



Amp Up Impact: Great Lakes Education Resources

**Minnesota Sea Grant
& Minnesota's Center for Great Lakes Literacy**

Image credit: John Downing



What is your Great Lakes story ?

- 1) Find that place on the map
- 2) Put a post-it with your name at that spot

INTRODUCTIONS

Let's get to know each other!

Environmental Literacy & Workforce Development Extension Educator

I design, coordinate, implement and assess accessible education and workforce development programs focused on Minnesota's water resources and blue economy. These programs align with the University of Minnesota Sea Grant's mission and 2024-2027 Strategic Plan. My role emphasizes collaboration with the Sea Grant Center for Great Lakes Literacy (CGLL)

I develop accessible, research-based K-12 education programs that reflect local needs, Minnesota Sea Grant research and community water-related issues:

**water resources coastal resilience blue economy sustainable
fisheries aquaculture maritime transportation**

I build and sustain partnerships to enhance environmental literacy and expand workforce development in Minnesota.



Heidi M.S. Ferris, Ed.D.



INTRODUCTIONS

Let's get to know each other!

Minnesota Sea Grant

Fisheries & Aquaculture Extension Educator

I am responsible for providing outreach and applied research on fisheries and aquaculture. I will work closely with other Minnesota Sea Grant staff, U of M extension educators, and Sea Grant extension educators across the Great Lakes and nation who are involved in related issues.



Julia Grenn, Ph.D.



The History and Present of Minnesota's Land and Water

University of Minnesota Land Acknowledgement Office of Diversity & Inclusion

- The University of Minnesota system has campuses that are located on the homelands of the Dakota and Anishinaabe peoples, and acknowledges the eleven Tribal Nations of Minnesota.
- It is important to acknowledge the peoples on whose land we live, learn, and work as we seek to improve and strengthen our relations with our tribal nations.
- We must ensure that our institution provides support, resources, and programs that increase access to all aspects of higher education for our American Indian students, staff, faculty, and community members.



11 Nations of Minnesota

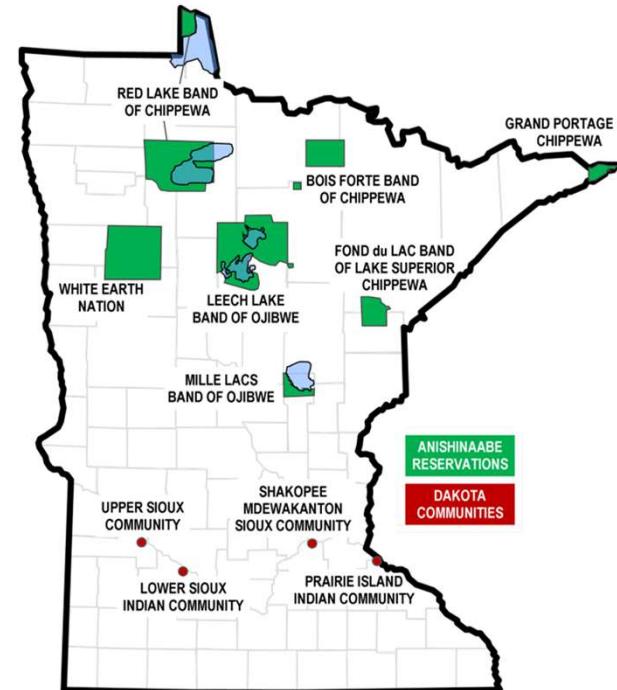


Image credit: Minitex

What's at the heart of
Minnesota Sea Grant and
the Center for Great
Lakes Literacy?



CGLL fosters informed and responsible decisions that advance basin-wide stewardship by providing hands-on experiences, educational resources, and networking opportunities promoting Great Lakes literacy among an engaged community of educators, scientists, and youth.

Vision

Growing a community of Great Lakes literate individuals able to steward the Great Lakes and connected freshwater resources.

Mission

The Center for Great Lakes Literacy (CGLL) engages and inspires teachers, scientists and students to develop a Great Lakes-literate public capable of effectively contributing to the sustainable use of the Great Lakes and connected freshwater resources.

Engagement, Education and Training



54,570 K-12
students
reached



How and
when did the
Minnesota
Sea Grant
program get
started?

History of Minnesota Sea Grant

A Systemwide Program

- Began as the Minnesota Sea Grant Institute at U of M Twin Cities in 1977
 - Mainly a water science extension program
- In 1985, MNSG was designated a College Program and became one of 22 colleges of the U of M.
 - MNSG assumed a major role in water research at U of M
- 1993-1994: MNSG Director's office moved to Duluth. Reported to the U of M VPR Twin Cities
- Director's reporting moved to UMD ca. 2016

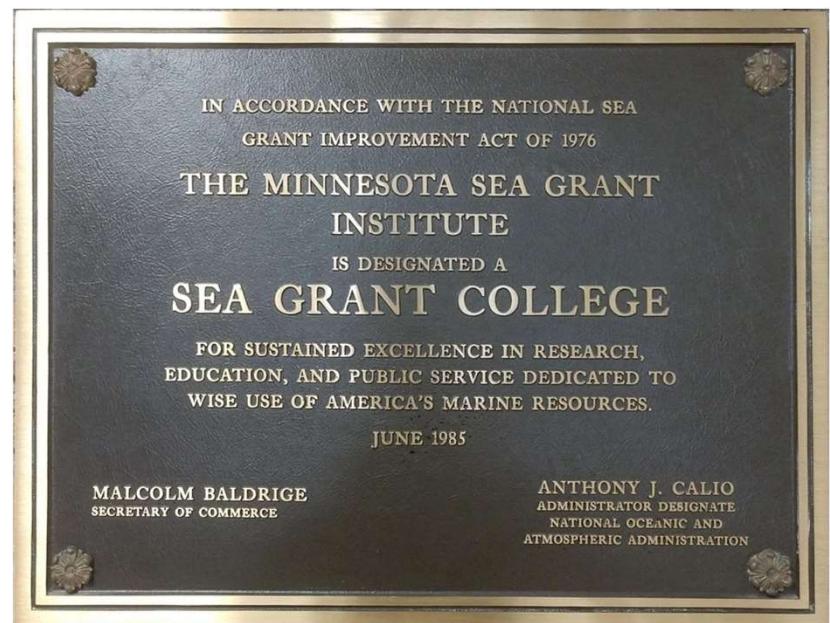


Image credit: John Downing/MNSG

What do MNSG and CGLL do?



