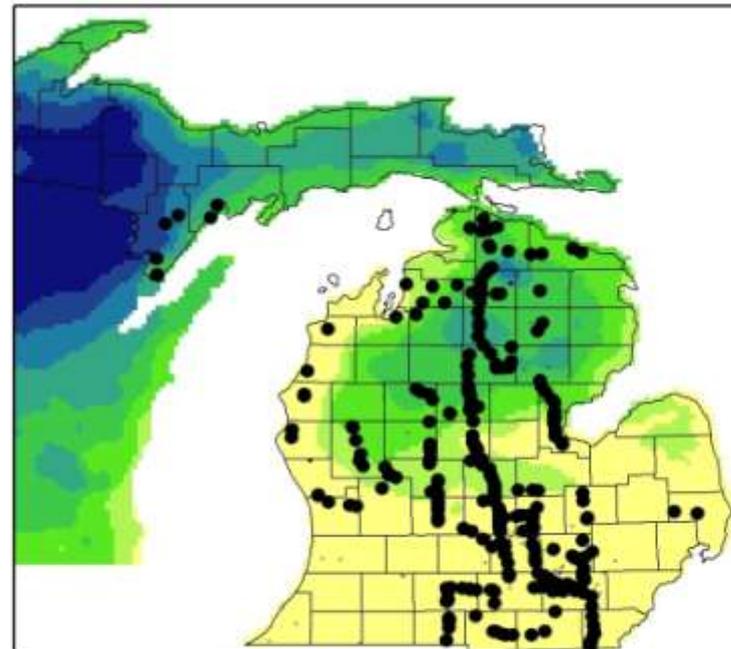
Changes in species' ranges



Min Winter Temp
(degrees C)



1968



2006-2008

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



American elm (*Ulmus americana*)

Model Reliability: ● (Medium)

Abundance Change Maps by GCM Scenario

Importance value maps under five climate scenarios and two emission levels. You can also animate the scenarios to visualize change.

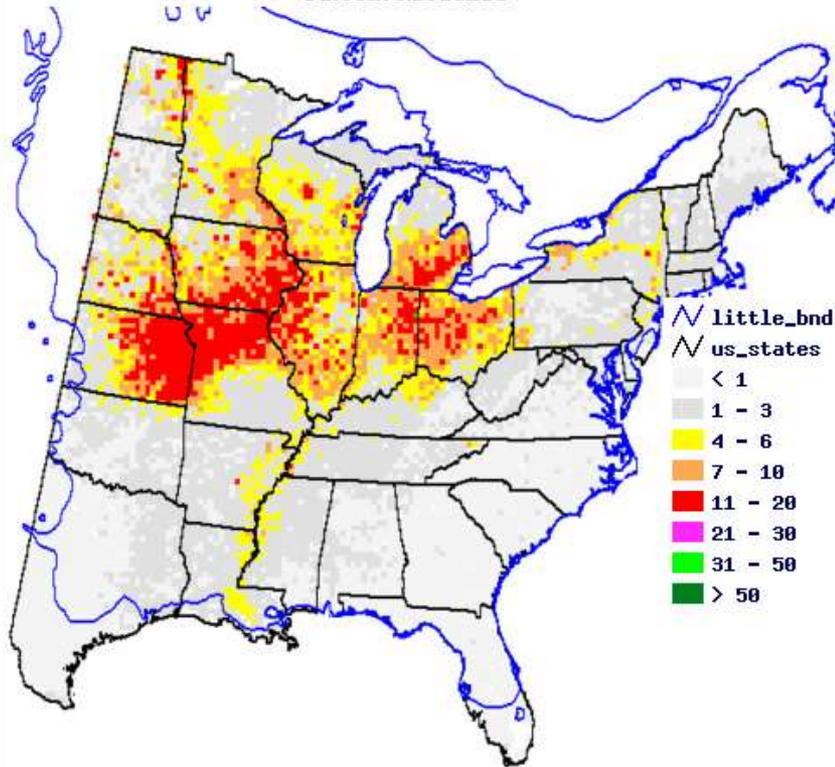


[Animate Scenarios](#)

