Combating Invasive Species in the Les Cheneaux Watershed

Objective: *Demonstrate how low water levels and invasive species have adversely impacted the Les Cheneaux Watershed, describe the different strategies used by the community to combat them, and provide communities with the decision support tools necessary to decide when and how to manage invasive species.*

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Update Note: *May 2016 updates appear in the "Awareness" and "Strategy" sections of the case study.*

Clark Township, located along the eastern end of the Upper Peninsula in Mackinac County, Michigan, is comprised of two centuries-old coastal communities, Hessel and Cedarville. These communities are at the heart of Lake Huron's Les Cheneaux Watershed, which is renowned for its pristine waters, shoreline, and 36-island archipelago known as the Les Cheneaux Islands. Of the township's more than 2,000 residents, more than 40% make their living from outfitting, lodging, and hospitality services to the thousands of tourists who visit the islands annually for a variety of activities ("Clark Township").

Over the last few decades, residents have begun to notice changes in the watershed, particularly declining water levels and the encroachment of invasive plant species ("Les Cheneaux Watershed Council"). The Great Lakes are subject to naturally-occurring annual, semi-annual, and multi-decadal water level fluctuations. On Lake Michigan-Huron the onset of lower than average lake levels began nearly two decades ago (NOAA Great Lakes Water Level Dashboard). At the time of this case study's publication (02/2014), data from the NOAA Great Lakes Water Level Dashboard indicates that lake levels have remained below average on Lake Michigan-Huron, with the exception of June – August of 2009, since December1998 (NOAA Great Lakes Water Level Dashboard). In the Les Cheneaux Watershed lake levels have gotten so low that residential docks, harbors, and points of access have had to be extended or dredged order to keep them accessible during the summer (Smith Interview, 2013).

Les Cheneaux Watershed Council Combats Invasive Species to Preserve Recreational Opportunities

Since its inception the Les Cheneaux watershed has been known for its pristine waters and recreational opportunities. In 2002, residents of abutting Clark Township first observed the presence of Eurasian Watermilfoil. Since its detection, residents of the township and the local watershed council have organized to contain and combat this invasive weed.

Low Water Levels in the Les Cheneaux Watershed.

Courtesy of the Les Cheneaux Watershed Council

Although the observed changes in water levels have occurred slowly over several decades, the introduction and propagation of invasive weeds in the area has been much more acute. In 2002 the Michigan Department of Natural Resources first noted the presence of *Eurasian watermilfoil* (EWM), a rapidly growing aquatic invasive weed, in the Les Cheneaux Watershed. By 2006 the invasive plant had become so dense in some areas that fish populations noticeably declined and boaters were unable to navigate without their propellers becoming entangled by the weed. As a result, recreators, residents, and resort owners alike began to voice their concerns over the health of their treasured watershed (Smith Interview, 2013). In addition, the community has been faced with an invasion by *phragmites*. ("Les Cheneaux Watershed Council").

The cumulative impacts of low lake levels, the influx of invasive plant species, and predicted changes in climate could have significant implications for the quality and accessibility of the pristine natural features that are the linchpin of the local economy ("Public Gives View on Milfoil Control"). Since 2007, an estimated $600,000 in community investments and grant funding has been spent on the management of these invasive plant species in the Les Cheneaux Watershed alone (Smith Interview, 2013). These management costs are expected to continue, lest the local economy suffer without the support of recreation and tourism revenue. Low lake levels, climate change and invasive species have thus been identified as primary threats to recreation and tourism in the state of Michigan (Nicholls, 2012). The purpose of this case study is to provide communities with the tools and resources necessary to inform their decision-making concerning when and how to manage invasive weeds in a changing climate and thus make them more resilient to the resulting ecological and economic impacts.

Les Cheneaux Watershed Update
May 2016

Since the publication of this case study nearly two years ago the Great Lakes have undergone significant changes. More specifically, over the past three years Lake Michigan and Lake Huron water levels have increased more than three feet. Current levels are nearly a foot above the 90-year average. As a result, many beaches have narrowed, near shore boating has improved and lake freighters can transport more materials with the higher water. Docks, harbors, and points of access not reachable several years ago now have water

access. Even though water levels have risen, there is no assurance that they will remain at this high level into the near future.