HEALTHY COASTAL
ECOSYSTEMS



SUSTAINABLE
FISHERIES &
AQUACULTURE



RESILIENT
COMMUNITIES
& ECONOMIES



ENVIRONMENTAL
LITERACY &
WORKFORCE
DEVELOPMENT



THE GREAT LAKES BASIN



8 Great Lakes Literacy Principles

What are
some
resources
online?



[Learning Opportunities](http://cglL.org) at
cglL.org:

- Professional learning
 - Shipboard Science
 - Workshops
 - GLLees
- Youth Opportunities
 - GLLees
 - Aquaculture Challenge
 - Bioblitz
 - Students Ask Scientists



Aquaculture Challenge for 8-12 Grade Students >

The Aquaculture Challenge is a four-month competition that engages 8-12 grade students, in teams of 1-15 and supported by a coach, in STEM learning, innovation, and career exploration by developing small aquaponics systems and business plans. Teams are to be sponsored by a school or after-school program like 4-H, FFA, etc.



Bugs Below Zero >

Winter Dynamics of Invertebrates in Trout Streams of Minnesota and Wisconsin: How Can the Public Connect with and Contribute to Research?



Center for Great Lakes Literacy >

The Center for Great Lakes Literacy (CGLL) helps create a Great Lakes-literate public capable of effectively contributing to the environmental, economic and social sustainability of the Great Lakes.



Shipboard Science Workshops >

Sea Grant's shipboard science workshops are part of the [Center for Great Lakes Literacy](#) and help transform teachers into motivated Great Lakes educators.



Which of these MNSG programs peaks your curiosity?

Why?

Find out more at:

<https://seagrant.umn.edu/programs/educator-resources>

Aquaculture + Aquaculture Challenge Project



Chad Hebert, Yellow Perch aquaponics producer, Women's Environmental Institute aquaponics instructor, and former Little Earth of United Tribes urban farm manager, and project partner, GLAC advisory board member.



Image credit: A. Schrank



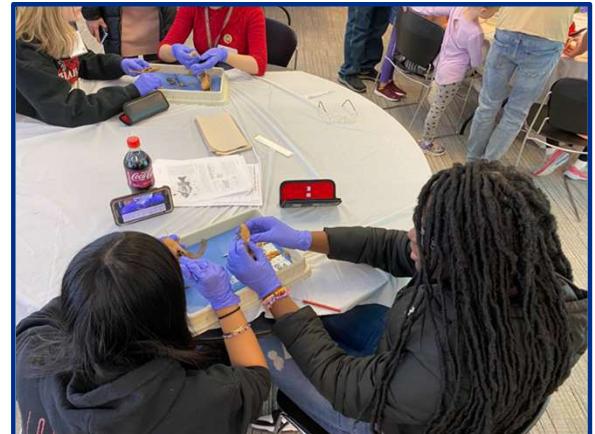
Image credit: C. Dettman

What is
happening
now?

What is happening now?

These projects are in the works!

- Mini-grants for Educators
 - Applications online Nov/Dec
 - 8 awarded \$550-\$600/each
 - Experiential learning & professional development
- Educator Needs Assessment
 - Data from across Minnesota
 - Formal/In-formal Educators
 - This research will drive action & resources
- Communication
 - MNSG Updates & CGLL Newsletter
 - <https://seagrant.umn.edu/programs/educator-resources>
 - hferris@umn.edu
- Workshops & Trainings
 - *Lake Superior Speaks: Educator & Researcher Confluence*
July 2025
 - Shipboard Science Immersion on Lake Superior in 2026!



Exciting Opportunities!



- **Register for the 2026 Aquaculture Challenge**
- **Apply for 2026 Shipboard Science**
 - 1 week in July with educators and scientists
 - Live aboard the Lake Guardian on Lake Superior.
 - Applications open January 1, 2026.



CGLL fosters informed and responsible decisions that advance basin-wide stewardship by providing hands-on experiences, educational resources, and networking opportunities promoting Great Lakes literacy among an engaged community of educators, scientists, and youth.





Explore Minnesota Sea Grant's Education Kits!



GREAT LAKES LITERACY PRINCIPLES

1. The Great Lakes, **bodies of fresh water** with many features, are connected to each other and to the world ocean.
2. **Natural forces** formed the Great Lakes; the lakes continue to shape the features of their watersheds.
3. The Great Lakes influence local and regional **climate and weather**.
4. Water made Earth **habitable**; fresh water sustains life on land.
5. The Great Lakes support a broad **diversity of life and ecosystems**.
6. The **Great Lakes** and **humans** in their watersheds are inextricably **interconnected**.
7. Much remains to be **learned** about the Great Lakes.
8. The Great Lakes are socially, economically, and environmentally **significant** to the region, the nation, and the planet.

GLL Posters
available
today!

What's the big
deal about
Minnesota
and water?



