

Climate Change in the Great Lakes



Great Lakes Integrated Sciences & Assessments

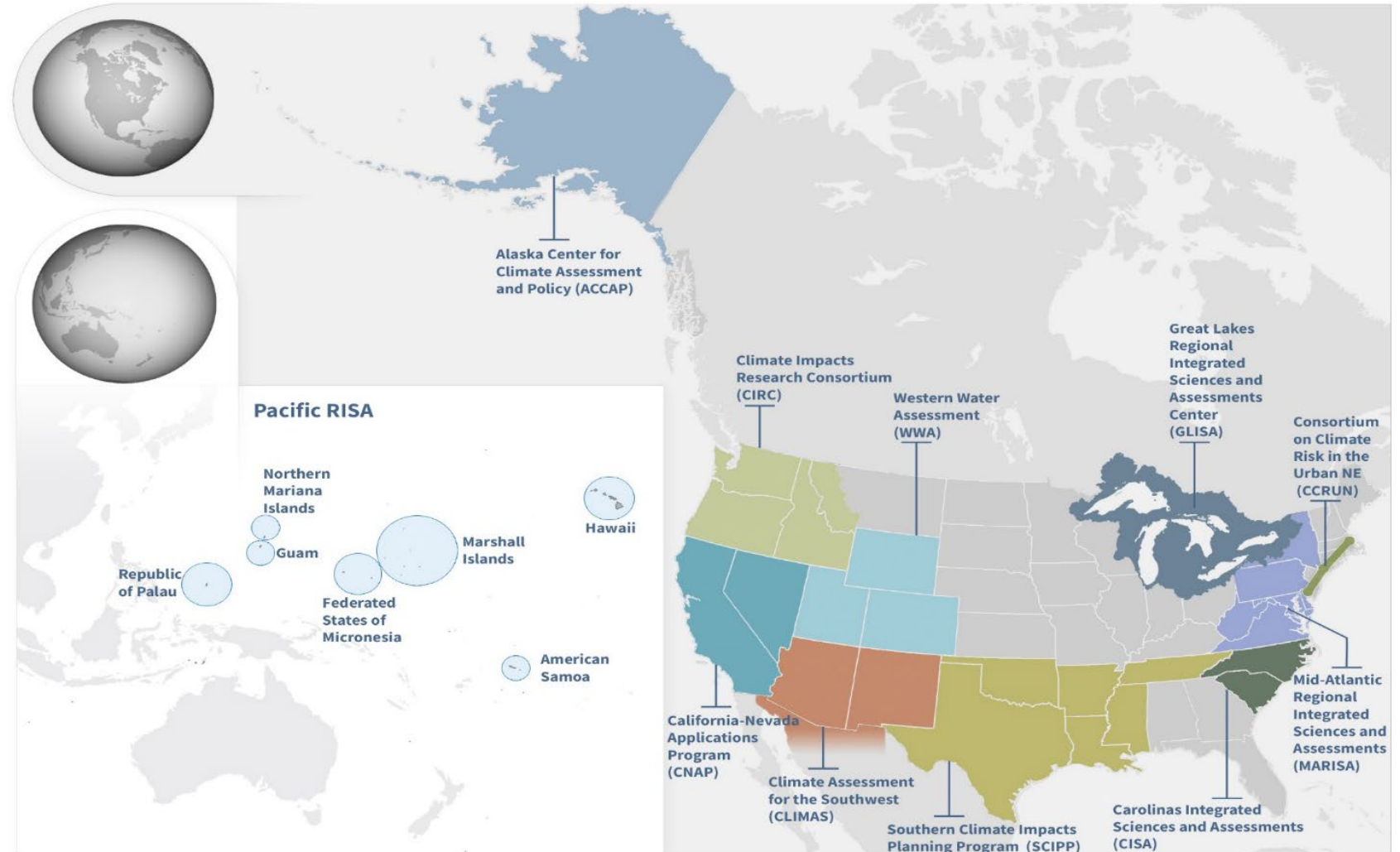
GLISA

GREAT LAKES INTEGRATED SCIENCES + ASSESSMENTS



NOAA Regional Integrated Sciences and Assessments (RISA)

Regional teams that help the nation to prepare for and adapt to climate variability and change