Higher Water Levels in the Les Cheneaux Watershed

Courtesy of Rob Smith

Over the past two years Eurasian watermilfoil has almost disappeared from the Les Cheneaux area. An exception is that it continues to exist in marinas and launch sites. During 2016 extensive efforts will be made to minimize milfoil in these locations. Since 2013 milfoil growth has been progressively less. Studies by the Watershed Council in Sheppard and Cedarville Bays have shown that milfoil growth has decreased 90% from 2013 through 2015. The water level rise of over three feet during this period may explain the surprising reduction in milfoil growth. An additional benefit of high water is that observers have noted linear, annual decreases in algae concentrations presumed to reflect dilution of nutrients that fuel algal growth, primarily phosphorus, in the shallow bays and channels.

Awareness **> Understanding** Analysis Strategy

The Great Lakes and their connecting channels are now home to more than 180 nonindigenous species. When seeking to understand their potential impacts, the critical first step is to understand which invasive plant species are present in your community, how they spread, how they are impacted by climate change, and finally, the threats these invasive weeds pose to the vitality of your community. By carefully considering a few simple questions, a community can begin to equip itself with the knowledge needed to make an informed decision about when and how to manage an invasive species.

A. What are the invaders featured in this case study, and how do you identify them and others?

1. Phragmites:

Phragmites australis (phragmites, common reed) is a perennial wetland grass that has

Phragmities in the Les Cheneaux Watershed
Courtesy of the Les Cheneaux Watershed Council

rapidly invaded each of the lower 48 U.S. states over the last 200 years. Phragmites can grow as high as 20 feet tall, and is characterized by dull, stiff, hollow stems. Typically, phragmites grows in moist habitats including lake shores, river banks and roadways, and can spread as much as 10 feet in area per year. This highly tolerant species can survive in brackish waters, dry conditions, and alkaline to acidic soils. Phragmites encroaches on existing plant communities in two primary ways: through extensive rhizomes (i.e. long roots from which new plants sprout) and through shading out smaller and slower-growing plant species. The primary vectors for this invasive weed are root fragmentation and airborne seed dispersal ("Phragmites").

2. Eurasian watermilfoil:

Close-up of Eurasian Watermilfoil
Courtesy of Wisconsin DNR

Myriophyllum spicatum (Eurasian watermilfoil, EWM) is an aggressive aquatic invasive weed that is native to Europe, Asia, and northern Africa. This plant is characterized by its long stems and feathered leaves that grow in dense canopies at the surface of the water. EWM typically grows in the shallow areas of lakes and ponds or in slow-flowing areas of rivers and streams. EWM displaces native plant species primarily through its rapid growth and capacity to shade out competing plants with its large, leafy canopies. EWM has proven a poor substitute for the native plants on which waterfowl and invertebrates rely for food and habitat. The primary vectors for this invasive weed are their own stem fragments, which attach to boats and motors and colonize new areas as they dislodge to settle into new lake, river, and stream beds ("Eurasian watermilfoil").

3. If you are unsure what species are impacting your community:
NOAA has created a database of over 180 nonindigenous plants and animals that are either present in, expanding their ranges within, or predicted to invade the Great Lakes basin. Each species listed in this Great Lakes Aquatic Nonindigenous Species Information System can be searched by common name, scientific name, or taxonomic group. Each also has an associated page detailing its unique identifiers, country of origin, and where it has been found in the Great Lakes basin to date.

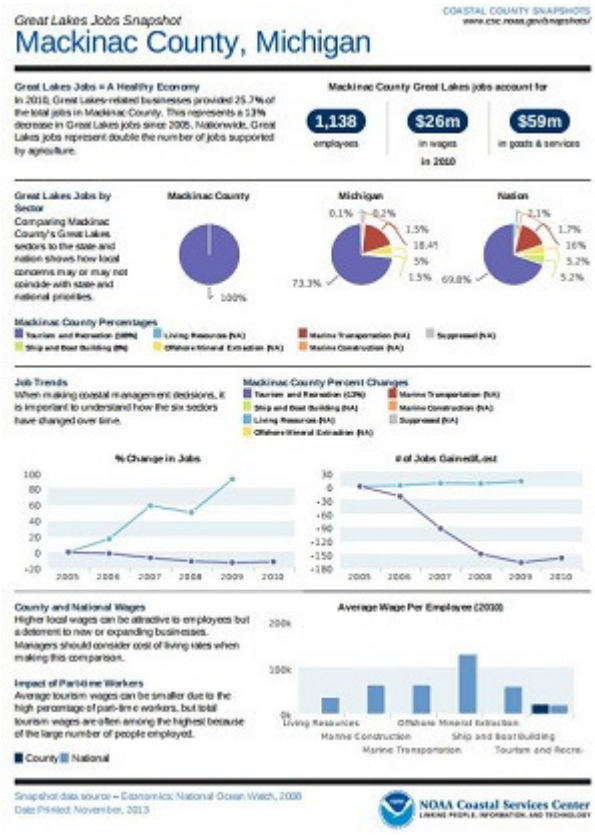
B. How are climate change and low lake levels exacerbating them?