**Lake Superior is Challenging for Maritime and
Coastal Communities - Because it is Big, Deep,
Dynamic & Harsh**

Image credit: Cait Dettmann/MNSG

A Primer on Lake Superior

Some facts

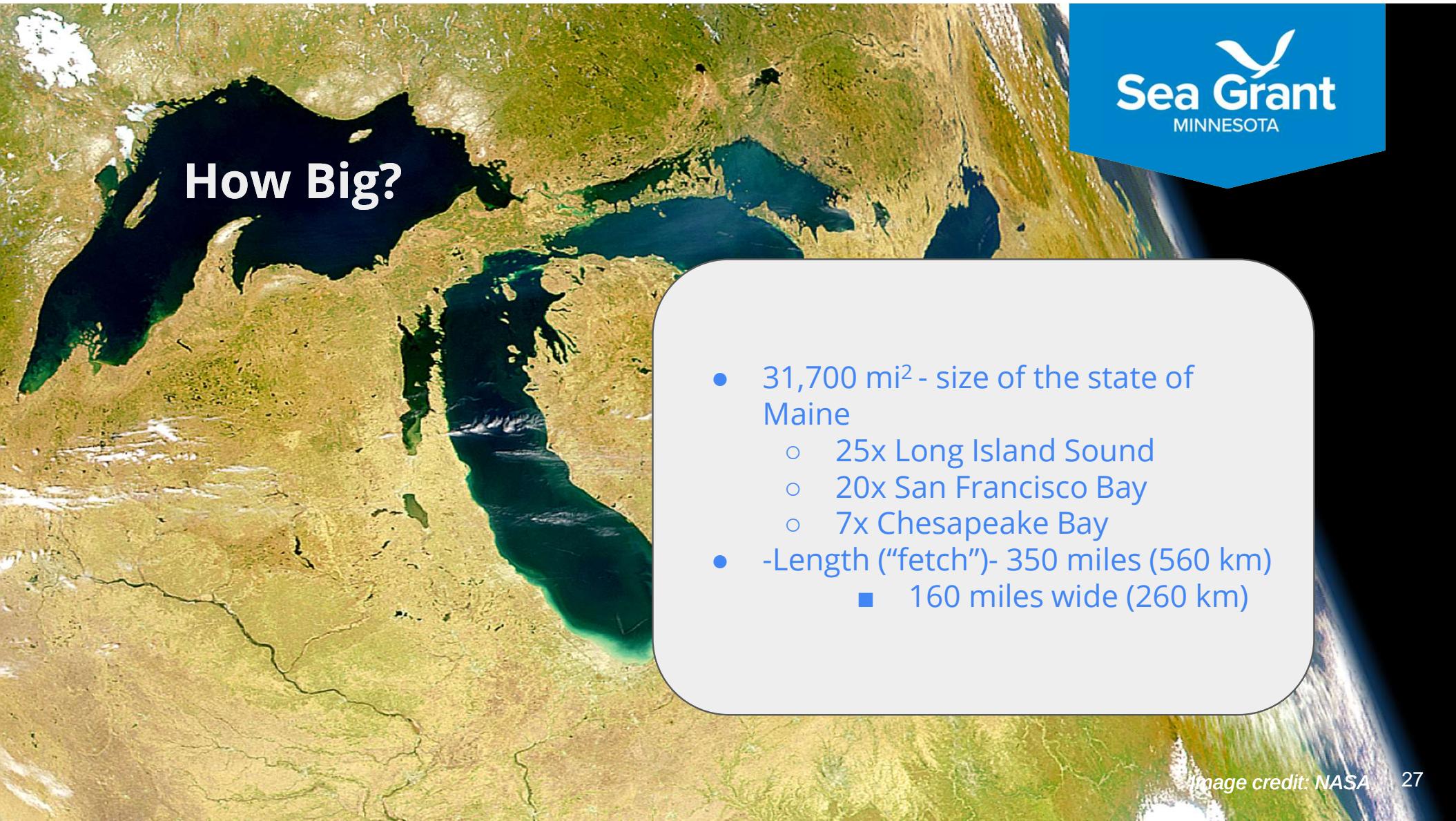
- Has the largest area of any freshwater lake on Earth
- Was formed by a mid-continent fault and carved and warped by glaciers
- Holds about 11% of Earth's surface freshwater
- Is a multinational resource shared by 3 states, 1 province, and 15 First Nations
- Is highly sensitive to pollution (phosphorus & nitrogen < the most dilute oceans)

North Shore - Looking Toward Duluth



Image credit: John Downing

Nutrient data from NOAA's Ocean Atlas (2024)



MN has More Lakes Than any State (except Alaska)

- >14,000 lakes > 10 acres; 34,000 miles of lakeshore
- We are U of M-wide so expected to serve all of MN.

Lake Superior shore

- 200 miles of coast + 40 miles of estuary and harbor
- 2023 population of 250,000 for coastal counties
 - receive 1.2M visitors per year
- Duluth-Superior is largest port in the Great Lakes- 12th largest in U.S. by total tonnage
- By NSGO estimates, PA, NH, Guam and IL/IN have smaller coastal zones; Guam has a smaller coastal population

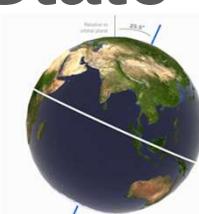


Image credit: NASA Jet Propulsion Lab

Minnesota's Waters - Shows Only Water

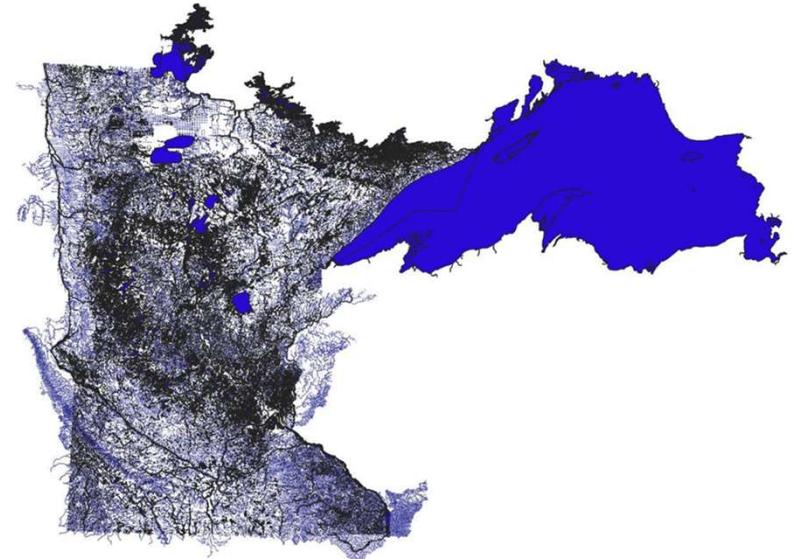


Image credit: John Downing

How deep?



- Deepest of the Great Lakes
- Average depth of 490 feet (150 m)
 - 33x SF Bay or LI Sound
 - = US continental shelf
- Max depth 1333 feet (410 m)
 - 4x Long Island Sound
 - 3x SF Bay at Golden Gate
 - 4x Chesapeake Bay

Image credit: Marquette, MI Police

29

How Harsh?

