

# Investigating Local Rivers and Connecting to our Great Lakes

*Au Gres-Sims Elementary School, Au Gres, Michigan*

*A rural elementary school*

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## About the case study

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This case study of place-based stewardship education (PBSE) at Au Gres-Sims Elementary School is one of 11 case studies developed by staff of the Great Lakes Stewardship Initiative (GLSI), staff of the GLSI's nine regional hubs, and the educators whose work is featured in the study.

The case studies focus on PBSE efforts during the 2014–15 school year. At most of the sites featured in these studies, the PBSE approach has been developed over the course of several years.

Each school featured in a case study works with the GLSI through a regional hub. Hubs provide professional development for educators, help schools connect and partner with community-based organizations, and provide funding and other PBSE supports with an environmental stewardship emphasis.

*Cover: A student takes time to reflect during a local stewardship effort.*

Au Gres-Sims Elementary School has a longstanding relationship with its hub, the Northeast Michigan Great Lakes Stewardship Initiative.

### Investigating Local Rivers and Connecting to Our Great Lakes

*November 2016*

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## Conventions in this document

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As you read this study, you will see special icons in the text.



This icon marks a teaching tool, resource, or product that you can access and download from the case study.



This icon marks a connection between the work being described and the GLSI's Guiding Principles for Place-based Stewardship Education, developed by GLSI central and hub staff to describe the GLSI's vision for exemplary place-based stewardship education. Certain aspects of each case study illustrate how one or more of the principles can be enacted in classrooms and communities.



# Quick Summary

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## Elementary students studied a local river and collected, analyzed, and shared data

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The Au Gres River, which runs within a half mile of the Au Gres-Sims Elementary School, is part of the Saginaw Bay Watershed, which drains into Lake Huron. Au Gres students launched an ambitious study to learn about the river's water quality and increase the public's awareness of its importance to their community.

Fourth and fifth grade students investigated biotic (living) and abiotic (non-living) indicators at several sites on the river.

Students analyzed and interpreted the data they collected and also shared it through Great Lakes FieldScope, a web-based mapping, analysis, and collaboration tool that engages volunteers—in this case, students—as citizen scientists.



*Students work in teams to sample macroinvertebrates.*

*“We can help the community and make sure that the river and the streams are healthy.”*

*—Au Gres-Sims student*



# Community Context

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## Context is essential in place-based stewardship education

There is perhaps no more distinctive characteristic of PBSE than its treatment of place as the context for learning.

Our sense of place does not exist in only one geography, and it changes as we age. When we are very young, we may experience our strongest sense of place in our homes, neighborhoods, and favorite places for play. As we grow, we begin to understand that we are members of other communities, too—a school community, a city or town, a watershed, a state, or a bioregion such as the Great Lakes.

PBSE relies on place—including lands and waters, people and organizations, history, and culture—as a starting point for teaching and learning. Reading about rainforests or deserts may be interesting, but environmental learning grounded in students' home communities builds on a foundation of community attachment and place-based knowledge.

That foundation for Au Gres youth includes Lake Huron, the vast freshwater wetlands of Saginaw Bay, and local rivers, forests, and farmland.

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## Au Gres has many natural resources and a strong connection to the Great Lakes.

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*Above: Au Gres is situated at the north edge of Saginaw Bay on Lake Huron. Left: Caption.*

Au Gres is a small, rural community of about 800 people that is situated on the Sunrise Side Coastal Highway. This road traces Lake Huron's shoreline and is well-traveled by visitors.

Ecotourism plays an important role in Au Gres' economy. The region offers recreational opportunities year-round, from fishing and golf to snowmobiling and cross-country skiing.

Boating is especially popular; the town's amenities include four marinas and a port of refuge.

The Au Gres River, which runs through the town, connects residents and visitors alike to the beauty and resources of nearby Saginaw Bay and Lake Huron.

# Lake Huron and Saginaw Bay are an outdoor enthusiast's wonderland

*The Saginaw Bay watershed is an important focus of The Nature Conservancy's Great Lakes Project.*



*The Saginaw Bay watershed  
Map: The Nature Conservancy*



*Thousands of birds gather during migration at the Fish Point State Wildlife Area on Saginaw Bay.  
Photo: State of Michigan*

At the heart of Lake Huron lies Saginaw Bay. Often referred to as “The Chesapeake of the Midwest,” this is the largest continuous system of freshwater coastal wetlands in the United States.

The Saginaw Bay watershed is Michigan's largest. It encompasses 5.5 million acres and 22 counties. About 45 percent of the watershed's land area is used for agriculture.

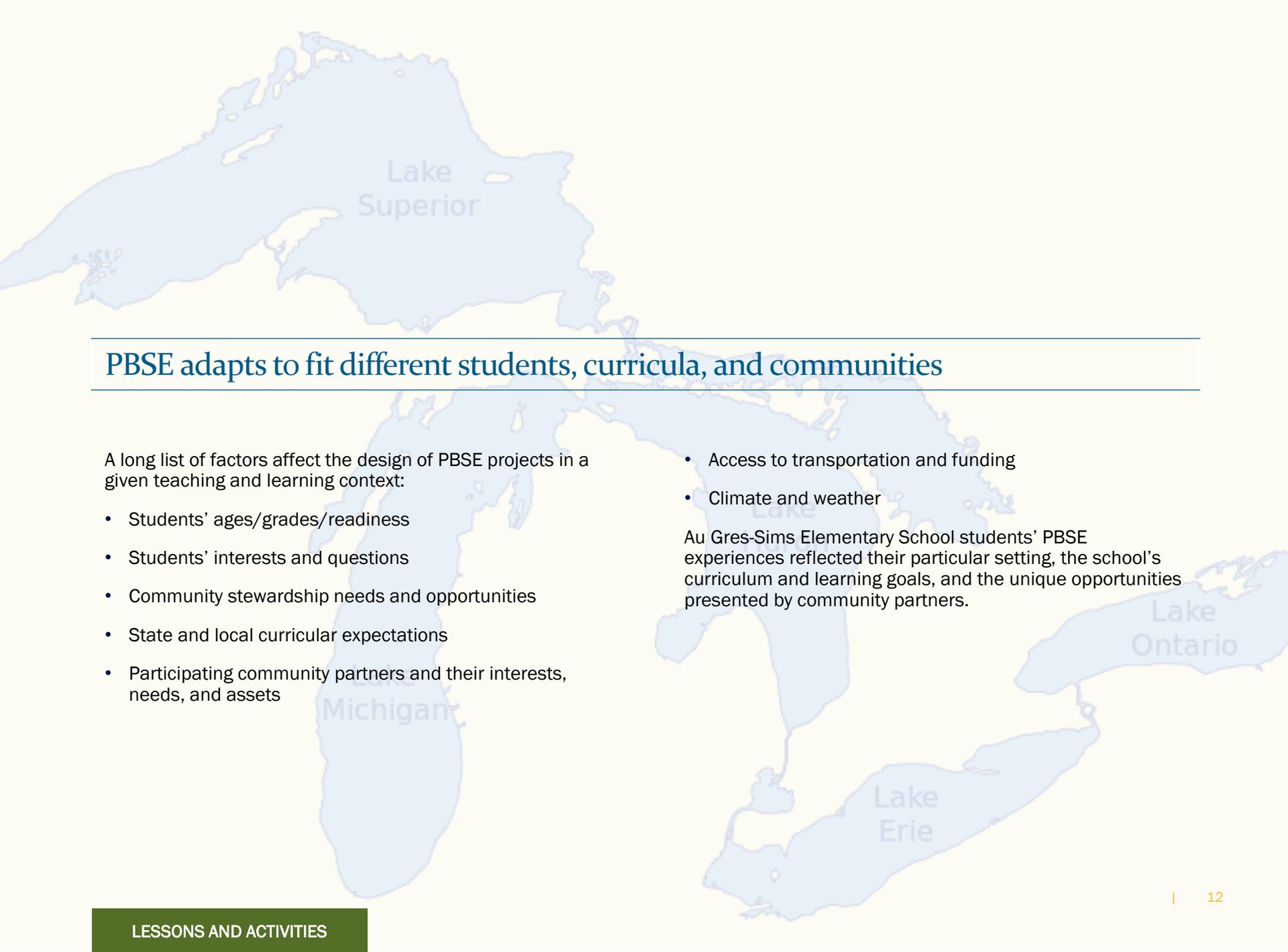
According to The Nature Conservancy, one of the greatest threats to this watershed is excess nutrients and sediment that enter rivers and lakes because of poor land use practices.