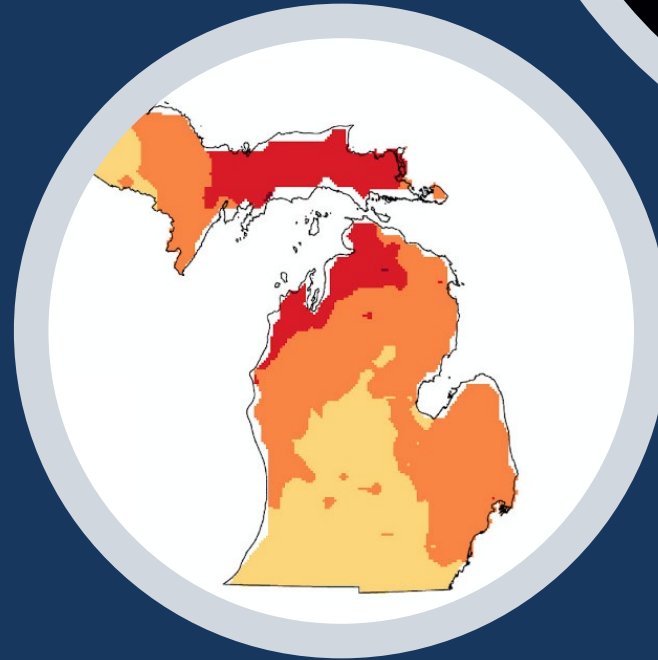
GLISA's Approach



- Interpret *existing* information and data for stakeholders
- Provide *locally* relevant climate synthesis:
 - What has happened?
 - What could happen?
 - What are the impacts?

Global | Regional | Local

- There are multiple ways of looking at climate change:
 - Global
 - Regional
 - Local
- Local factors can drastically alter the magnitude of climate change impacts, but can also be adapted to more readily.



Global | Regional | Local



Rising Temperatures

Observed



2.3°F

Warmer

1951-2020

Future



3 to 6°F

Warmer

2040-2059

Winters are Warming Faster



2.3°F increase averaged
over the entire year

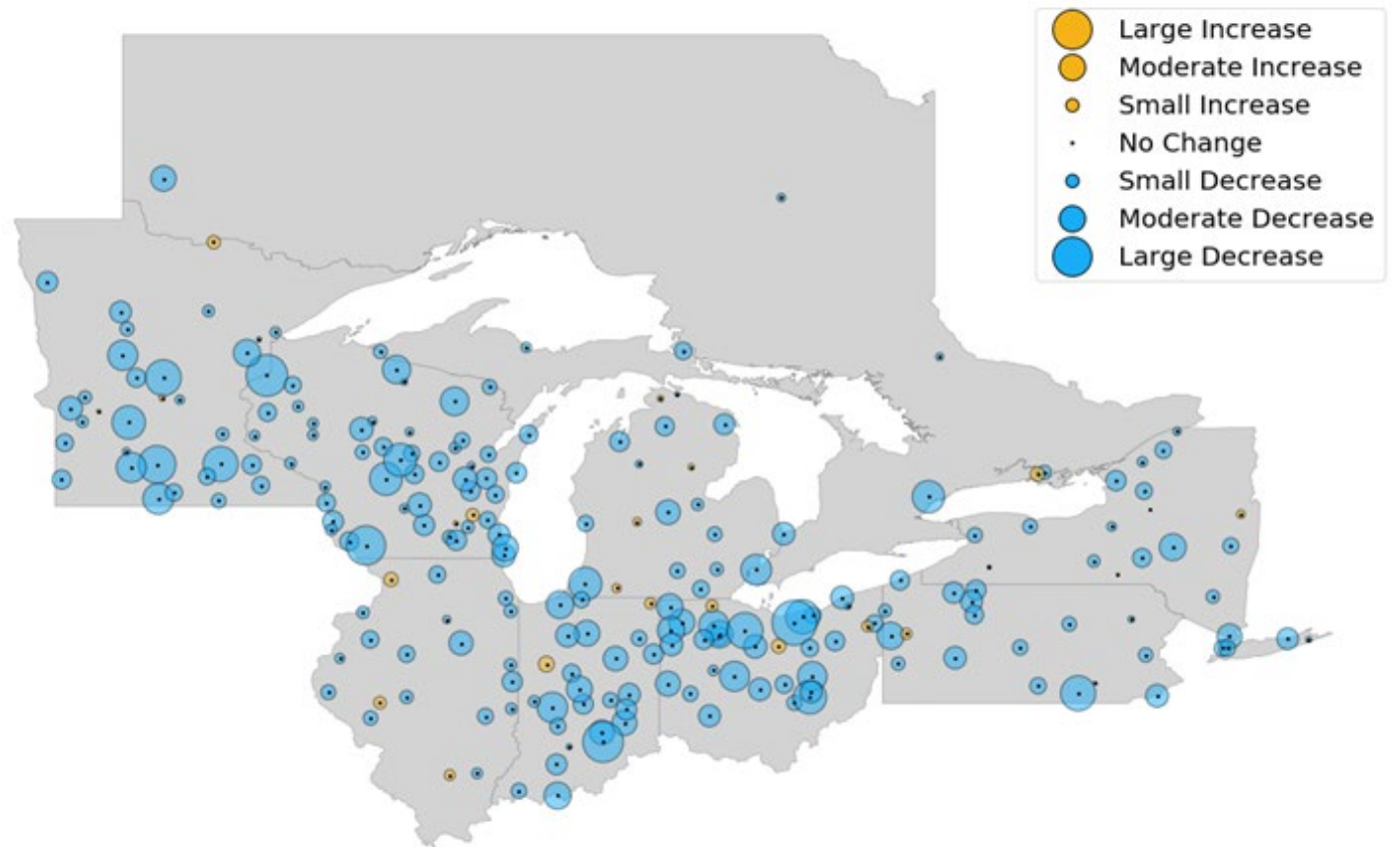


3.9°F increase during
winter (December - February)