- Famously massive waves
- Commonly 20' (6 m) or more
 - <10% of ocean waves exceed 18 feet (5.5 m)
- Due to 350 mile (560 km) fetch across the lake
- Surface temperature colder than E&W coasts in winter; warmer than Pacific coast in summer (but warming)



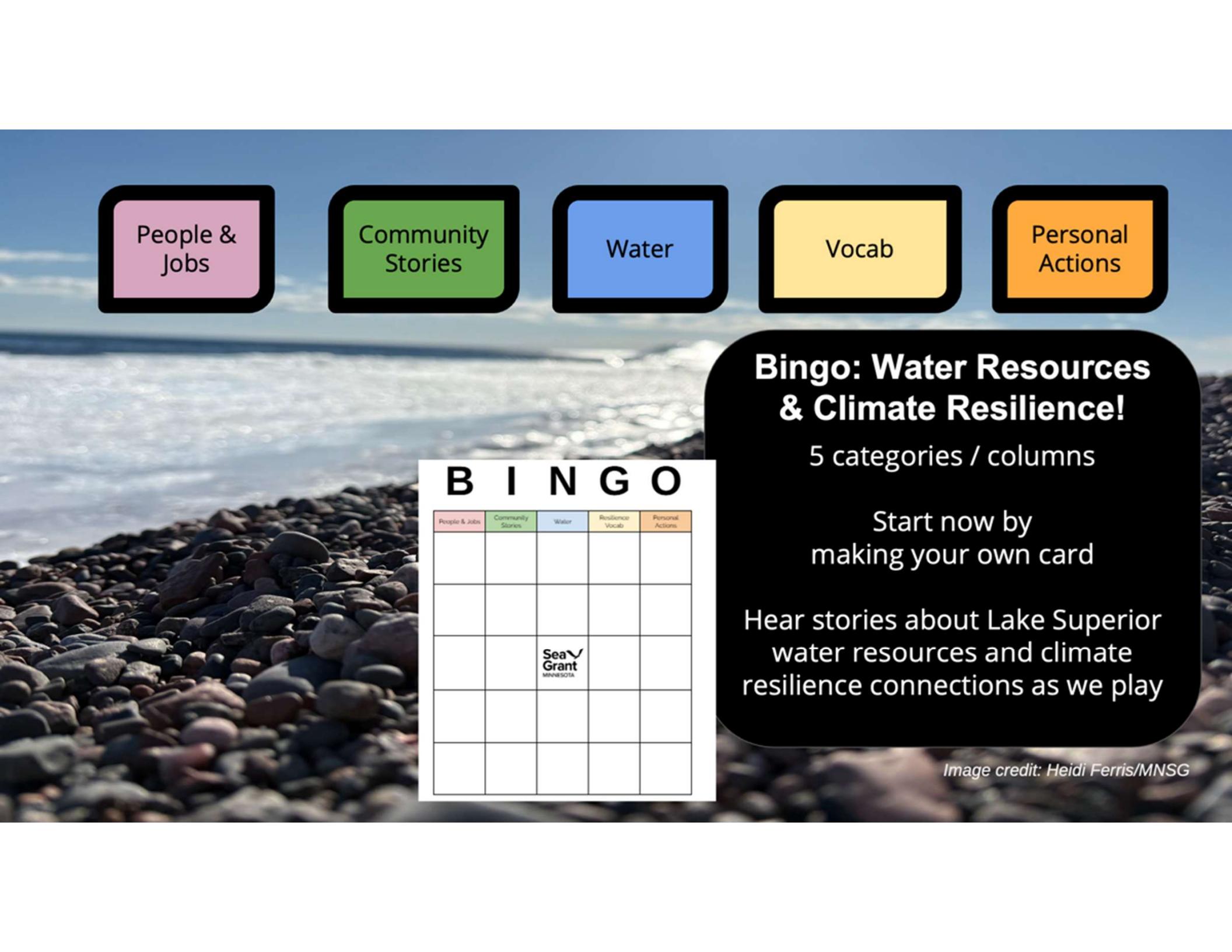
Image credit: Clint Austin/Duluth News Tribune 30

Let's play with
that MNSG
water science!



Bingo: Water Resources & Climate Resilience

Image credit: John Downing



People & Jobs

Community Stories

Water

Vocab

Personal Actions

Bingo: Water Resources & Climate Resilience!

5 categories / columns

Start now by
making your own card

Hear stories about Lake Superior
water resources and climate
resilience connections as we play



Image credit: Heidi Ferris/MNSG



Our 'People & Jobs' category today focuses real world careers in the Great Lakes centered on water resources and resilience

Choose 5 of the words/phrase below
and enter them in any order into the
5 boxes in column 1.

Ecologist
Coordinator
Community
Stormwater

Hydrologist
Limnologist
Fisher
Educator





Image credit: A. Shie/MNSG

Our 'Community Stories' category today shares stories across the Lake Superior Basin

Choose 5 of the words/phrase below and enter them in any order into the 5 boxes in column 2.

Madeline Island

Lakewalk

Duluth Flood

Saxon Harbor

Chester Creek

Sturgeon





Our 'water' category today focuses on the 8 Great Lakes Literacy principles.

Great Lakes literacy is an understanding of the Great Lakes' influences on you and your influence on the Great Lakes.

Water

Choose your 4 favorite numbers from the list below. Put those numbers in any order in the open boxes in your column 3. Sea Grant logo is a free space!

1.
2.
3.
4.
5.
6.

7.
8.





Our vocabulary category introduces you to key words and concepts in resilience and water science

Vocab

Choose 5 of the words/phrase below and enter them in any order into the 5 boxes in column 4.

Resilience

Adaptation

Mitigation

Projection

Vulnerability

Watershed

Estuary

AIS

Eutrophication





Our personal actions category shares actions and activities you can do in your community to build resilience and support clean water

Personal
Actions

Choose 5 of the words/phrase below and enter them in any order into the 5 boxes in column 5.