Under the right conditions, changes in climate and water levels may exacerbate the spread of invasive species. Minor changes in ambient air and water temperature, precipitation, water clarity, and water level regimes can alter ecosystems by simultaneously creating suitable habitat for invasive species and decreasing the resilience of existing biota (U.S. EPA, 2008). For example, changes in climate have had significantly increased evaporation rates

off of the Great Lakes, a change that is thought to be the driving force behind the recent prolonged period of below long-term average water levels (Egan, 2013). The resulting decline in lake levels has increased the amount of shallower areas in the lakes where species like EWM and phragmities thrive. Consequently, as the climate changes ecosystems become ripe for the introduction and proliferation of invasive species. There is, however, still much to be learned about the multiple stressor effects climate change can have on existing ecosystems, including the onslaught of invasive species (U.S. EPA, 2008). When planning for the future, communities must be mindful of how climate and water level regimes are predicted to change.

C. What are their impacts on my community?

Invasive weeds like phragmites and Eurasian watermilfoil have the potential to adversely impact a wide variety of resources valued by coastal communities. At first glance, the changes resulting from the presence of an invasive weed may appear to be limited to the shoreline or water body itself; however, the most deleterious effects are often barely perceptible, occurring slowly over time while the invasion worsens. For example, within years of first reaching a water body, plants that grow in dense beds like EWM have the potential to restrict swimming, fishing, and boating in the shallow waters in which they thrive during the summer months. Over the long term, the growth and decomposition of these invasive plants adversely impacts water quality as well by lowering the amount of dissolved oxygen available to other forms of aquatic life, thereby limiting their ability to grow and thrive. Finally, because these invasive weeds are poor substitutes for their native counterparts, their proliferation and hybridization with local species can significantly impact the vitality of the populations of fish, birds, and other biota that depend on native plant communities for food and habitat (Illinois-Indiana Sea Grant, 2013, "What are Aquatic Invasive Species?"). Thus superficial visible changes are often only a precursor to significant long-term changes in the health and sustainability of the watershed and the biota that depend on it.



Mackinac County, Coastal County Snapshots**.**

These effects can also negatively impact local economies, particularly where recreation and tourism are responsible for a large part of the incoming revenue. As part of its Digital Coast initiative, the NOAA Coastal Services Center has created Coastal County Snapshots which concisely describe the level of flood exposure, wetlands benefits provided, and jobs created by the Great Lakes for each county along its coast. These snapshots can provide a solid informational foundation from which communities can begin to analyze and discuss how an invasive species may be having adverse impacts on their economic vitality. For example, a community could use their county's Great Lakes Jobs snapshot to assess how many local jobs are created by boat rentals, lodging, and other services related recreation and tourism. This statistic that might give this community a qualitative sense of how invasive species could negatively affect the economy by choking up and degrading the aesthetic quality of their waterways.

Another critical tool developed by NOAA is its Great Lakes Lake Level Viewer, this visualization tool was designed to help communities understand and communicate how fluctuations (+/- 6 feet) in lake levels could impact their watershed by showing predicted inundation areas and dry lake beds. This is a useful tool for communities who are attempting to identify areas that could become vulnerable to invasive weeds as a result of lake level change.