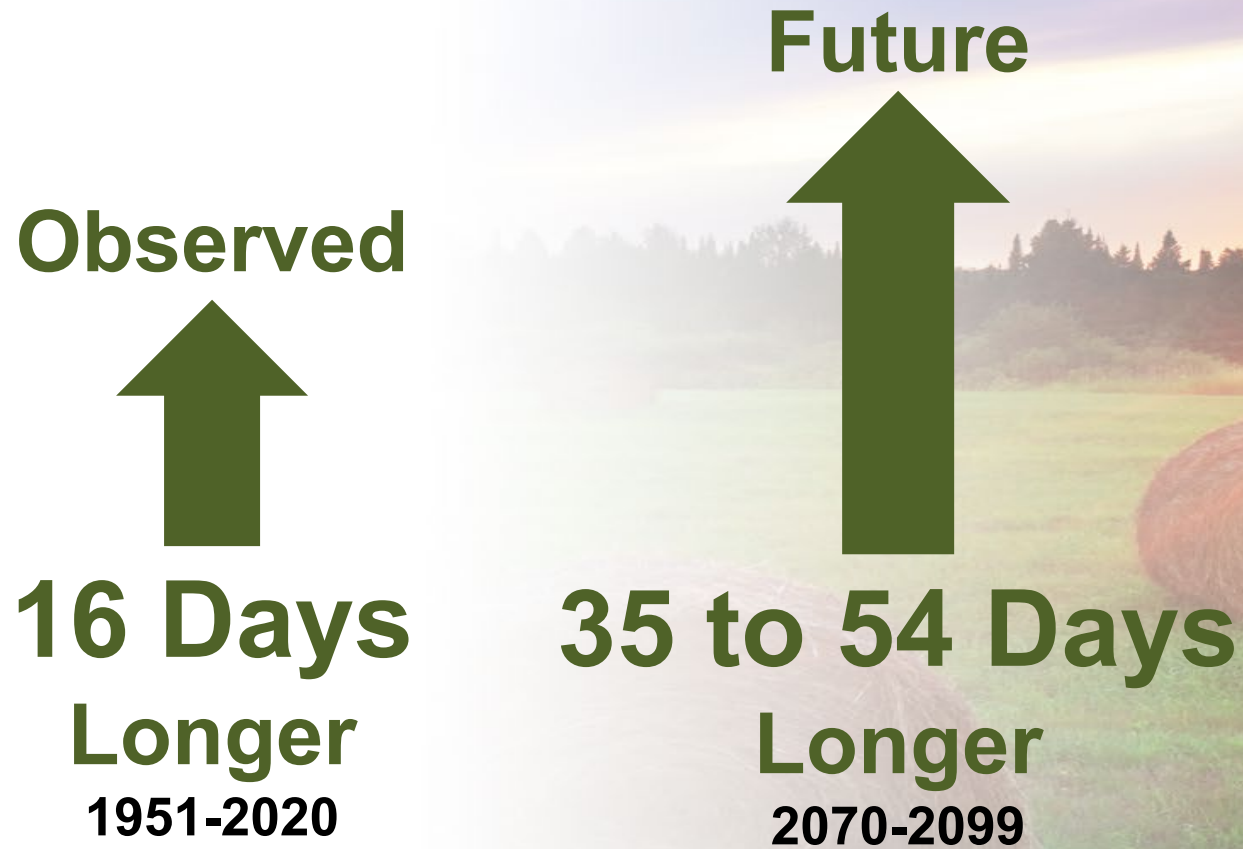
Freeze-Thaw Cycles

**The
number of
freeze-thaw
cycles are
decreasing
regionwide**

Annual Linear Trend of Freeze-Thaw Cycles for 1951-2020



A Longer Frost-free Season

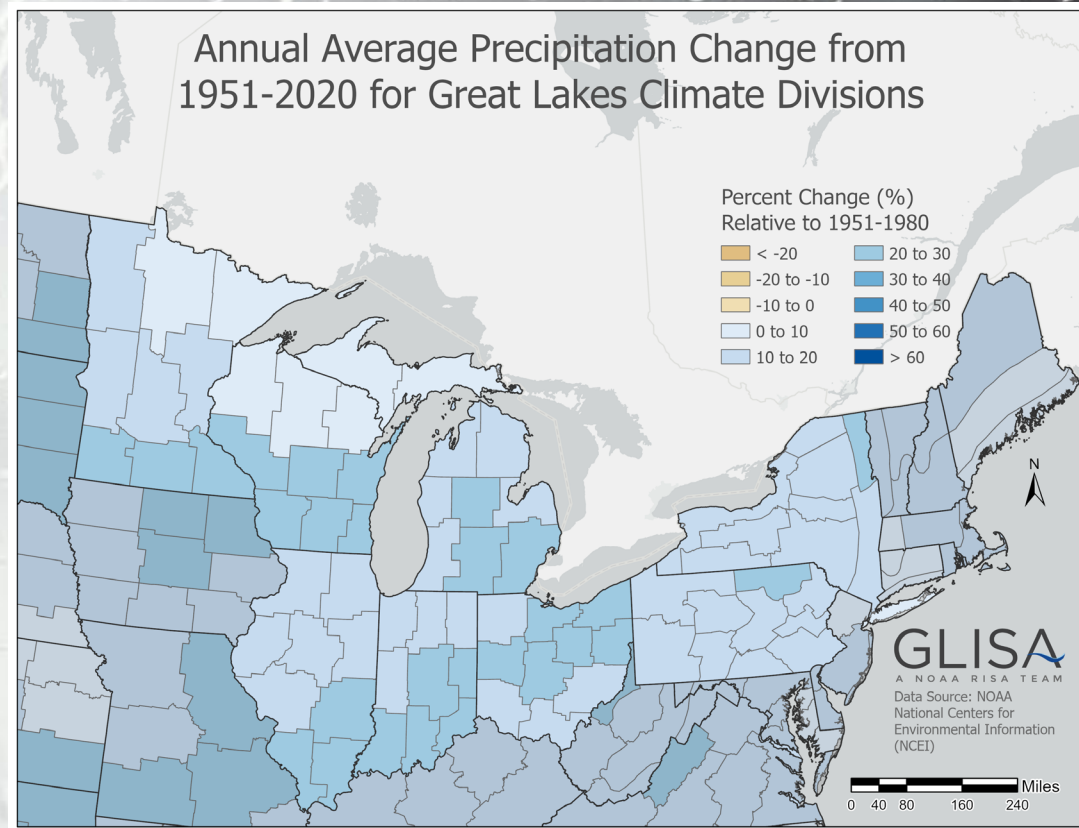