Fix it	Storm drain
Transport	Prevent AIS
Speak up	Volunteer
Neighbor	
Native species	

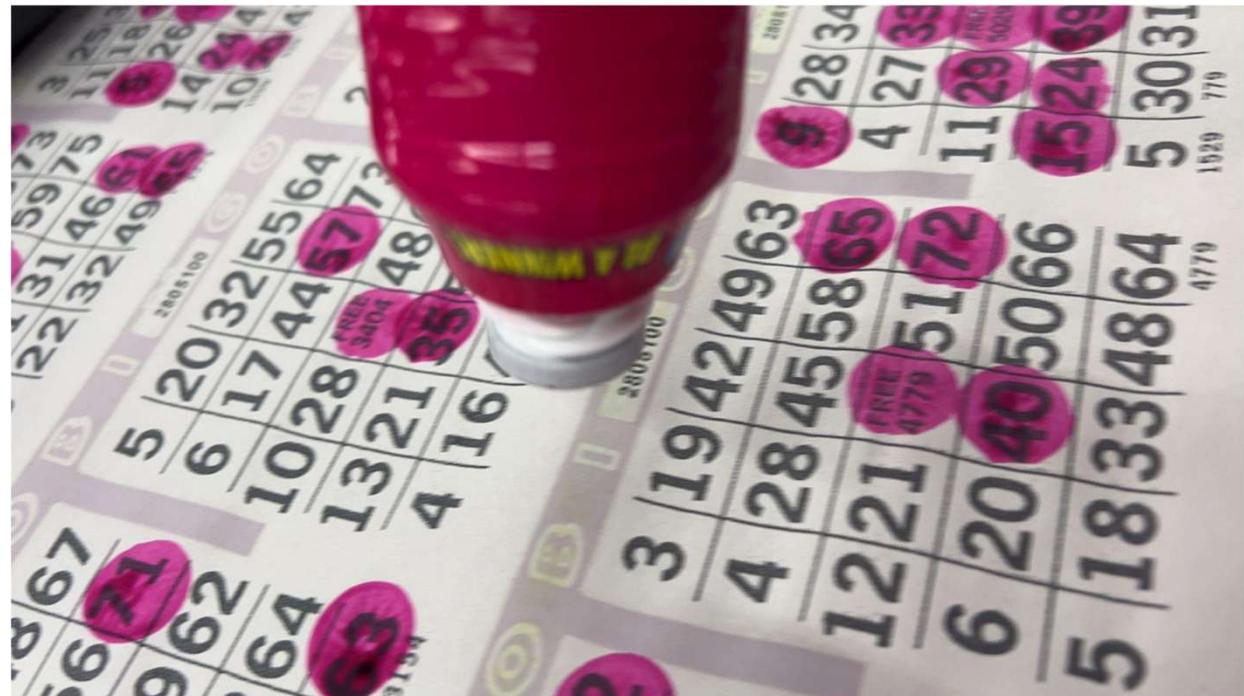


Bingo rules

Mark off 5 squares in a row
(down, diagonal, across) to
win

Minnesota Sea Grant
square is a free space!

Mark it off now



Vocab



AIS (aquatic invasive species): A freshwater or marine organism (plant, animal, pathogen) that has spread or been introduced beyond its native range and is either causing harm or has potential to cause harm to the ecosystem.



Image credit: Bayport Marina Association



Great Lakes Literacy Principle #2

Natural forces formed the Great Lakes; the lakes continue to shape the features of their watershed.

Environmental **Educator**

An environmental educator teaches the public about water conservation, ecosystems, and Great Lakes stewardship.

People &
Jobs

Sea Grant
MINNESOTA



Madison Rodman and Maggie Karschnia, MNSG

Personal
Actions



Fix it! Fix what you have instead of replacing it. Shoes, clothes, furniture and even some electronics can be repaired to extend their life and keep waste out of landfills





Great Lakes Literacy Principle #1

The Great Lakes, bodies of fresh water with many features, are connected to each other and to the world ocean.

Limnologist

A limnologist studies freshwater ecosystems to understand how they function (ecologically, chemically, physically) and how human activities and climate change affect them.



Chris Filstrup, Natural Resources Research Institute
Kait Reinl, Lake Superior National Estuarine Research Reserve

Lake Sturgeon Restoration

Lake sturgeon populations in Lake Superior are rebounding thanks to decades of restoration efforts, including habitat protection, hatchery programs, and collaboration among government agencies, Tribal nations, and researchers. Successful spawning has been documented in several tributaries, including the St. Louis River.



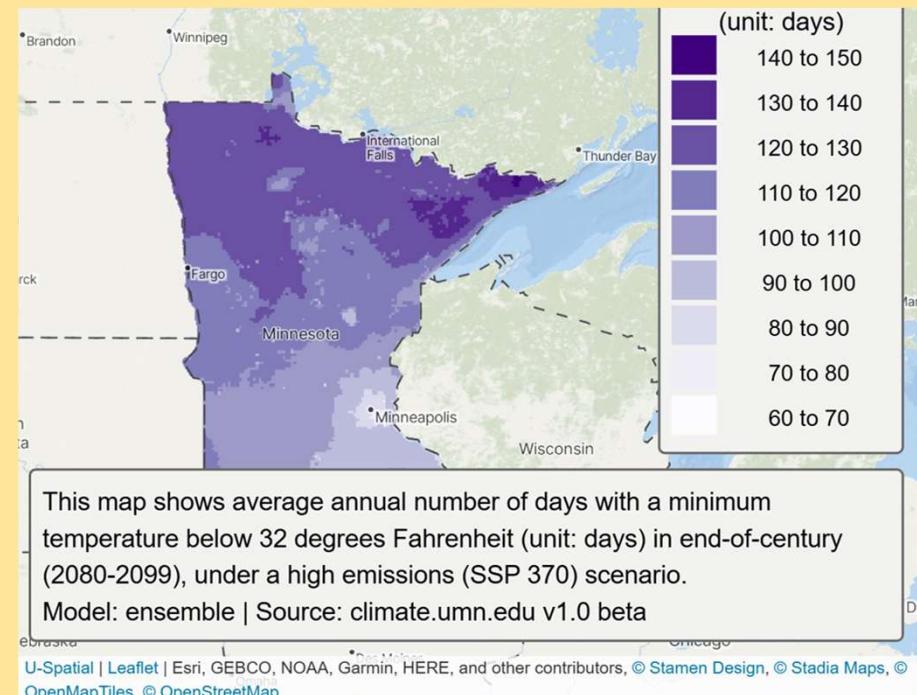
Image credit: 1854 Treaty Authority

<https://www.dnr.state.mn.us/mcvmagazine/issues/2017/may-jun/lake-sturgeon-restoration.html>

Vocab



Projection: The simulated response of the climate system to a scenario of future emissions or concentrations of greenhouse gases and aerosols, generally derived using climate models



University of Minnesota Climate Adaptation Partnership. V1 released October 2023.