Climate Scenario Menu

Choose Climate Scenario from Menu

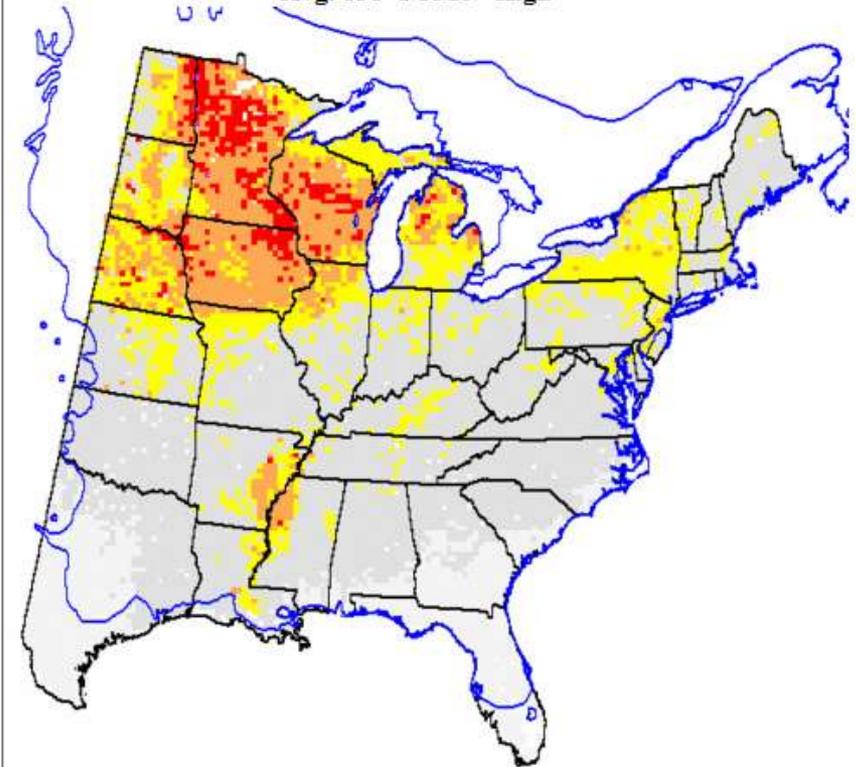
Current Modelled



Climate Scenario Menu

Choose Climate Scenario from Menu

Avg. of 3 GCMs - High



'Vine that ate the South' has landed in the Great White North



The perennial and invasive kudzu vine moves quickly, stretching across the countryside and engulfing trees, fences and homes

**Kudzu on a bluff overlooking Lake Erie,
near Leamington, Ont (September 24, 2009)**

Photo: Sam Brinker/Ontario Ministry of Natural Resources

Phenology – contribute data!