Lake Huron is a valuable asset for all of northeast Michigan's communities, including Au Gres. By surface area (23,000 square miles), it is the second largest Great Lake and the third largest freshwater lake in the world.



# Lessons and Activities

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## PBSE adapts to fit different students, curricula, and communities

A long list of factors affect the design of PBSE projects in a given teaching and learning context:

- Students' ages/grades/readiness
- Students' interests and questions
- Community stewardship needs and opportunities
- State and local curricular expectations
- Participating community partners and their interests, needs, and assets

- Access to transportation and funding
- Climate and weather

Au Gres-Sims Elementary School students' PBSE experiences reflected their particular setting, the school's curriculum and learning goals, and the unique opportunities presented by community partners.

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## Learning about their place helped young people care about their place

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The 50 fourth and fifth grade students who investigated the Au Gres River were some of the youngest residents of the Saginaw Bay watershed. But they were eager to get their feet wet in order to make some important contributions to their environment and their community.

The students studied the east and west branches of the river, learning about natural history, aquatic biology, and the impacts of human activity. One such impact, channelization (the straightening of a river), often increases the rate of erosion and the sediment load in rivers and streams and ultimately decreases biodiversity. Increased sediment load in waterways causes major problems in the Saginaw Bay watershed, of which the Au Gres River is a part.



*Students measure the depth of the Au Gres River at specific points along its course.*

*“Water is a part of our life and we need it to survive.”*

*—Au Gres fifth grade student*

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# The study of two branches of the Au Gres River occurred in parallel for fourth- and fifth- grade students

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## *East branch of the Au Gres River*

Students monitor water quality at Vaughn Creek, one of the headwaters of the East Branch of the Au Gres River and an agricultural site on the river

## *Making data meaningful*

Students review, interpret, and analyze data using National Geographic's Great Lakes FieldScope

## *East branch of the Au Gres River*

Students revisit the same sites from the fall to better understand seasonal changes in the river and the watershed; students share findings

FOURTH GRADE



FIFTH GRADE

## *Making data meaningful*

Students review, interpret, and analyze data using National Geographic's Great Lakes FieldScope

## *West branch of the Au Gres River*

## *West branch of the Au Gres River*

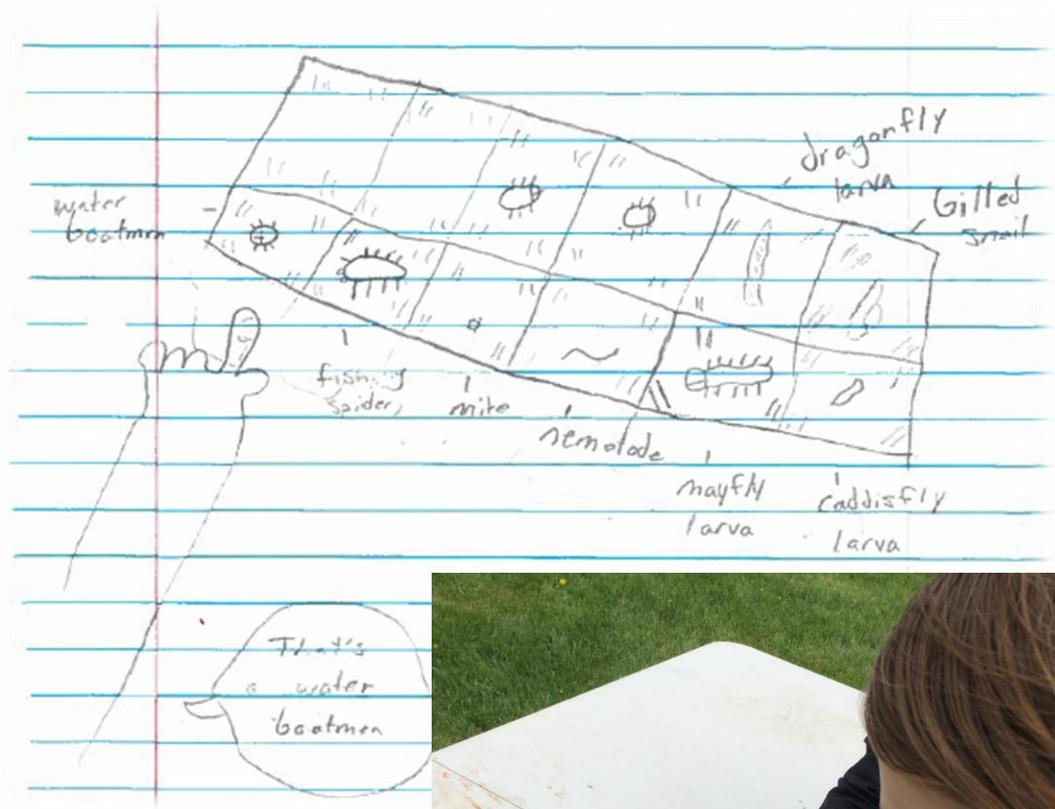
Students monitor water quality at Sage Lake, one of the headwaters of the West Branch of the Au Gres River and an agricultural site on the river

Students revisit the same sites from the fall to better understand changes in the river and the watershed; students share findings

## Great Lakes scientists helped students learn to identify macroinvertebrates

Before conducting their river project, Au Gres-Sims students connected with Great Lakes scientists. Scientists brought river samples into the classroom, and students learned to use a dichotomous key to identify macroinvertebrates that live in streams. This helped ensure accurate identification of these species during the students' study of the Au Gres River.

Several federal agencies have a strong presence in northeastern lower Michigan. The largest city in the region, Alpena, is home to the Thunder Bay National Marine Sanctuary, which operates the Great Lakes Maritime Heritage Center. The U.S. Fish and Wildlife Service has a regional office in the area, as do the Michigan Department of Natural Resources' Fisheries and Wildlife Divisions; the Fisheries Division also operates a specialized Great Lakes Fisheries Research Station here. By working alongside scientists before or during their stewardship projects, students can be exposed to career opportunities.



Top: A student's drawing of various types of macroinvertebrates native to the Au Gres River. Right: A student works with a dichotomous key to identify macroinvertebrates.



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## Preparation by teachers helped organize and standardize students' work

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Prior to the students' arrival, teachers Michael Fields and Tracy Stoldt marked off 65-foot sections along the Au Gres River using a transect line with meter increments. The transects helped organize sampling by teams of students and also allowed students to create a depth profile of the river.

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## Students took on new roles at the river

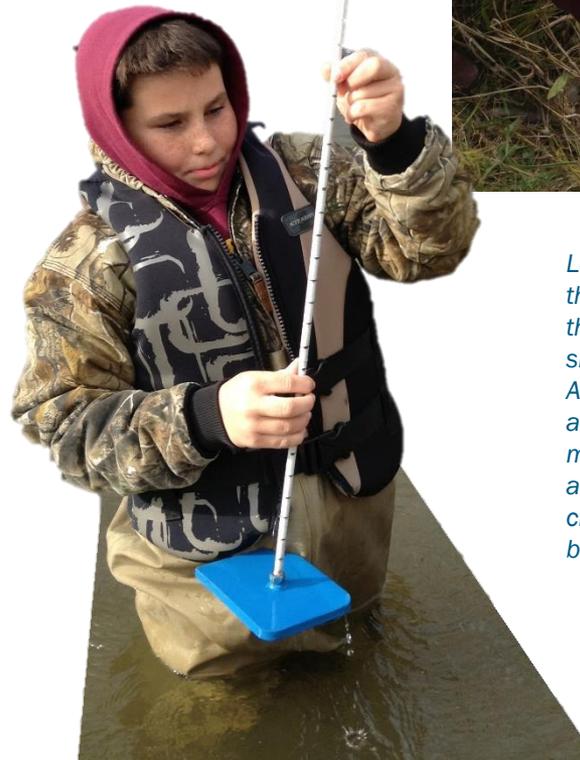
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*Hands-on, purposeful learning helped develop leaders and environmental stewards whose efforts made a difference.*

Students developed leadership skills through their investigation of the river. They worked in teams, with each team selecting its own captain who determined roles for other team members. Students recorded data about the riparian zone and various water quality parameters, and also collected samples of living and non-living indicators of water quality. They worked together to ensure that the information they gathered was reliable and accurate.