Change your
transport: Walk,
bike, take public
transport, or share
a ride.

Personal
Actions



Hydrologist

A hydrologist studies how water moves through the environment. They help manage and project water resources including lakes, rivers, wetlands, and groundwater.

People &
Jobs

Sea Grant
MINNESOTA



Kelsey Forward, Minnesota Department of Natural Resources

Vocab



Freshwater **Estuary**: Semi-enclosed area where river water mixes with lake water. These waters are chemically distinct and create a unique and dynamic ecosystem.



St. Louis River Estuary, Great Lakes Aquarium

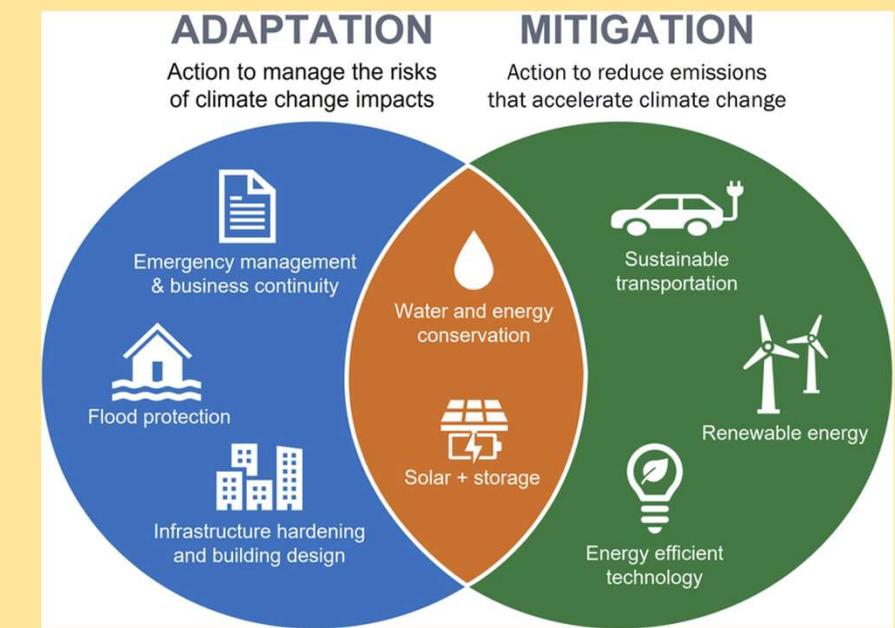
Community Development Manager

Engage members of the community to bring community voice to development projects to grow a more sustainable, equitable, creative, and connected community



Andrea Crouse, Zeitgeist

Adaptation is the process of adjustment to actual or expected climate and its effects to moderate harm or exploit beneficial opportunities



Rabinowitz et al 2023

Sustainability **Coordinator**

A city sustainability officer or coordinator develops and implements programs to improve environmental and social responsibility, often focusing on reducing waste, conserving energy, and promoting sustainable transportation.



Amy Coomes, City of Thunder Bay

Vocab



Eutrophication: Excessive plant and algal growth due to increased availability of nutrients, primarily nitrogen and phosphorus. Can lead to depleted dissolved oxygen and negative impacts to aquatic life.



Minnesota Stormwater Manual



Great Lakes Literacy Principle #7

Much remains to be learned
about the Great Lakes.

Duluth Lakewalk

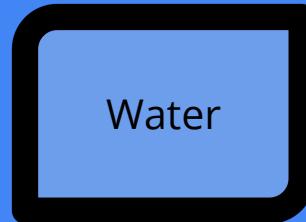
Community
Stories



A series of large coastal storms in 2017 and 2018 severely damaged the Duluth Lakewalk, a popular biking and walking path. The Lakewalk has been rebuilt higher, and a large armored revetment has been installed to protect Canal Park from future damage from large storms.



Photos: Minnesota Star Tribune, Great Lakes Now



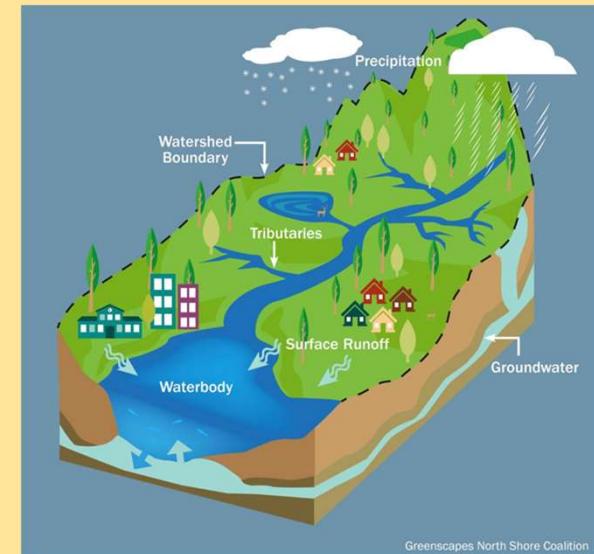
Great Lakes Literacy Principle #3

The Great Lakes influence local and regional weather and climate.

Vocab



Watershed: An area of land that channels rainfall, snowmelt, and runoff into a common body of water (i.e. Lake Superior). Also called a drainage basin



Watershed Diagram. Credit: Greenscapes North Shore Coalition

Saxon Harbor

Community
Stories



A major 2016 storm dropped 10" of rain on Saxon Harbor in Northern Wisconsin destroying the marina, roads, and campground. It has recently been rebuilt to make it more resilient to flooding and severe storm events.