Observed changes
due mostly to **earlier**
last winter freeze

More Precipitation

**Total annual
precipitation
in the region
has increased
by:**

17%



Uneven changes across the Region

More Extreme Precipitation

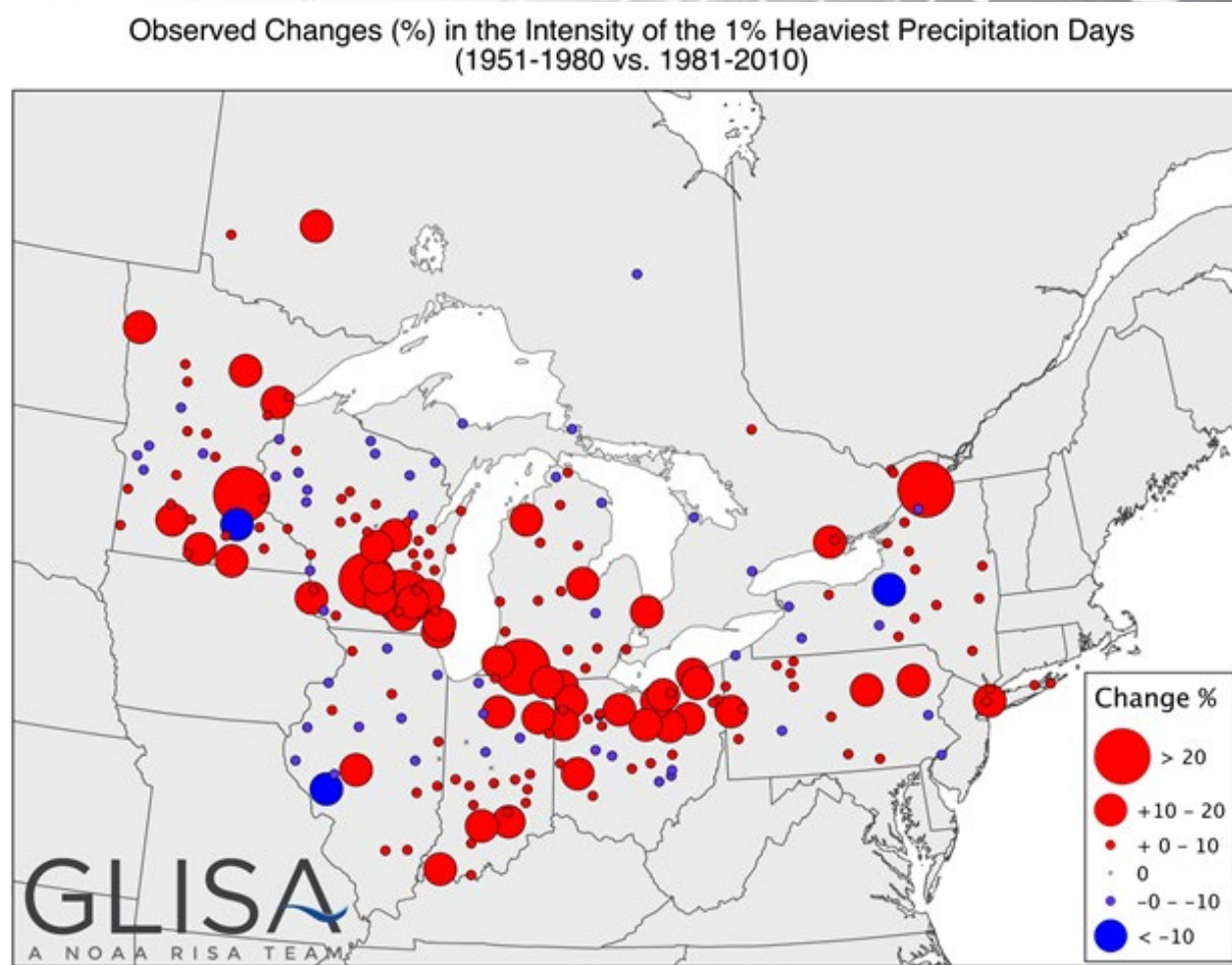


**1% Heaviest
Precipitation Events:**

24%

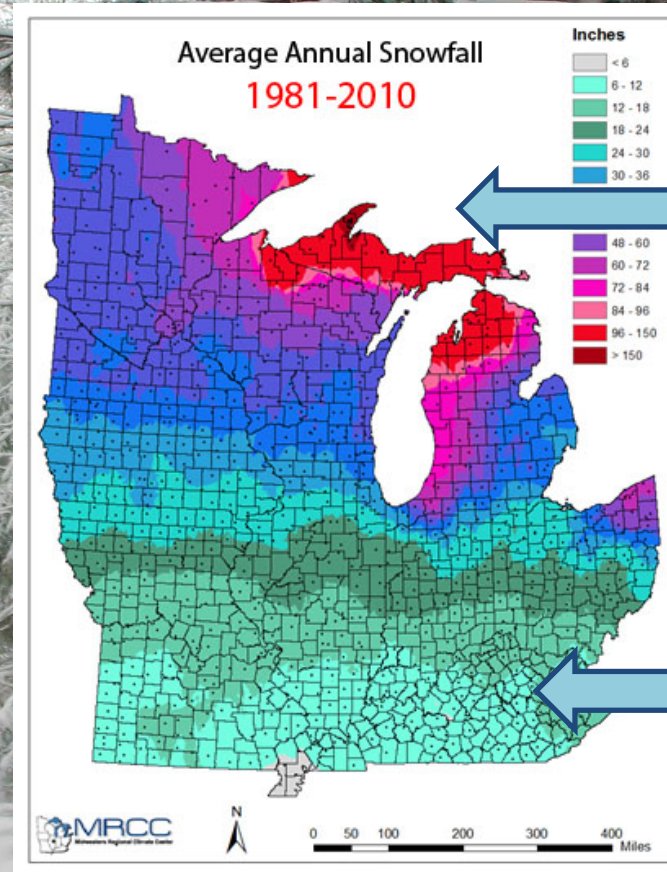
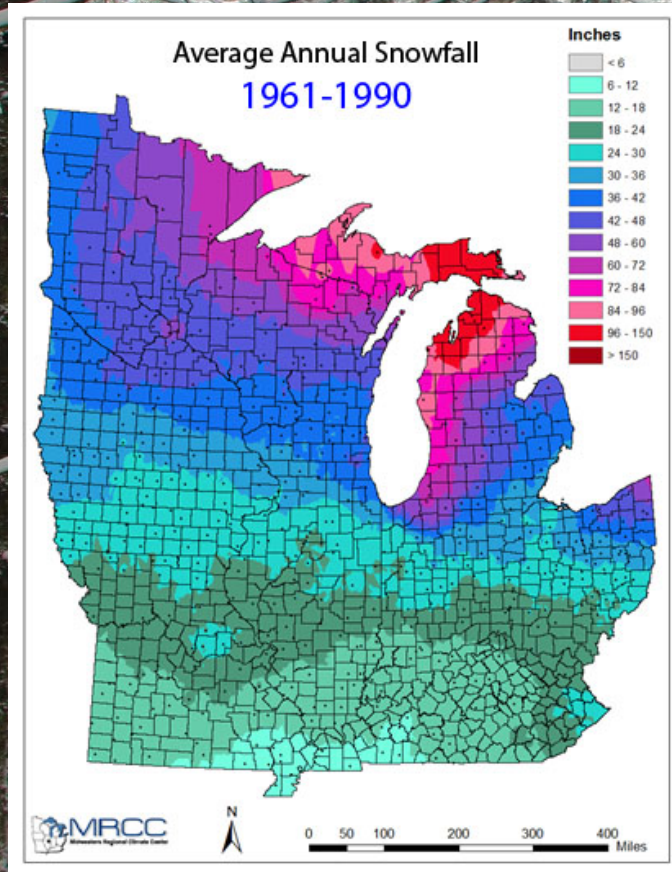
**Nuisance flooding and minor damages
are reported more frequently after
these events**