*“Accuracy counts when you do this. It isn’t just a fun field trip; you have to get right down to work. When you record this kind of information on a recording sheet you have to have the correct data.”*

*—Au Gres-Sims Elementary fifth-grade student*



*Left: Using a homemade depth detector, this student is measuring river depth across the width of the river while recording the size and type of river bottom substrate. Above: Using a standard form, the leader of a student group records data on macroinvertebrates, river water chemistry, and physical attributes, while her classmates perform other tests in the background.*

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## Place-based stewardship education provided opportunities to integrate teaching and learning across several subject areas

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Students became water resource experts as they worked in the river. Teams measured physical parameters of the river, including its width, depth, type of river bottom, and flow rate. Applying chemistry, they tested samples from various stretches of the river to determine levels of ammonia, nitrate, and dissolved oxygen in the water.

Students surveyed and counted aquatic macroinvertebrates. By analyzing these data, they got a sense of the river's biodiversity and ecology.

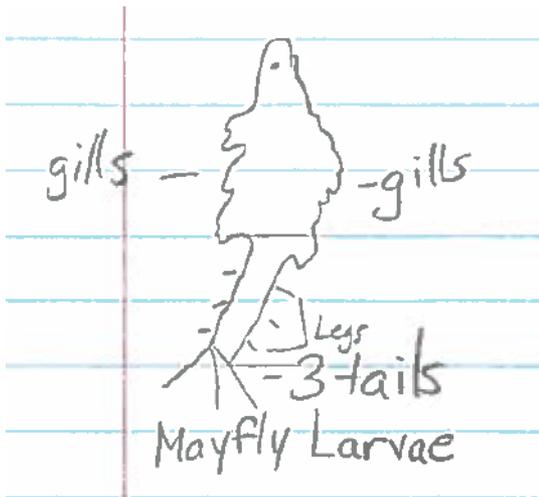
Applying math, they used their counts of organisms as biological indicators in calculating a water quality index that was then compared to an index based on results of their water chemistry tests. These activities, in combination, connected to a variety of classroom learning goals and gave students a well-rounded picture of the river's health.



*Au Gres students make their way upriver while sampling.*

## Students were assessed, in part, on the basis of written reports

In addition to entering their data into a citizen science web site, students developed summative reports of their findings. Written reports offer students the opportunity to interpret their data and link their classroom learning to the community. Through written reports, students are also offered the opportunity to integrate English Language Arts, mathematics, and science.



*Drawing assignments help develop observation skills.*



*A student records data.*



**Guiding Principle 3b:** Teach students to draw on multiple disciplines and ways of knowing as they consider and take action on local stewardship needs.

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## Students shared the results of their research with others in their community

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Au Gres-Sims fourth and fifth grade students made others in their community aware of their research efforts and results. They presented a summary report to the City Council, which highlighted the importance of water quality and its contribution to ecotourism in the region. They described their river investigation, including the methods they used to analyze the river's water quality.

Au Gres-Sims students also participated in the Northeast Michigan Youth Watershed Summit, where they described their stewardship project and its results to the public and to fellow students from other schools who had also completed projects.

These events expanded students' skills and experience in public speaking and helped them appreciate the value of their research to the community.



*Two Au Gres students present their research at the Northeast Michigan Youth Watershed Summit.*

**[LINK: SEE STUDENTS' SUMMARY ON THE HEALTH OF VAUGHN CREEK, AS PRESENTED TO CITY COUNCIL](#)**



**Guiding Principle 10:** Support and enable the visible, meaningful participation of students in the community's public discourse.



*“PBE has been a difference-maker for us. We have been able to leverage all of our great and abundant resources here within the Saginaw Bay Watershed in order to provide enriching and applicable education experiences for students of Au Gres-Sims.”*

*—Jeffrey Collier, Superintendent of the Au Gres-Sims School District*



# Team and Planning

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## PBSE builds relationships that support teachers

Relationships are an important part of most PBSE efforts. Teachers can work in grade level, multidisciplinary teams on a common PBSE effort, or on teams that span grades or even schools. This does not mean that a single teacher cannot implement PBSE, just that the benefits are often greater when they can work with a team.

Teachers also form partnerships with community members who have environmental expertise or resources to share, or an ongoing community or environmental project that would benefit from the involvement of students.

Over the years that the GLSI has been operating, many teachers have said that they particularly value this opportunity to collaborate with other teachers and experts in the community.

The benefits of teacher collaboration are supported by research like [\*The Missing Link in School Reform\*](#), from the Stanford Social Innovation Review.

**[\*LINK: THE MISSING LINK IN SCHOOL REFORM\*](#)**

# Many people and organizations contributed to Au Gres-Sims Elementary's PBSE efforts

*PBSE relies on strong school-community partnerships, and helps develop them.*

Community connections were essential to the success of this place-based river investigation. Michael Fields, the teacher who led this effort, has been a part of the Au Gres community for 25 years. His history in the area helped pave the way for local partners to avidly support the students' project.

Local partners who contributed equipment and materials, data, staff expertise, or access to facilities or funding included the U.S. Fish and Wildlife Service, Michigan Sea Grant, Huron Pines and its AmeriCorps program, NOAA B-WET program, Saginaw Bay Watershed Initiative Network, Saginaw Chippewa Indian Tribe of Michigan, and MSU Extension 4-H Youth Programs. These organizations were interested in the students' research because it aligned with their own missions to educate the public and protect the area's natural resources and the Great Lakes.

This project was also enthusiastically supported by school administrators, teachers, parents, and students in the Au Gres-Sims School District. Having both school and community support for place-based education will help ensure that students in the Au Gres-Sims School District will have place-based stewardship education experiences throughout their K-12 careers.



# Place-based stewardship education is fully compatible with the school district's purpose

*The mission of Au Gres-Sims School District is to educate all students to be caring, productive, and self-fulfilled citizens.*

In the 2015-2016 school year, nearly 400 K-12 students were enrolled in the district, with 68 percent of these qualifying for free or reduced lunches. In that same period, nearly 95 percent of the student body was white or Caucasian.

With its elementary, middle, and high schools housed in the same building, the district can more readily organize and facilitate place-based education across the grades for these students.

Au Gres-Sims School District identified four key pillars that are connected to both place-based education and STEM instruction in a spiraling curriculum that spans all grades. In future, the district hopes to similarly connect place-based education with other disciplines, including English Language Arts and Social Studies.



## Au Gres-Sims' Four Focused STEM Pillars

- 1. Robotics and Engineering**
  - ROVs, UAVs, First Robotics
- 2. Watersheds and Ecosystems**
  - River Investigations, Water Quality Studies, Vernal Ponds
- 3. Schoolyard Habitats**
  - Charity Island Study, Butterfly Garden, Beach Conservation
- 4. Meteorology**
  - WeatherBug, Climate Studies



**Guiding Principle 3e:** *PBSE informs, enhances, and supports school and district priorities related to curriculum and school improvement.*

**Environmental Stewardship**  
Place-based Education (PBE)  
Student-centric / Experiential Learning  
Site-based Experimentation  
Longitudinal Studies  
Higher-order Thinking Skills  
Multi-layered & Cross-curricular  
Extended Learning Opportunities



⇒ ROVs, UAVs, & Weather Station  
⇒ Water Quality Studies  
⇒ Schoolyard Habitats  
⇒ Applied Sciences & Mathematics  
⇒ Practical, Hands-on Field Studies  
⇒ Community Partnerships  
⇒ Digital Portfolios  
⇒ Capstone Experiences

# The Au Gres-Sims district created a STEM Curriculum Overlay

*This planning tool helps connect place-based education with school-wide learning goals.*