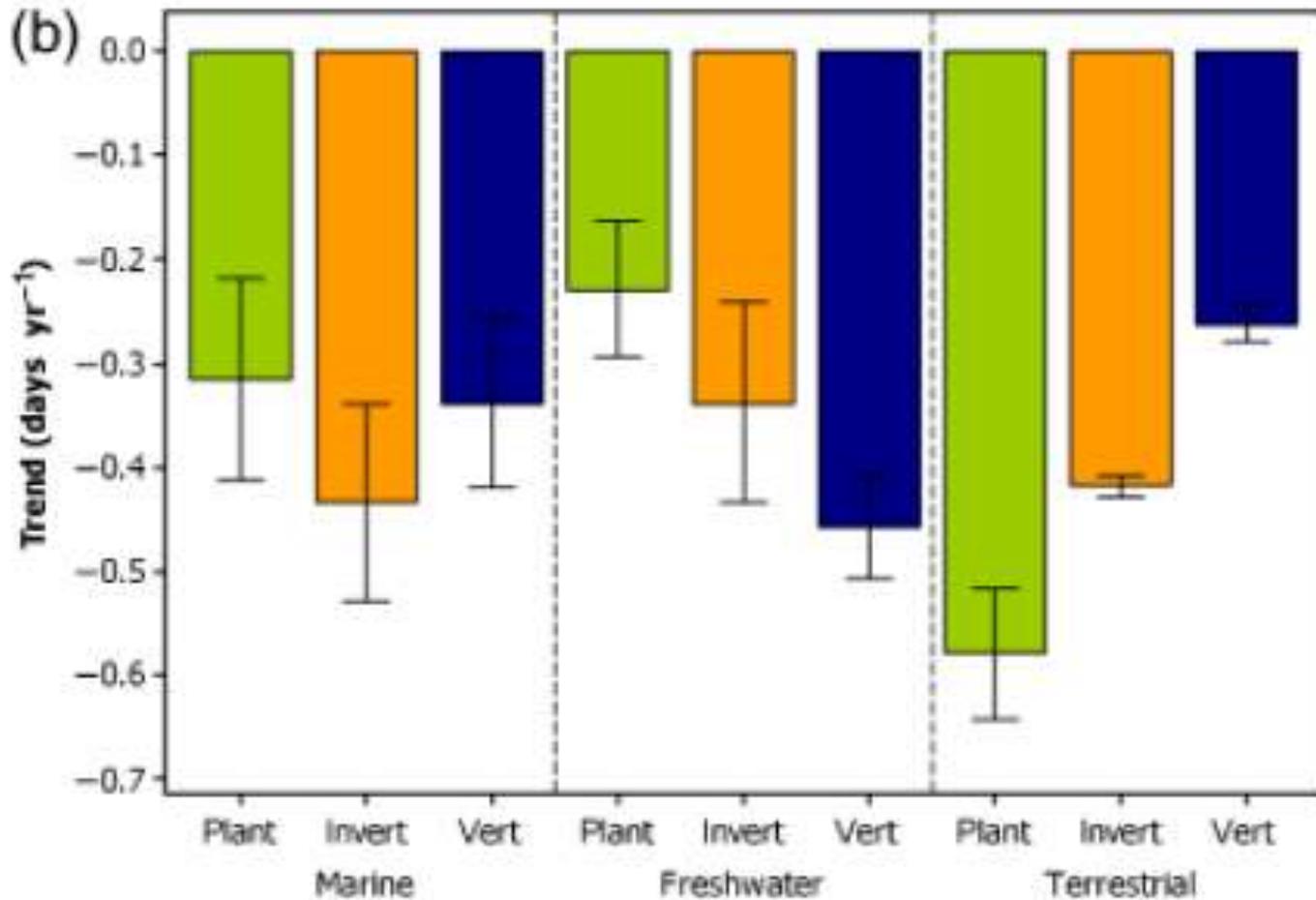
The screenshot shows the Project BudBurst website. At the top, the title "Project BudBurst" is displayed in a large, white, cursive font. To its right, the tagline "Timing is everything!" is written in a smaller, white font. Further right, there are links for "REGISTER | LOGIN" and a "Welcome guest" message. Below the title and tagline, there are three main images: a field of orange poppies, a close-up of blue flowers, and a close-up of white berries. A navigation bar below these images contains six colored buttons: "About BudBurst" (red), "Get Started!" (blue), "Plant Resources" (orange), "Phenology" (green), "View Results" (yellow), and "Report Observations" (purple). Below the navigation bar, there is a section with a "Choose a plant ..." dropdown menu, a "Visit Our Blog" button, and a "Go Mobile" button. The text "Help us track plants through the seasons" is overlaid on the right side of the main images.