More Extreme Precipitation



Data: GHCND (NOAA)

Change in Snowfall



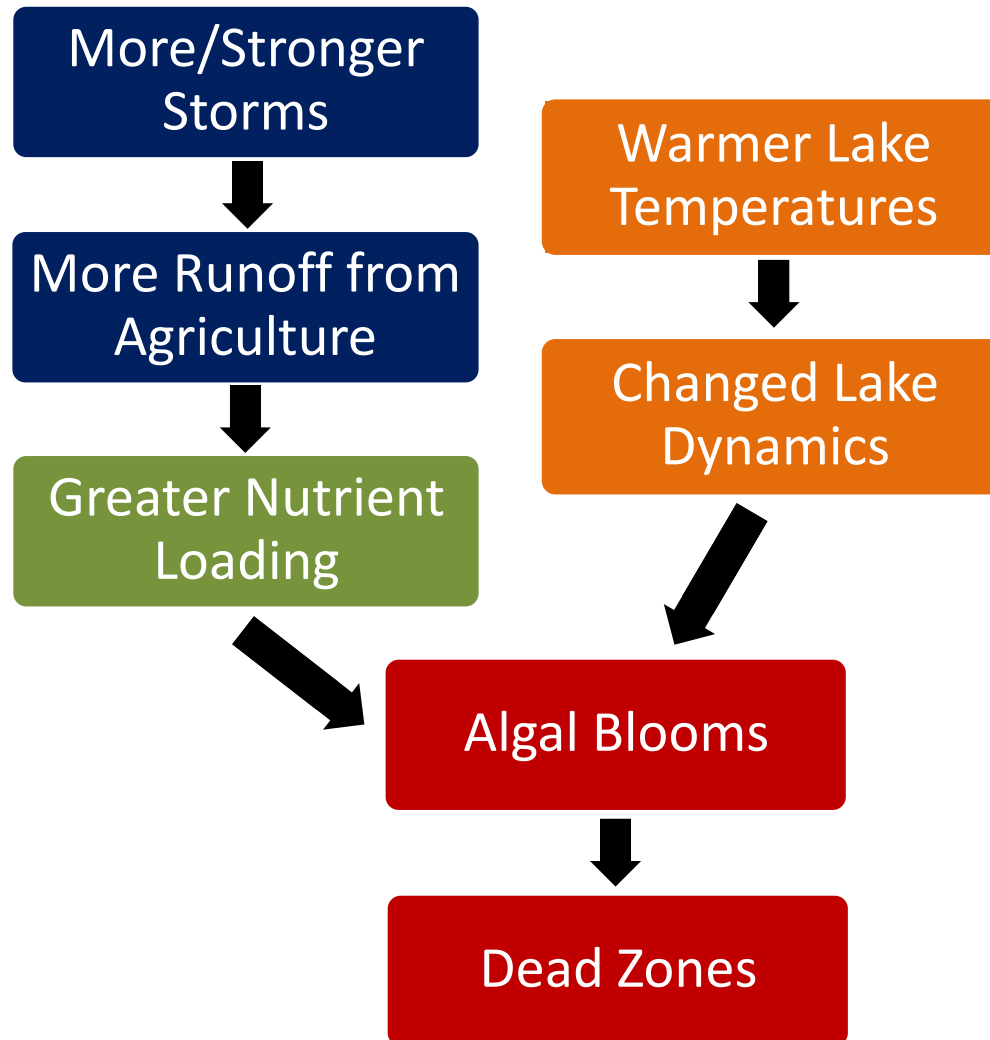
Snowfall has increased in lake-effect areas

Snowfall has remained stable or decreased throughout southern parts of the region

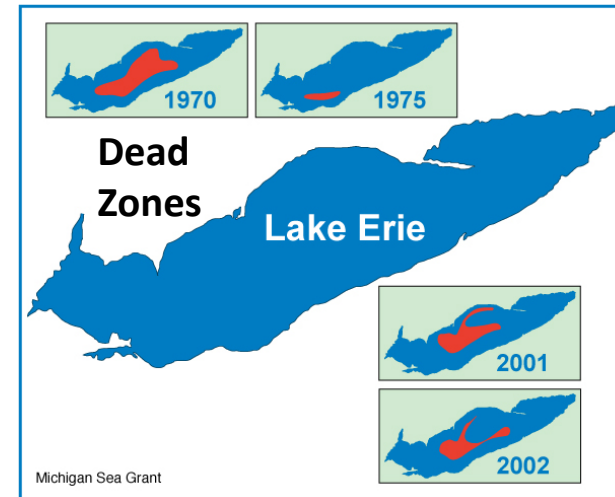
Impacts



Algal Blooms and Water Quality



NOAA



Michigan Sea Grant



MI SeaGrant

Stormwater Impacts



With increased extreme precipitation events, intense, flashy runoff amplify flooding risks.