Remote Operated Vehicles	Water Quality Studies	Schoolyard Habitats	WeatherBug Weather Station
<p><b>Grades K-2</b> Students will assemble and disassemble small and large objects while exploring the specific principles of sink and float in relation to the properties of objects.</p>	<p><b>Grades K-2</b> Students will explore the physical attributes of human environmental interactions within the Saginaw Bay Watershed.</p>	<p><b>Grades K-2</b> Students will observe, identify, and investigate the basic required resources, interconnections, and physical traits of plants and animals while maintaining a wildflower garden.</p>	<p><b>Grades K-2</b> Students will compare daily visual observations with <i>WeatherBug</i> weather station data while investigating severe weather, heat transfer and earth system connections.</p>
<p><b>Grades 3-5</b> Students will learn and comprehend buoyancy and acquire wire circuitry skills while constructing simple ROVs.</p>	<p><b>Grades 3-5</b> Students will collect, record, and analyze Saginaw Bay Watershed data on the <i>National Geographic FieldScope</i> website and relate findings to the health of the Watershed.</p>	<p><b>Grades 3-5</b> Students will study complex internal structures, survival strategies, and environmental effects through investigation and interaction with a wildflower garden.</p>	<p><b>Grades 3-5</b> Students will use charts, graphs, and models collected from the <i>WeatherBug</i> weather station data to demonstrate comprehension of how weather patterns affect regional climates.</p>
<p><b>Grades 6-8</b> Students will solder digital circuitry and design complex ROVs to collect water and sediment samples, with an introduction to the principles of flight design and a Capstone experience.</p>	<p><b>Grades 6-8</b> Students will expand their analysis of the Saginaw Bay Watershed while using ROVs and apply scientific principles to determine methods of lessening human impact.</p>	<p><b>Grades 6-8</b> Students will use the wildflower garden to examine specialized cellular features, specific chemical resources, and environmental impacts on the Saginaw Bay Watershed.</p>	<p><b>Grades 6-8</b> Students will expand their interpretation of the <i>WeatherBug</i> weather station data to better forecast both weather and climate in the Saginaw Bay region.</p>
<p><b>Grades 9-12</b> Students will design sophisticated ROVs and/or aeronautic drones for exploration of the Saginaw Bay Watershed and competition(s), while mastering practical applications of the science standards.</p>	<p><b>Grades 9-12</b> Students will conduct sophisticated analyses and employ scientific principles to determine the health of the Saginaw Bay Watershed and provide relevant action plans for continued environmental preservation.</p>	<p><b>Grades 9-12</b> Students will comprehend the connectivity between energy, chemical, and biological resources as related to the health and future preservation of the Saginaw Bay Watershed.</p>	<p><b>Grades 9-12</b> Students will use longitudinal data to predict the potential results of climate change on the biological, economical, and sociological aspects of the Saginaw Bay Watershed and propose solutions to mitigate negative impacts.</p>

With district and school-wide support, the Au Gres-Sims School District developed a STEM Curriculum Overlay that identifies place-based education pillar strategies related to environmental stewardship.

By listing relevant curricular connections, this document helped ignite and organize conversations about place-based education and illustrates how the leadership and support of the school's district and building administrators and teachers can pave the way for powerful student learning.

[LINK: DOWNLOAD THE AU GRES-SIMS' STEM CURRICULUM OVERLAY](#)



**Principle 3d:** *Establish clear but flexible learning goals that relate to robust standards for student achievement.*



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*“Teaching through place-based education allows students to make a personal connection with the state standards and environment that is essential to our way of life.”*

*— Michael Fields, lead teacher*

# Outreach by partners can expand awareness of PBSE well beyond the community

Through various media, the school district, the GLSI regional hub, and other partners celebrated the students and their work. This recognition helped students recognize that the work they did made a real difference in their community.

The superintendent of the school district featured place-based education in his podcasts, which reached not only local residents but also fellow school administrators across the state.

[LINK: SUPERINTENDENT JEFF COLLIER'S PODCAST ABOUT PLACE-BASED EDUCATION](#)

[LINK: NORTHEAST MICHIGAN GREAT LAKES STEWARDSHIP INITIATIVE'S PROJECT PAGE ABOUT THE AU GRES RIVER STUDY](#)

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Home

## Students promote Lake Huron biodiversity during Charity Island excursion

All Au Gres-Sims elementary students team up with Great Lakes scientists to monitor threatened re phragmites plant populations on Charity Island.

by [Brandon Schroeder](#), Michigan State University Extension, Michigan  
Justin, Michigan State University Extension

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## Go with the flow



By JACOB DAWITT  
Huron Pines Area Corps  
and BRANDON SCHROEDER  
Michigan Sea Grant

From its upper stretches to where the Au Gres River meets Lake Huron, elementary students from Au Gres-Sims Schools explore water quality across their watershed, inspiring community awareness and building partnerships.

Some of the youngest citizens within the Saginaw Bay Watershed, the elementary students are stepping up – and getting their feet wet – in hopes of making important contributions to the environment and their community. With an understanding of watersheds, the resource-minded students are looking inland and to the rivers that feed Saginaw Bay.

The project connected Au Gres-Sims students with conservation partners including U.S. Fish and Wildlife Service, Michigan Sea Grant, Huron Pines, NOAA B-WET program, Saginaw Bay Watershed Initiative Network, Saginaw Chippewa Indian Tribe of Michigan, 4-H Youth Programs and local township officials, among many others.

ARENAC COUNTY – Lake Huron is a valuable water asset for northeast Michigan communities – with nearly 3,830 miles of shoreline and 23,000 square miles, it is the third largest freshwater lake in the world.

At the heart of Lake Huron is Saginaw Bay. Fed by an impressive network of rivers and streams, the Saginaw Bay Watershed drains water from nearly 15 percent of Michigan's total land area into Lake Huron.

A treasured and important resource, Saginaw Bay supports a wide diversity of fish and wildlife and may be best known as a walleye and whitefish wonderland. These fish and wildlife resources depend on the Bay's vast coastal wetland – a unique habitat that represents the largest continuing system of freshwater coastal wetlands in the nation.

The scale of the Great Lakes resource and its connecting watershed is not lost on the elementary students of Au Gres-Sims School who sit by Saginaw Bay. Neither is the opportunity to provide a leadership role focused on monitoring and increasing awareness about these important water resources.



Using a homemade depth detector, this student is measuring river depth across the width of the river while recording the size and type of river bottom substrate.



More than 40 Au Gres-Sims Elementary students hike along the East Branch of the Au Gres River preparing to set up six data collection stations. The information they collect will be uploaded to FieldScope, an online database where other regional schools in Northeast Michigan also store information on local river health.

**Au Gres-Sims School District Newsletter** Postal Patron  
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www.ags-schools.org

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## Students Conduct Scientific Charity Island Study

Au Gres-Sims Elementary students embarked on a unique collaborative scientific study to monitor threatened and invasive plant species on Charity Island as part of the district's project-based STEM program in October.

Partnering with the Northeast Michigan Great Lakes Stewardship Initiative, including Michigan State University Extension, Michigan Sea Grant, Huron Pines, Michigan Natural Features Inventory, and U.S. Fish and Wildlife Service, students and scientists boarded the *Miss Charity Isle* from Brown's Landing Charter Services and traversed the waves to Charity Island where they began their scientific research.

Carrying clipboards, data sheets, identification charts and global positioning satellite (GPS) units, the young scientists were eager to begin their mission collecting information. The fourth graders counted, mapped and monitored populations of the federally threatened Pitcher's Thistle plant, known to grow only in the sandy dune shoreline areas of the Great Lakes and islands. Students also collected data on Phragmites, an invasive plant species encroaching upon and threatening this same coastal habitat.

Under the direction of Michigan Natural Features Inventory

scientists, the children documented over 200 plants during their trip. They were trained to take precautions against harming the plants while conducting their study. The students also collected seeds from adult plants, which will be cultivated by the U.S. Fish and Wildlife Service to support future restoration efforts on the island. Further, they exercised teamwork, communication, and professional responsibility during the course of the project. Learners enjoyed exploring the natural and historic aspects of the island, including the famed lighthouse, before returning to school to begin summarizing their findings.

Publications featuring PBSE at Au Gres. Click any image to link to the full publication.



# Impacts of the Project

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## PBSE offers deep learning and community enhancement

One of the key principles of PBSE is that when students are able to create tangible, meaningful benefits for the community and the environment through their own efforts, they benefit academically. Not “either or,” but “both and.”

This win-win quality of PBSE makes it particularly attractive when resources for community and environmental enhancement are scarce, and when schools are challenged to meet new, higher expectations for student learning.

Involving students in their communities makes learning more relevant and engaging. Students are intrinsically motivated to learn when the work is interesting and consequential.