www.neoninc.org/budburst

The screenshot shows the USA National Phenology Network website. At the top, the text "National Phenology Network" is on the left and "The Pulse of Our Planet" is on the right. Below this is the "USA npn" logo, with "National Phenology Network" written underneath. A navigation bar contains buttons for "Home", "About NPN", "Participate", "Products", "Education", "Data", "Archive", and "Log In to My NPN". The main content area features the heading "USA National Phenology Network" and a row of ten small images showing various natural phenomena: a bee, autumn trees, red flowers, a butterfly, a bird on a nest, yellow flowers, a bird, a flower, a dragonfly, and a bird. To the right of this row is a "What's New...?" section with the sub-heading "...at USA-NPN" and several links: "Twitter Phenology", "NPR Science Friday Interview", "Coming soon! The USA-NPN Wildlife Phenology Program", and "Co-Founder of USA-NPN Receives Top Honor". Below the row of images, there are three links: "What is the USA-NPN?", "What is phenology?", and "Join us!". The text "Photo credits" is visible at the bottom right of the image row.

www.usanpn.org

Phenological mismatches



Phenology and extreme weather



“Easter freeze” of 2007 across East & Midwest.

- Lower frost frequency, but higher damage.
- We can learn from past about “refuges” from impact

Source: Gu et al. 2007 Bioscience

Expect surprises!

Red-eared sliders in Illinois

- Temp-dependent
sex determination
(warmer = more females)

But phenology changed too...



Roadmap

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- What changes have been observed?
- **How do we assess vulnerability?**
- How do we update conservation?

Components of vulnerability

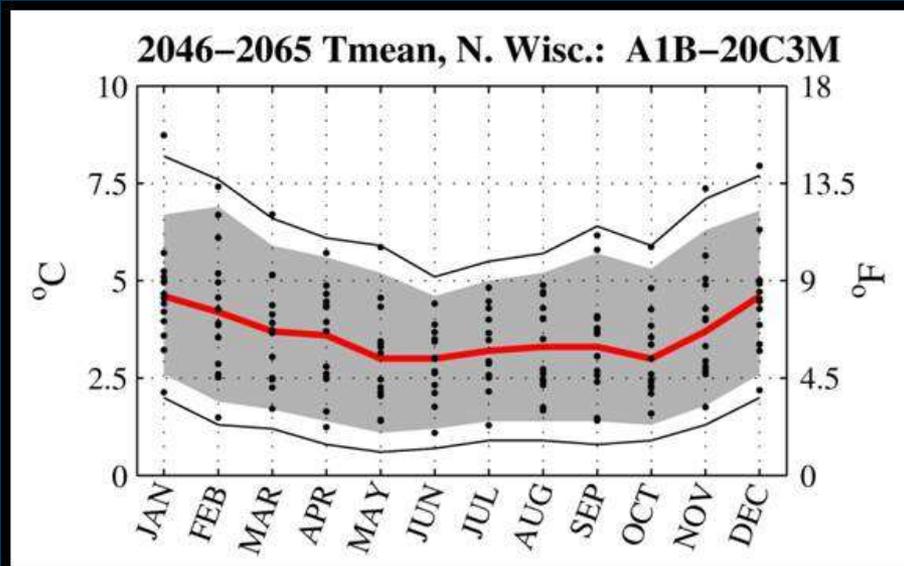
Vulnerability = Exposure X Sensitivity
- Adaptive capacity