<https://wem.wi.gov/ready210609/>



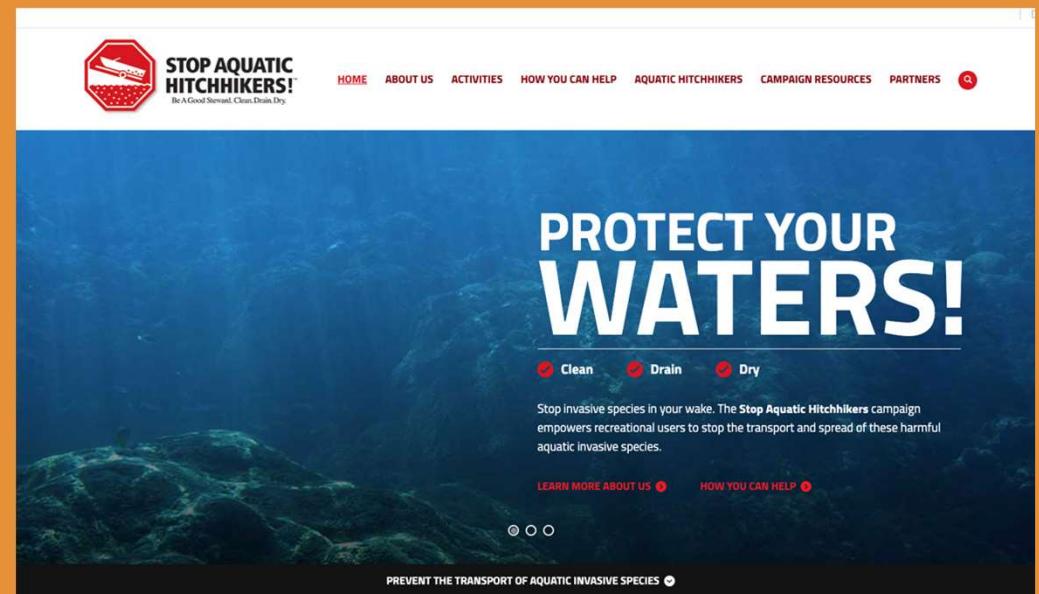
Photos: Duluth News Tribune, Travel Ironwood

Prevent AIS

Help stop the spread of aquatic invasive species. Always Clean, Drain, and Dry your boat, trailer, and gear after leaving the water. These simple steps help stop the spread of invasive species that harm wildlife and water quality.

Personal Actions

Sea Grant
MINNESOTA



stopaquatic hitchhikers.org

Vocab



Resilience is the ability of social, economic, and environmental systems to withstand, adapt to, and recover from the impacts of climate change

Chester Creek Stream Restoration

Following the 2012 flood, Chester Creek in Duluth underwent a comprehensive restoration to enhance its ecological health and resilience. The project included removing damaged dams, re-meandering the stream to restore natural flow patterns, and stabilizing banks with native vegetation and engineered structures to support native brook trout habitat and mitigate future flood impacts.

https://www.southstlouiswcd.org/case_study/chester-creek-project/

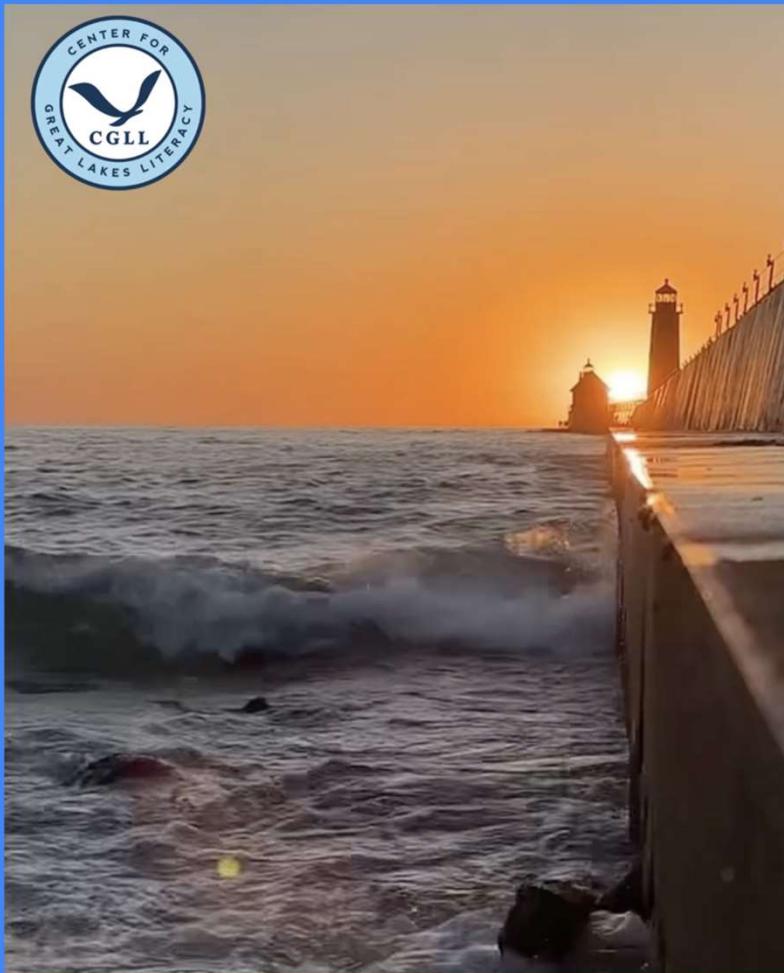


Personal
Actions



Volunteer for local stream and beach clean-up events. These events help remove harmful debris from local streams and shorelines to protect water quality and support wildlife.





Great Lakes Literacy Principle #4

Water makes Earth habitable; fresh water sustains life on land.

Personal
Actions



Speak up: Speak up and get others to join in taking action. It's one of the quickest and most effective ways to make a difference. Talk to your neighbors, colleagues, friends, and family.



Personal
Actions



Plant native species

Native plants can help with erosion control, trap sediments, filter pollutants, support biodiversity, withstand harsh conditions, and require less water and fertilizer.