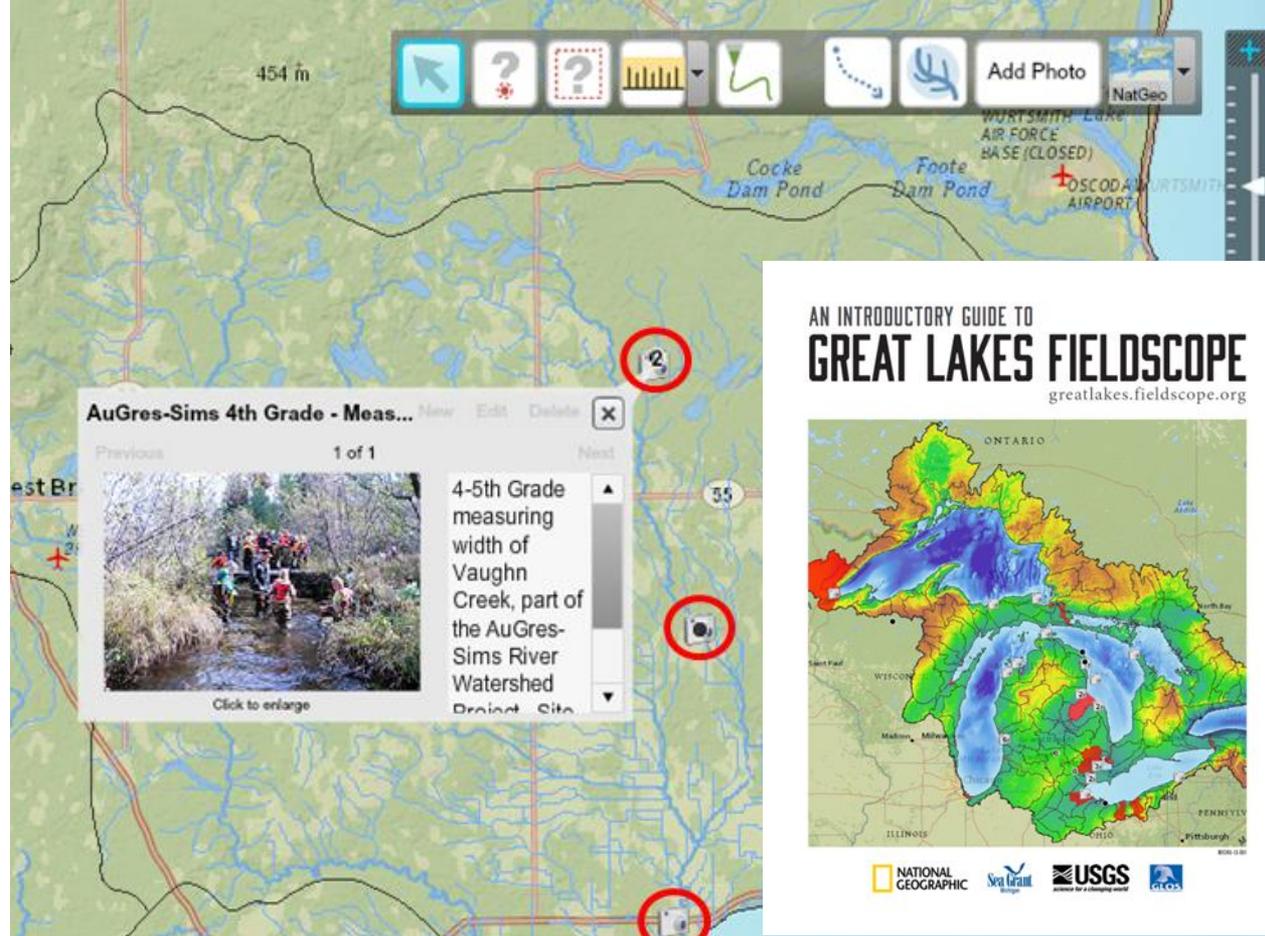
Students participating in PBSE efforts supported by the U.S. EPA grant to the Great Lakes Stewardship Initiative participated in pre- and postexperience surveys. Students at Au Gres-Sims Elementary School took the same surveys during the 2013-14 school year, and the data here reported includes surveys from both years unless otherwise specified.

This section explores the benefits to the Au Gres community and environment achieved through PBSE at Au Gres-Sims Elementary School, including selected findings regarding student impacts.

Image of Great Lakes FieldScope data points submitted by Au Gres-Sims Elementary. The introductory guide to Great Lakes FieldScope is available online.

## Students contributed their data to an interactive website for citizen scientists across the Great Lakes

LINK: [GREAT LAKES  
FIELDSCOPE](http://GREAT_LAKES_FIELDSCOPE)



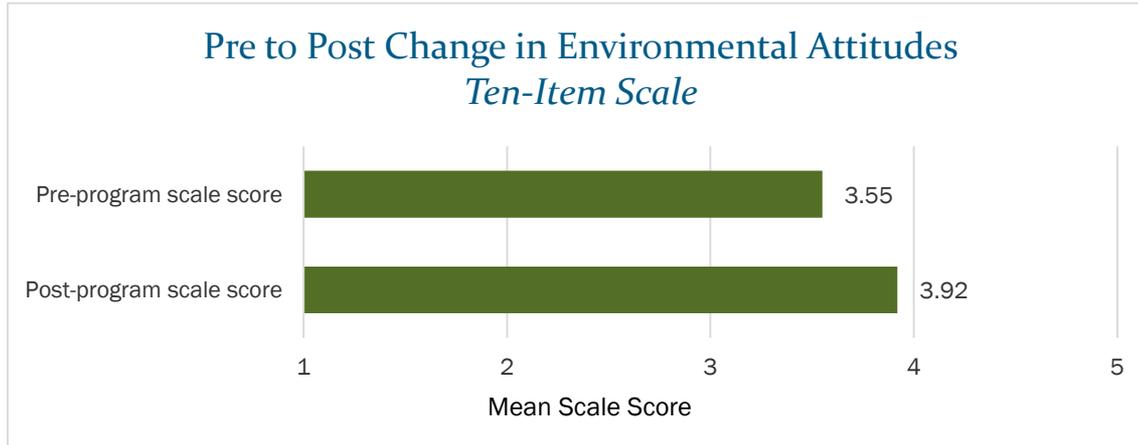
Au Gres Elementary School was the first school in the Great Lakes region to contribute data to Great Lakes FieldScope, a web site created by the National Geographic Society, Michigan Sea Grant, and the U.S. Geological Survey that focuses on water resources and encourages citizen science.

Citizen science is recognized by many as a potentially powerful strategy to increase scientific literacy in the United States (Bonney et al. 2009; Garbarino and Mason 2016). By mapping their school's testing sites and adding the data they collected there,

students learned about geography and GIS technologies. The site's interactive maps allowed students to further explore their own and others' findings in the context of different geographic scales (e.g., their watershed, Lake Huron, the Great Lakes, and the world).

Great Lakes FieldScope is a digital backbone for a network of schools and communities that conduct research, build awareness of natural resources, and promote environmental stewardship and Great Lakes literacy.

# Students' pre- and postexperience surveys revealed growth in attitudes about the environment



*Pre- and postsurvey results for Au Gres-Sims Elementary fourth- and fifth-grade students. Only students with a matched pair of surveys are included in the analysis.*

Students took surveys before and after their water-quality monitoring work. The surveys contained multiple agree-disagree questions that, as a group, measured key aspects of environmental stewardship (see box, left). Each scale ranged from one to five, with larger values representing a stronger stewardship position. The scale scores each represent a student's averaged responses to several thematically related questions.

Au Gres-Sims students' scores on the environmental attitudes scale increased by

0.37 between the pre-program survey and the postprogram survey. The effect size of the change was 0.57 (moderate). An effect size is a standardized measure of change based on the standard deviation—an effect size of 0.5 is a change equal to half the standard deviation of the underlying scores. Students exhibited a trivial increase in environmental sensitivity, a trivial decline in responsible environmental behaviors, and no change in place attachment (data not shown).

## *Scales in the surveys*

**Environmental sensitivity** is a feeling of care for nature and connection to nature.

**Environmental attitudes** are a set of beliefs about the importance of environmental protection and conservation.

**Responsible environmental behaviors** are choices (such as turning off the water when brushing one's teeth) that are within our capacity to make, and that are beneficial for the environment.