Data sources for exposure



climatewizard.org



WICCI Climate
working group
www.wicci.wisc.edu



Climate Change Vulnerability Index



Steve Young

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

Target audience: Wildlife Action Plan teams

Sensitivity checklist

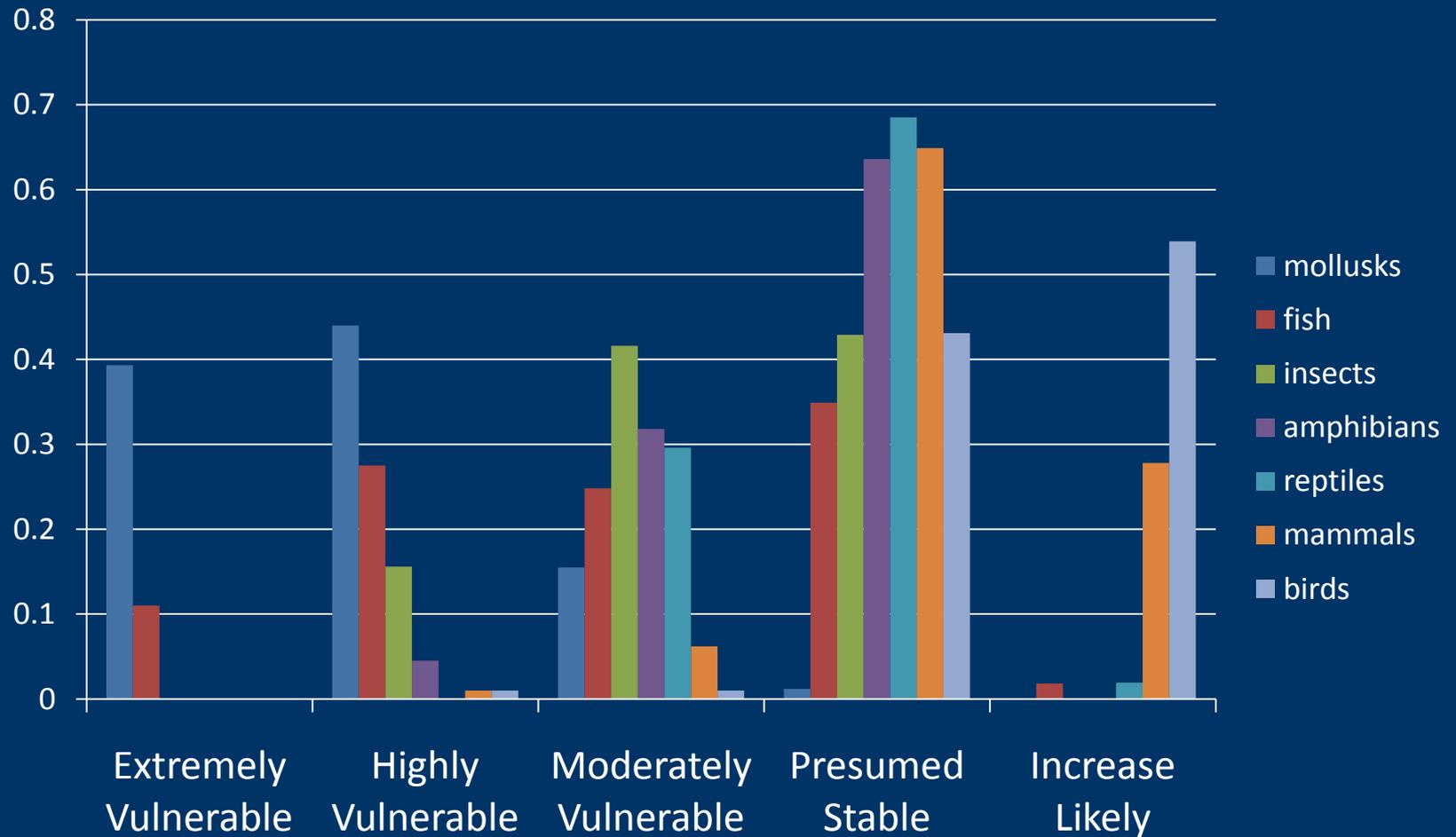


- Temperature tolerance
- Drought tolerance
- Dependence on a particular hydrologic regime
- Dependence on a particular disturbance regime
- Dependence/sensitivity to specific habitats or species interactions

Is it there? (range changes, mortality)

Is it there at the right time? (phenology)