Ontario
Spring 17'
Flood

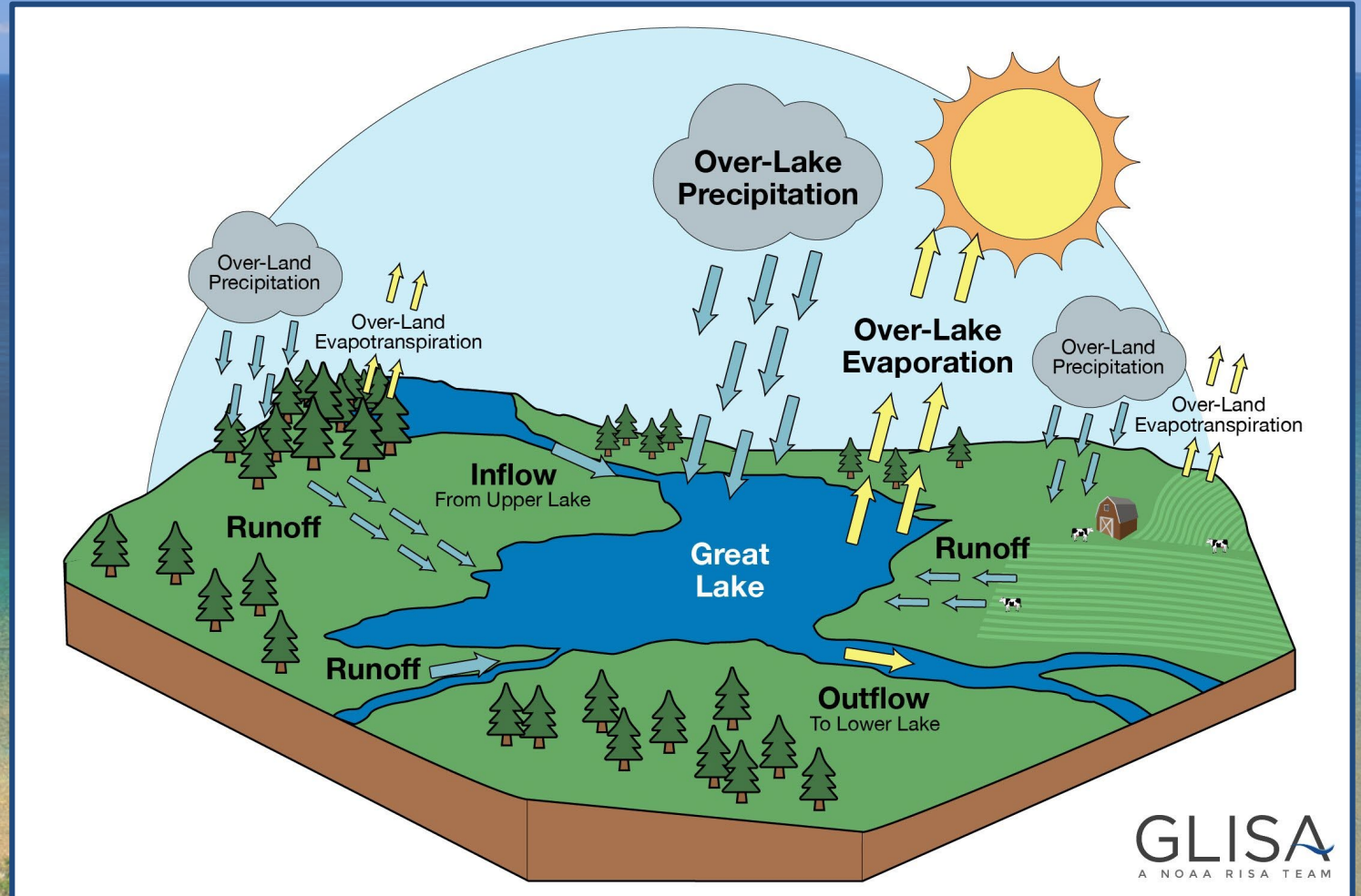


U.S. Army National Guard

Lake Levels

Main drivers of water supply on the lakes are:

- Precipitation - Evaporation + Runoff
- All three drivers are affected by regional climate change