**Community/place attachment** includes the sense that a place or community is "part of me," that one is known in the community, and that the community is a good place to do "what I like to do."

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## Most students felt they learned “things I can do to protect the environment”

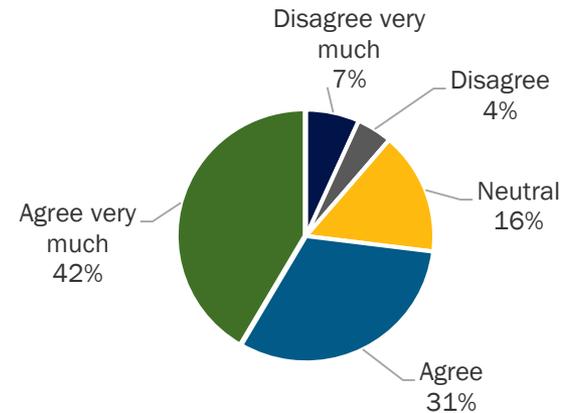
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In the postexperience survey, 73 percent of the students agreed “strongly” or “somewhat” with the statement, “By working on our stewardship project, I learned about things I can do to protect the environment.”

*“The kids are no longer taking the fact that we are surrounded by water in Au Gres for granted. They also understand that water is a precious resource. Now, they appreciate the importance of maintaining good clean water and how lucky we are having 20% of the world’s freshwater in our backyards.”*

*—Michael Fields*

By working on our stewardship project, I learned about things I can do to protect the environment.



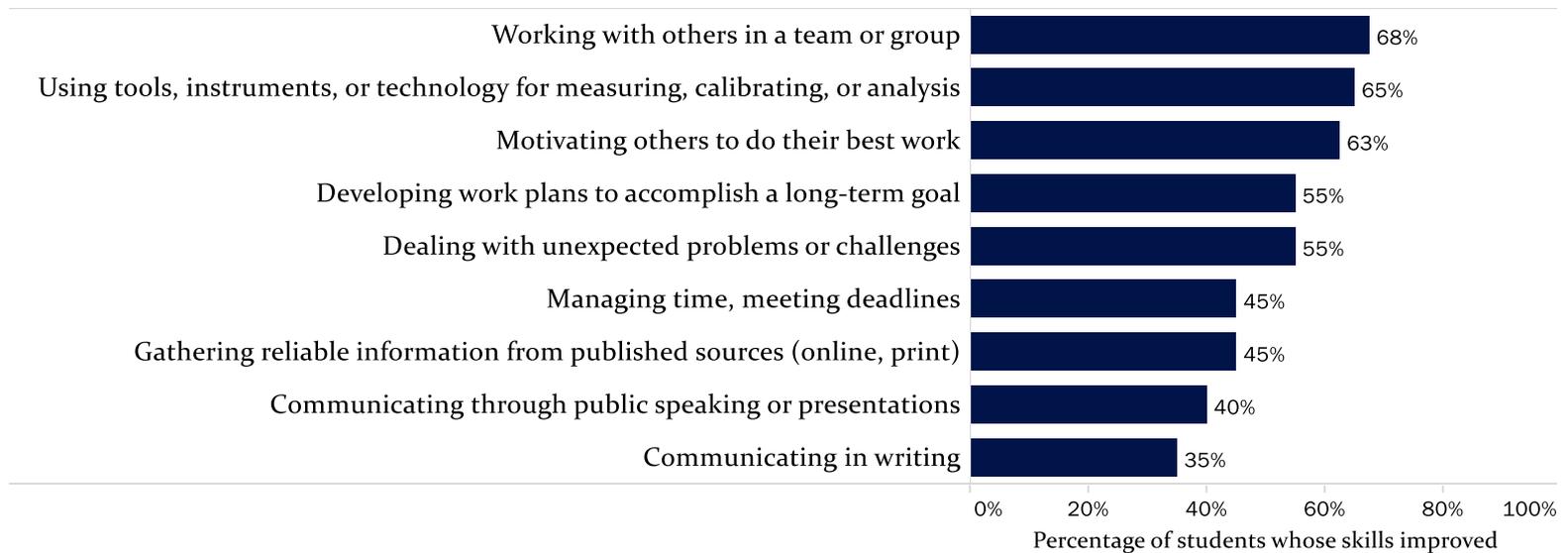


*“It’s fun, but you’re actually learning stuff. And you’re out in the field, and you’re getting fresh air, instead of being in a classroom.”*

*—Au Gres-Sims fifth grader*

## Fourth- and fifth-grade students reported gains in many different professional skills

*Students responding to the survey checked 4.7 skills, on average, that they felt they had developed through stewardship work.*



*Results from the post-only portion of the stewardship survey taken by fourth- and fifth-grade students at Au Gres-Sims Elementary during the 2014–15 school year.*

In the postexperience survey (after students had completed their stewardship projects), students were presented with a list of skills and asked to check any that their stewardship work helped them develop.

Au Gres-Sims students were particularly likely to say they learned to collaborate with others, use technology or tools for measuring and analysis, motivate others, develop work plans, and deal with unexpected problems or challenges.



*“Experiencing Great Lakes and natural resources careers first-hand, students are working alongside scientists from Michigan Sea Grant, Michigan Natural Features Inventory, US Fish and Wildlife Service, and Huron Pines. In trade, these young citizen scientists are collecting invaluable data used to monitor local water quality and aquatic habitats, manage invasive species, and promote Lake Huron biodiversity conservation.”*

*—Brandon Schroeder, Michigan Sea Grant*

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## Other PBSE efforts could yield a different set of benefits

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*There is a lot of freedom within the PBSE framework, so many benefits are possible depending on the direction taken.*

### BENEFITS OF PLACE-BASED STEWARDSHIP EDUCATION CAN INCLUDE:

#### STUDENT ACADEMIC GAINS

- Improved academic scores and grades
- Improved critical thinking skills
- Increased engagement in school and motivation for achievement
- Increased professional skills, such as leadership, persistence, taking responsibility, teamwork, developing plans to reach a solution, managing time, motivating others, and dealing with unexpected challenges
- Deeper learning and action competence
- Increased awareness of career options

#### POSITIVE YOUTH DEVELOPMENT AND STEWARDSHIP GAINS

- Social-emotional development, including increases in self-esteem, a sense of empowerment and agency, social interaction skills and capital, and awareness of cultural diversity
- Sense of place and community attachment

- Civic-democratic competencies and attributes
- Pro-environmental attitudes
- Environmental sensitivity and awareness
- Responsible environmental behaviors

#### TEACHER BENEFITS

- Opportunity to pursue their interests and advance their values
- Skill development
- Motivated students

#### SCHOOL AND DISTRICT BENEFITS

- Teacher engagement and satisfaction
- An integrated option to reach numerous and robust standards and curricular priorities as well as youth development priorities
- Increased awareness from the community of the conditions, needs, and efforts of the schools
- Stronger connections with community-

based organizations, parents, and individual community members

- Access to grants, funders, and recognition

#### PARTNER ORGANIZATION BENEFITS

- Engaged youth and schools in their work
- Raised awareness of the mission
- Increased capacity
- Networks with other organizations in the field
- Access to grants, funders, and recognition