Vulnerability by Taxa – 162 sp. in Greatest Need of Conservation

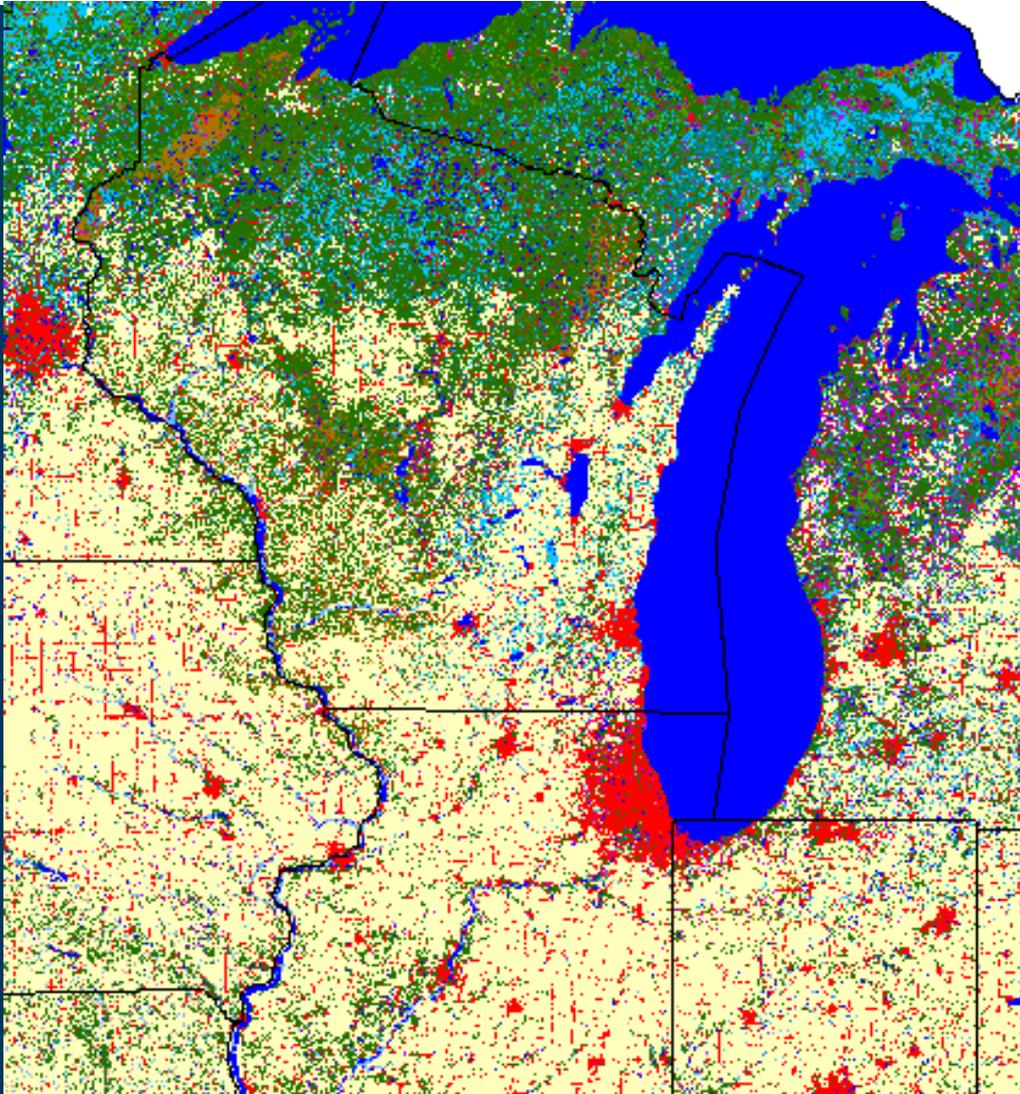


Analyses by Jeff Walk, Aaron Lange & Sarah Hagen, TNC

Roadmap

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Context is key



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

How? 7 “R’s” of Adaptation

Restoration

Reduce other stressors

Relocation/Reconnect

Refugia

Protect key ecological features

Representation

Replication/Redundancy

Ecosystem-based adaptation for people and nature

PROMOTE:



AVOID:



Acknowledgements





THANK YOU!