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Photo: Dan Brown

Future Lake Levels

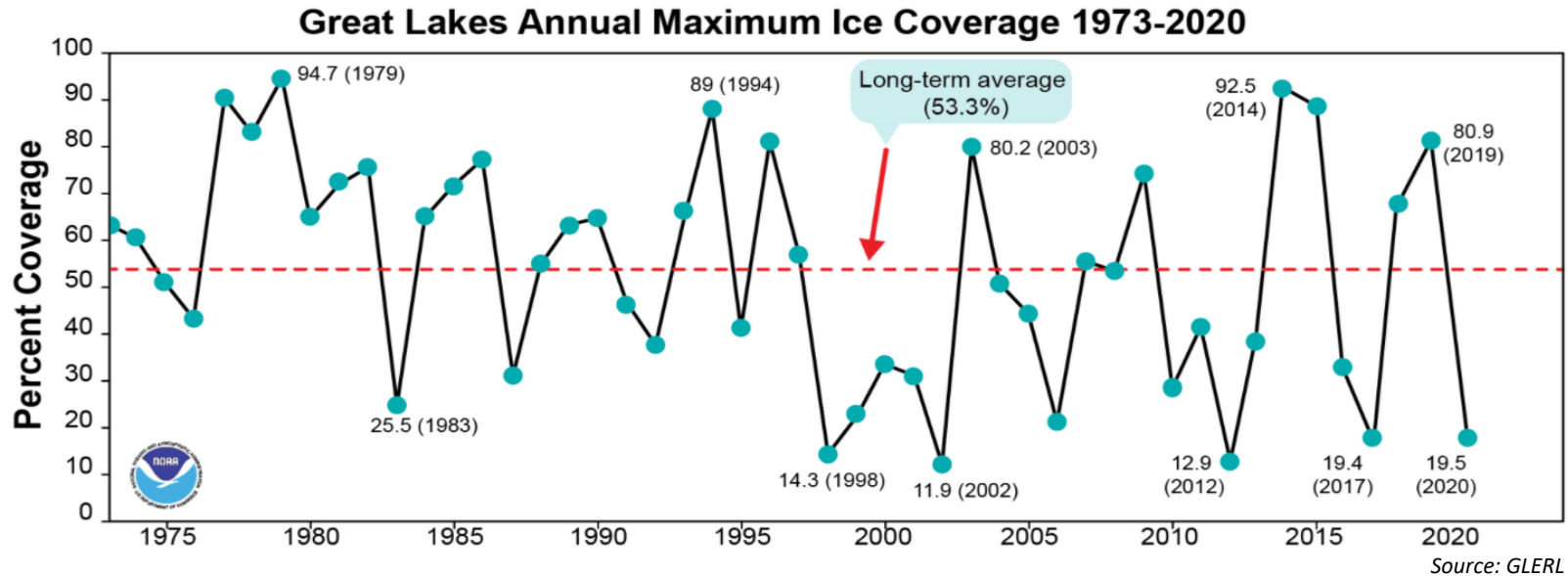
- Future water level changes will depend on whether precipitation or evaporation dominate
- Short-term variability with periods of high and low lake levels are still anticipated

Impacts of Lake Levels

- Boating and recreation
- Shipping and navigation
- Property
- Fisheries and wetlands



Impacts of Variable Great Lakes Ice Cover



- **Fishing Industry:** Ice cover protects whitefish spawning areas. Great Lakes commercial fishing is \$4 billion industry.
- **Coastal Zone:** In nearshore areas, ice provides stable platform for recreation and protects wetland areas from erosion.
- **Water Levels and Navigation:** Heavy ice cover can reduce evaporation and contribute to higher water levels in the following seasons—good news for shipping.

Potential Impacts on Shipping

Every lost inch of water depth:

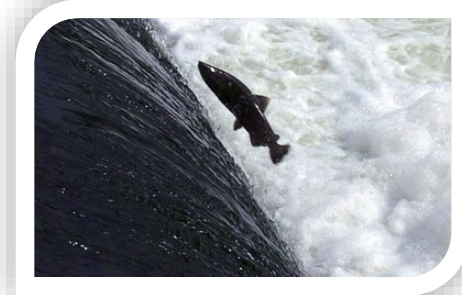
- Reduces cargo capacity 50-270 tons
- Costs \$10k-30k per transit.



...but less lake ice cover allows for a longer shipping season

Plants and Wildlife

- Forest ecosystems forced northward
 - Maple-Beech-Birch forest displaced
- Amplified stressors on biodiversity
 - Declining Coldwater fish populations, species migrating northward
- Agriculture
 - Longer growing season
 - Water availability, warm spells, spring freezes, flooding, and drought will reduce crop yields



A photograph of a sunset over a body of water, with reeds in the foreground. The sun is a bright yellow circle in the center of the frame, partially obscured by the reeds. The sky is a gradient of orange and yellow, and the water is dark and calm. The reeds are thin, dark lines in the foreground, some in focus and some blurred.

For More Information

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Photo: Kim Channell