#### LOCAL BENEFITS

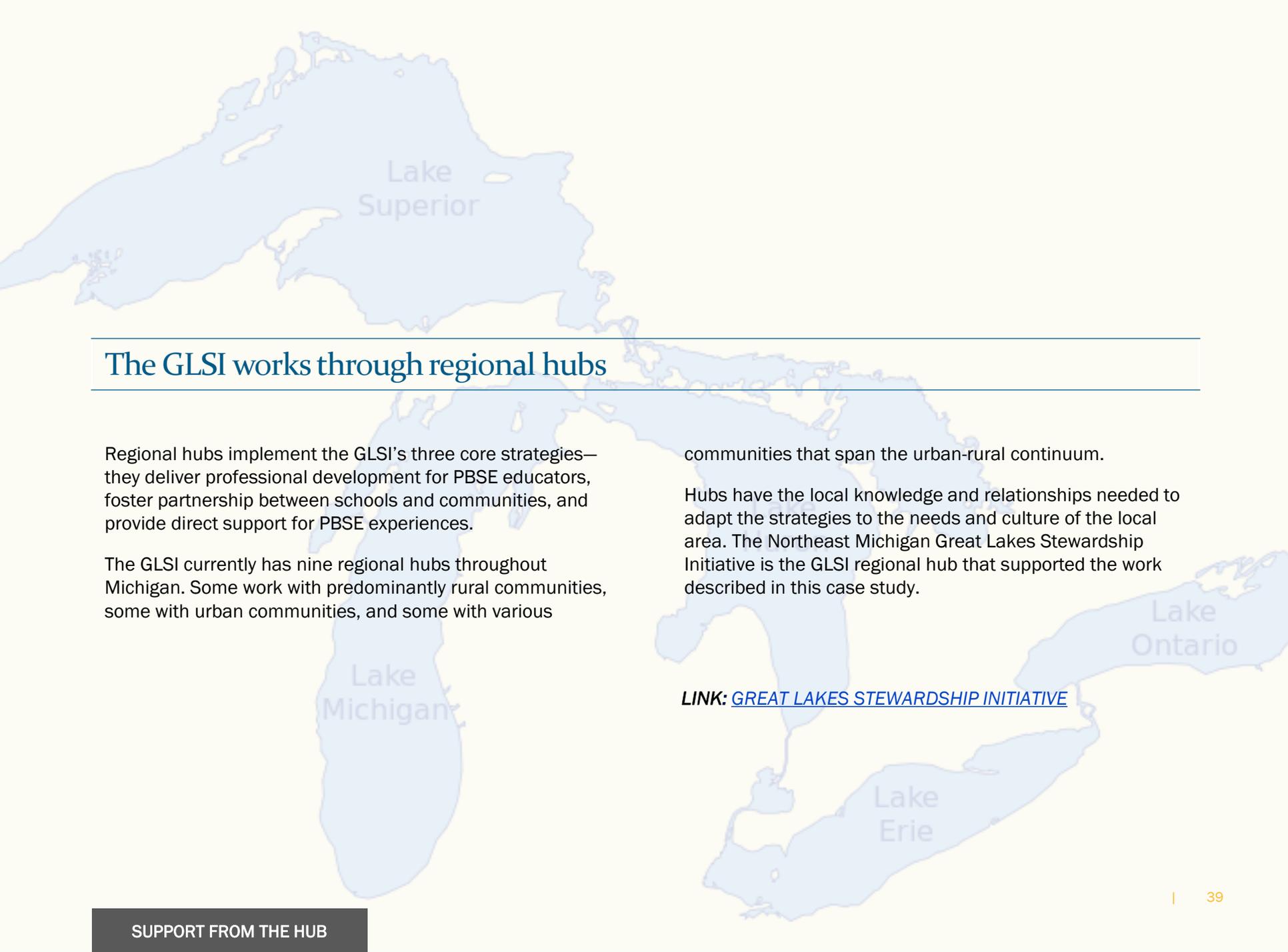
- Community revitalization and environmental improvements
- Sense of place
- Social capital and community capacity

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# Support from the Hub

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## The GLSI works through regional hubs

Regional hubs implement the GLSI's three core strategies—they deliver professional development for PBSE educators, foster partnership between schools and communities, and provide direct support for PBSE experiences.

The GLSI currently has nine regional hubs throughout Michigan. Some work with predominantly rural communities, some with urban communities, and some with various

communities that span the urban-rural continuum.

Hubs have the local knowledge and relationships needed to adapt the strategies to the needs and culture of the local area. The Northeast Michigan Great Lakes Stewardship Initiative is the GLSI regional hub that supported the work described in this case study.

**[LINK: GREAT LAKES STEWARDSHIP INITIATIVE](#)**

# The Northeast Michigan Great Lakes Stewardship Initiative serves a multi-county region in the northeastern lower peninsula

The NEMIGLSI is a regional network of education and community partners who collaborate to protect the Great Lakes and natural resources of northeast Michigan through hands-on learning in—and with—the community.

Since 2007, the NEMIGLSI has engaged schools, educators, and community partners in developing and executing place-based stewardship education. The hub helps young people and community partners identify and collaborate on PBSE efforts that address local stewardship needs.

Leadership and programming support for the NEMIGLSI is provided in partnership by:

- Alpena-Montmorency-Alcona Educational Service District and its regional Math and Science Center
- Cheboygan-Otsego-Presque Isle Educational Service District
- Michigan State University Extension 4-H Youth Programs
- Michigan Sea Grant
- Community Foundation for Northeast Michigan
- Northeast Michigan Council of Governments
- NOAA Thunder Bay National Marine Sanctuary
- U.S. Fish and Wildlife Service
- Huron Pines
- Participating local school districts



**LINK:** [NEMIGLSI'S PUBLICATION, "THE GUIDE"](#)

**LINK:** [NEMIGLSI'S LEADERSHIP TEAM](#)

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## Hubs implement three core strategies for stewardship

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Each GLSI hub provides a program of sustained professional development, brokers school-community partnerships, and supports place-based education. Their strategies are not inherently tied to environmental stewardship—that theme and content must be infused into each aspect of the work.

The GLSI's hubs have developed approaches that reflect the environmental character and needs of their respective communities, the interests and goals of their school districts, the strengths of the hub staff and the host organization, and the mix of community organizations engaged in stewardship work with youth.

Every hub shapes their strategies to meet the needs of its people and places.



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## NEMIGLSI professional development focuses on content, process, and relationships

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*Teachers learn about the development and life cycles of native fish during a professional development workshop hosted by the NEMIGLSI.*

NEMIGLSI's content-focused professional development emphasizes the Great Lakes and natural resource-based topics. The hub's process-focused workshops promote best practices in developing a project, aligning to curriculum, developing partnerships, and evaluating outcomes. Finally, the hub has a regular schedule of networking meetings to help foster strong relationships among teachers and community partners.

At the annual Regional Networking Meeting, all members of the NEMIGLSI network gather to review the collective body of work and receive updates and resources; interact and share lessons learned; help plan the future direction of the network (including selecting an annual theme); and develop new ideas.

Another regular annual event is the Lake Huron PBE Summer

Institute, where teachers:

- Learn about local stewardship needs and issues
- Build awareness of the relevance and importance of the Great Lakes, in part by studying the Great Lakes Literacy Principles as part of their project planning process
- Address and improve their understanding of Michigan's curriculum standards and identify ways to address selected standards through students' projects
- Identify and strengthen partnerships between their schools and local organizations

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## Community partners play a vital role in the hub

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Hands-on, place-based education is a proven method for developing knowledgeable and active stewards of the environment. When schools and communities work together, they produce powerful partnerships that are beneficial to all.

The NEMIGLSI is a growing network. The hub has worked with 34 schools from eight different counties. To date, nearly 200 individuals from across these communities have contributed in support of their schools' efforts to engage youth in environmental stewardship learning and leadership experiences. The community partners represent over 100 organizations including local, state and federal agencies; universities; nonprofit conservation and community organizations; nonformal education programs; and private businesses.

*Top: A representative of U.S. Fish and Wildlife Services works with students.  
Bottom: A community partner instructs teachers during a NEMIGLSI professional development event.*



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## NEMIGLSI extends small grants to participating schools and teachers

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NEMIGLSI encourages the further development of its network through mini-grants that build the network's capacity.

For example, teachers can submit a high quality lesson plan that adapts place-based education principles to a hands-on, community-based project, or can invite teachers without past experience to participate in a PBSE effort; each of these types of efforts can earn grant support. The hub also provides small grants to offset the costs of substitute teachers and meals so that teams can plan their projects, and sponsors teachers' participation in worthy professional learning opportunities that are relevant to PBSE, but not offered by the hub itself.



## Au Gres-Sims teachers and administrators are active participants in the NEMIGLSI

*These educators have both benefited from the network, and served it.*

Au Gres-Sims School District teachers participated in the hub's Summer Institute, which helped them learn about local stewardship needs and natural resources, develop their ideas for place-based stewardship projects, and connect those ideas to their school's curriculum.

Teachers Michael Fields and Tracy Stoldt and the district's superintendent, Jeffrey Collier, shared their experiences in developing a school-wide strategy for place-based education with other teachers and community partners in the NEMIGLSI network. They also presented at the Great Lakes Stewardship Initiative's annual Great Lakes Place-based Education Conference.