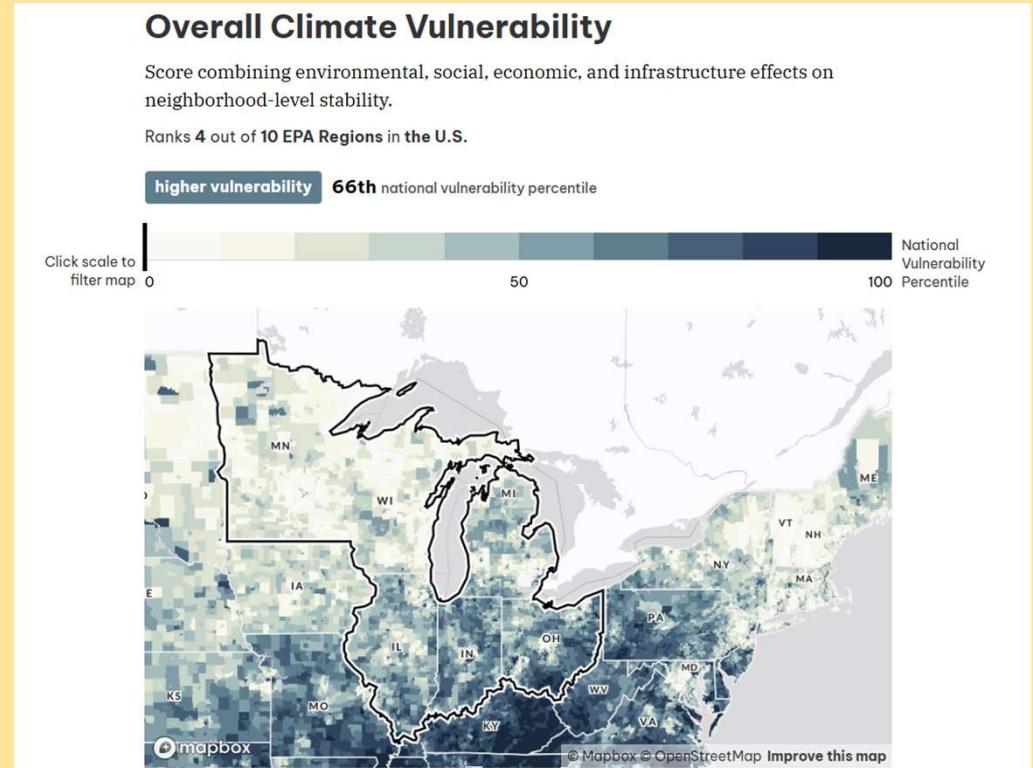
Great Lakes Literacy Principle #5

The Great Lakes support a broad diversity of life and ecosystems.

Vocab



Vulnerability is the degree to which physical, biological, and socioeconomic systems are susceptible to and unable to cope with adverse impacts of climate change



Personal
Actions



Adopt a **storm drain** to keep it clear of leaves, trash and debris. Stormwater is not treated before it enters rivers, lakes and streams and cleaning storm drains can prevent pollution from ending up in local water bodies.



Madeline Island

Community
Stories



The Madeline Island Community Garden builds resilience by supporting tribal food sovereignty. The garden connects residents to the land, each other, and provides free and low cost produce.

www.boreal.org/2021/09/05/367613/growing-food-sovereignty-on-the-shores-of-lake-superior





Great Lakes Literacy Principle #8

The Great Lakes are socially, economically, and environmentally significant to the region, the nation and the planet.

Duluth Flood

A large storm dropped 8-10" of rain on the Duluth area in June 2012. The steep terrain, numerous creeks and rivers around Duluth caused many road washouts and significant damage across the region. The storm caused the worst flood in the history of Duluth and 100 million dollars in damage



Photos: Minnesota Public Radio News



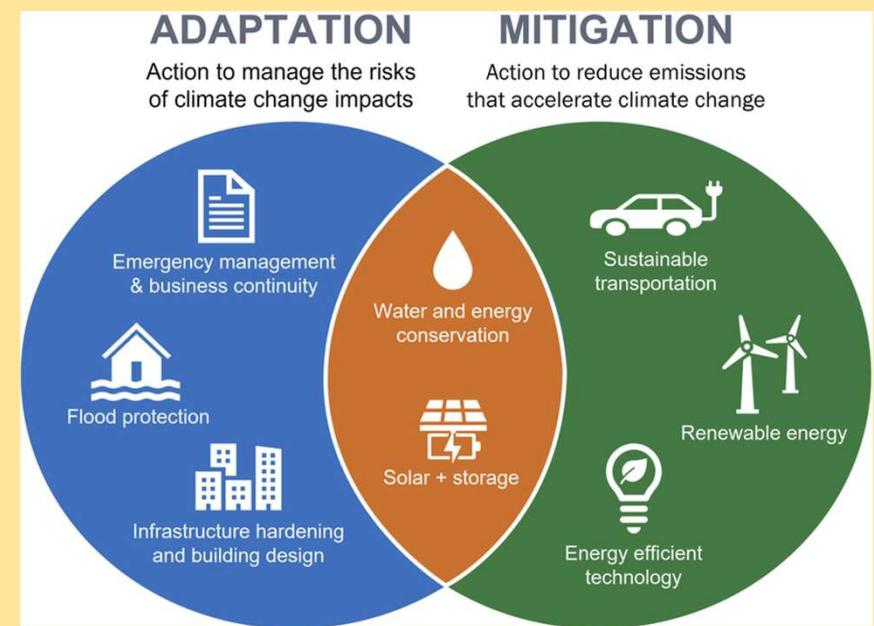
Great Lakes Literacy Principle #6

The Great Lakes and humans in their watersheds are inextricably interconnected.

Vocab



Mitigation includes actions that aim to reduce the amount of greenhouse gases in the atmosphere, thereby slowing down or the effects of climate change



Rabinowitz et al 2023

Know your **Neighbor**

Building community resilience starts by knowing who lives nearby. A strong community is one that is better prepared for and can recover from extreme events.

How could you help a neighbor after an extreme weather event?

Personal Actions