The school district invited staff from the NEMIGLSI to contribute to its in-service days, with a goal of helping teachers further develop place-based education projects and link them to content standards and the district's curriculum.

*“The NEMIGLSI has been essential in the development of this project. The network partners have helped to expand the initial project concept and made the entire learning experience much richer and more valuable by offering expertise, writing articles, and introducing us to Great Lakes FieldScope.”*

*—Michael Fields, Au Gres-Sims teacher*



# Looking Forward

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## PBSE is continuing to develop at Au Gres-Sims School

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### *Connecting with partners and resources*

At a professional learning event, Michael Fields learned about opportunities for watershed studies through the NEMIGLSI network made possible by funding from B-WET. Following the training, Fields connected with other community partners in the network. Together, they brainstormed ideas for a watershed study, and in the fall, students launched their investigation.

2013 -  
2014

2014 -  
2015

2015 -  
2016

FUTURE

### *Developing more PBE connections*

Students' place-based education experience expands to include native and invasive species investigations on nearby Charity Island. Students map and age threatened Pitcher's Thistle plants and collect data on the density of an invasive species of Phragmites reed.

### *Developing the watershed study*

The students continued to investigate and monitor sites on the Au Gres River in 2014-15, the year of focus in this case study. Interest in PBSE grew at Au Gres-Sims School.

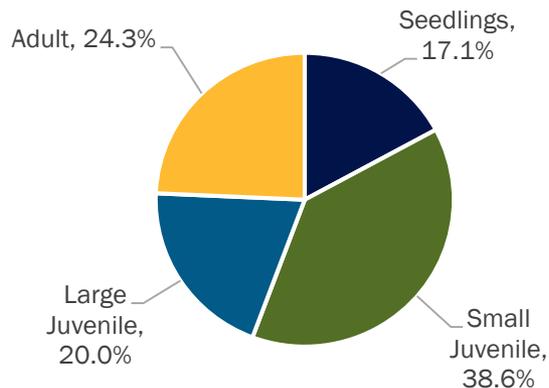
### *Connecting to other grades*

Middle school students will study parts of the Au Gres River and expand their watershed studies to include vernal pools and underwater robotics. Elementary students will continue to study the Au Gres River but will investigate only two sites due to rising river levels.

## In 2015-16, students began working on native endangered and threatened species, including the Pitcher's Thistle

Working on Charity Island in Saginaw Bay, the students are collaborating with Great Lakes scientists to map, identify, age, and count the federally-threatened Pitcher's Thistle. Students have permission to help collect seeds from adult plants. These seeds will be cultivated by a private business in support of future efforts to restore Pitcher's Thistle on the island. On the Au Gres-Sims Elementary School campus, students will raise different endangered and threatened species as part of a project to improve their schoolyard's habitat.

### Pitcher Thistle Count on Charity Island



## In the future, the work will expand to include middle school students



*The Au Gres River water-quality monitoring effort will expand to new sites and middle-school grades.*

In the Fall of 2016, Au Gres-Sims Middle School students (sixth, seventh, and eighth graders) will investigate several sites of the Au Gres River, including a feeder stream and channelized and un-channelized portions. The middle school extension will increase the number of study sites on the Au Gres River and result in more outreach so that the community can better understand issues and actions related to the water

quality of the river and their impact on Saginaw Bay.

Students will also analyze additional abiotic indicators, including phosphates and glyphosate. These fertilizers and pesticides can enter the watershed from agricultural lands. By monitoring these indicators, students will better understand how humans may impact the health of river ecosystems.

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## Students will have many PBSE experiences over the course of their studies in Au Gres

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As students transition from one grade level to the next, Au Gres-Sims School District hopes students will develop as stewards conscious of many issues connected to their local community and environment. In addition to benefitting their community, this approach enhances student learning and allows students to connect to potential careers.

With the development of the STEM Curriculum Overlay, Au Gres-Sims School District is dedicated to integrating place-based education across grade levels. This commitment to hands-on learning promotes a sustainable approach to place-based education.



*“The intentional design of our uniquely authored STEM Curriculum Overlay at Au Gres-Sims, along with our fostered partnerships with diverse professional organizations, have allowed us to mitigate traditional barriers toward advancing our progressive model of place-based education and have further provided an intentional roadmap for curricular mapping and sustained success throughout the district.”*

*—Jeffrey Collier, Au Gres-Sims School District Superintendent*



For More Information

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## Contact Us

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## About the Great Lakes Stewardship Initiative

The Great Lakes Stewardship Initiative was launched in 2007 to develop knowledgeable and active stewards of the Great Lakes and their ecosystems.

The GLSI enacts three key strategies (place-based stewardship education, sustained professional development, and school-community partnerships), mainly through the efforts of its nine regional hubs. A small central staff helps coordinate the work and provides technical assistance and support to hubs.

Hubs are funded, in part, by the Great Lakes Fishery Trust, which in 2007 pledged to provide more than \$10 million through 2017 to support the GLSI's work. The GLSI and its hubs solicit and receive additional support from foundations, federal and state agencies, local and regional partners, and individual donors.

From 2007 through the 2014–15 school year, the GLSI has worked with more than 1,500 teachers in more than 280 schools across Michigan, engaged hundreds of community partners, and supported rigorous place-based stewardship experiences for more than 80,000 students—and the work continues.

**LINK:** [GREAT LAKES STEWARDSHIP INITIATIVE](#)

**LINK:** [GREAT LAKES FISHERY TRUST](#)



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## The GLSI's 2014 grant from the U. S. Environmental Protection Agency supported this case study and other knowledge products

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In 2014, the U.S. EPA awarded the GLSI a \$150,000 grant through its Environmental Education Grant Program. Through this grant, the GLSI funded a collection of exemplary place-based stewardship projects across Michigan and documented these projects through case studies.

The grant also supported the development of several knowledge products to support the practice and spread of place-based stewardship education in K–12 schools and communities. The first knowledge product is a set of guiding principles that describes the GLSI's vision for place-based stewardship education in K–12 schools and communities. The principles can serve as a compass for practitioners, and also highlight the ways that place-based education connects to important goals and initiatives in education.

The second knowledge product is a rubric that supports the guiding principles. The rubric describes in detail the actions and practices that characterize various developmental stages in place-based stewardship education. It can be used for several important purposes, including a self-assessment of practice.

A third knowledge product is a white paper that focuses on expectations for and the educational, community, and environmental benefits of place-based stewardship education across urban, rural, and suburban contexts.

This document was developed under Assistance Agreement No. 00E01327-0 awarded by the U.S. Environmental Protection Agency. It has not been formally reviewed by EPA. The views expressed are solely those of the Great Lakes Fishery Trust and EPA does not endorse any products or commercial services mentioned.

*LINK: [OTHER EPA KNOWLEDGE PRODUCTS](#)*

*LINK: [FULL SET OF CASE STUDIES](#)*



# References

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## References

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Bonney, R., H. Ballard, R. Jordan, E. McCallie, T. Phillips, J. Shirk, and C. C. Wilderman. 2009. Public Participation in Scientific Research: Defining the Field and Assessing Its Potential for Informal Science Education. A CAISE Inquiry Group Report. Washington, D.C.: Center for Advancement of Informal Science Education (CAISE).

Garbarino, J., and C. E. Mason. 2016. The Power of Engaging Citizen Scientists for Scientific Progress. *Journal of Microbiology & Biology Education* 17(1): 7-12.

Great Lakes Literacy Principles. 2010. [greatlakesliteracy.net](http://greatlakesliteracy.net). Accessed July 6, 2015.

Leana, Carrie R. "The Missing Link in School Reform (SSIR)." *The Stanford Social Innovation Review*. Fall 2011. Accessed June 09, 2016. [http://ssir.org/articles/entry/the\\_missing\\_link\\_in\\_school\\_reform](http://ssir.org/articles/entry/the_missing_link_in_school_reform).

SEDL. "Concerns-Based Adoption Model (CBAM)." *American Institutes for Research*. Accessed June 9, 2016. <http://www.sedl.org/cbam/>.



With assistance from participating educators, civic leaders, and community partners, the GLSI:

- Helps young people become effective and motivated environmental stewards
- Encourages schools and community organizations to work together for mutual benefit
- Creates a sustained effort across Michigan to expand classrooms, strengthen communities, and improve the environment