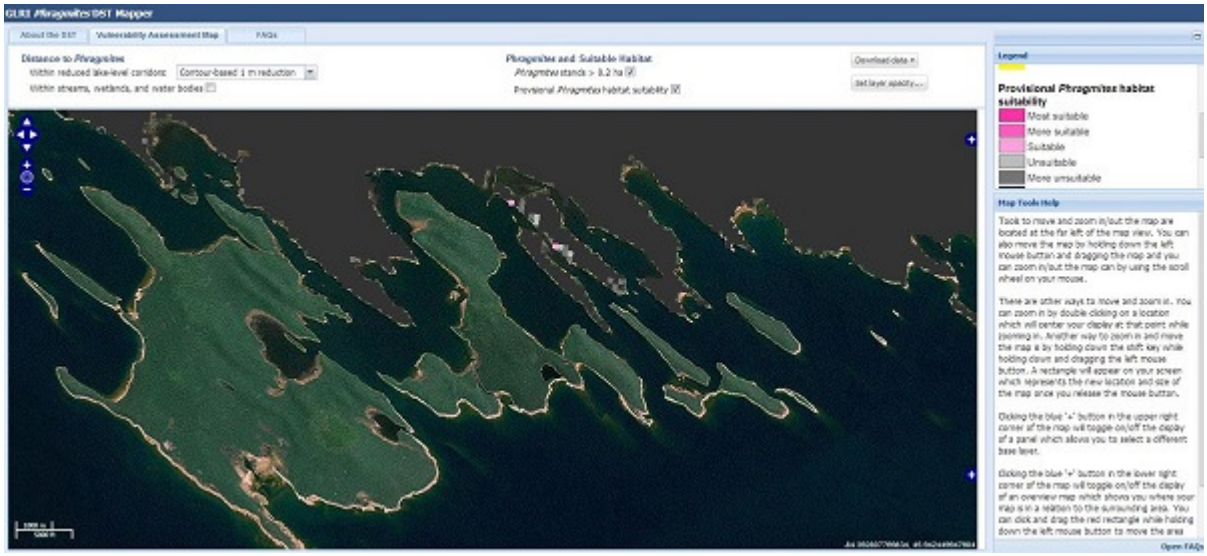
Once an invasive weed has established itself in a new area, impacted community members, local decision makers, and managers are faced with a multitude of difficult questions: What management strategies can be used to combat this new invasive species? Which is the most effective? And, do we have the resources to pursue any of these management alternatives? Recognizing that eradication is often not a feasible option, communities must carefully consider if or when efforts to control the spread of an aggressive invasive species will actually enhance their resilience to it. Communities need the right tools and resources with which to assess their vulnerability to the proliferation of invasive species and to support their decision making concerning when and how to manage. The tools and resources described in this section were selected with the aim to empower communities to accomplish this end.

Decision Support: To manage or not to manage?

When combating a nuisance plant invasion, communities are faced with a critical choice: to manage or not to manage? In general, the tipping point will vary based on the type and extent of the invasion, as well as the resources available for its treatment. To help communities with this question, The Nature Conservancy has created the Invasive Plant Management Decision Analysis Tool (IPMDAT). The IPMDAT walks users through four decision trees: one for strategy selection and three for evaluating the feasibility of different control strategies including eradication, containment/exclusion, and suppression. Throughout the process users are given guidance on whether the invasion warrants action, and if such is the case, what strategy should be applied to control it.

Evaluating the risk of invasive species propagation in your community:

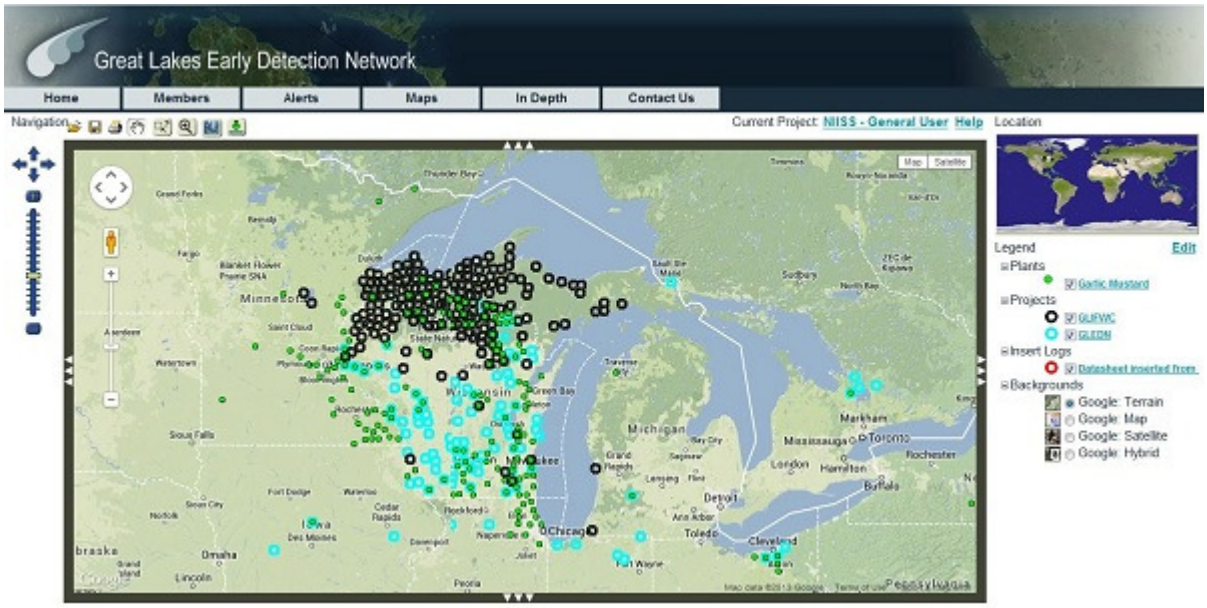
The first step in understanding the risks posed by invasive plant species in any community is to identify the types of species that are threatening the vitality of existing native biotic communities. Once these invaders have been identified, one must begin evaluating the risks posed by these species. The USGS Great Lakes Science Center, Michigan Tech Research Institute, U.S. Fish and Wildlife Service, and the Great Lakes Phragmites Collaborative have leveraged Great Lakes Restoration Initiative funding to create the Phragmites Decision Support Tool Mapper.



Screenshot of: GLRI Phragmites Decision Support Tool Mapper

This tool was designed to help Great Lakes coastal managers strategically develop effective phragmites control and invasion prevention programs, allowing users to create maps that show existing stands (0.2 hectares or larger), suitable habitat areas not yet affected, and likely invasion pathways based on current conditions and reduced water levels.

Recognizing that not all coastal communities are threatened by phragmites, the National Park Service has leveraged Great Lakes Restoration Initiative funding to create the Great Lakes Early Detection Network (GLEDN). The GLEDN is a mapping tool that allows users to monitor the presence and spread of Eurasian watermilfoil and other invasive plants and animals and alert users to their detection. The tool was designed to allow managers and citizen scientists to easily plot the area, density, and variety of the invasive species they encounter in the field.



Screenshot of: Great Lakes Early Detection Network

The tool can be accessed either on the web or via a mobile application, and facilitates real-time information sharing among the management community on invasive species throughout a given region.

Quantifying Potential Impacts on Local Economic Vitality

To support the decision-making process, communities often need a better understanding of the impacts an invasion may have on residents and various sectors of their economy as well as the costs associated with its management. To gain a better understanding of the costs associated with removal and treatment of invasives at the state/regional level as well as their potential impacts households and industries, the Anderson Economic Group was commissioned to complete an analysis of the economic impact of aquatic invasive species in the Great Lakes by The Nature Conservancy. Although not aimed at forecasting future costs, this report documents the costs that these species have had imposed on the economy.

For more information on the potential economic impacts of invasive species, please consult the United States Department of Agriculture's National Invasive Species Information Center.

Expressed research needs and gaps:

Although many tools exist for monitoring and evaluating the locations, extent, impacts, and management of invasive weeds themselves, there is a distinct dearth of resources available with which to regularly monitor the ecosystem conditions that influence their growth each year. An annual monitoring protocol for water levels and clarity, air and water temperature, and available standing biomass in the Great Lakes basin could provide essential information on how the growth of invasive species will change as our climate changes and these species proliferate. In the long term, monitoring of this nature supported by satellite imaging could capture critical data on the effectiveness of the various control strategies implemented and may potentially inform a seasonal model that would predict these conditions from year to year. Such access to real-time data and seasonal projections for local-level ecosystem conditions could advance the ability of communities to effectively and efficiently curtail the spread of nuisance weeds, and allow them to make sound decisions about the management strategy to apply each year based on current scientific data (Smith & Gauthier Interview, 2013).

Invasive plant species management strategies can be grouped into four broad categories: 1) prevention, 2) control (chemical, biological, or mechanical), 3) eradication, and 4) adaptation. The suitability and effectiveness of each strategy will depend on the nature of the species being managed, the severity of the invasion, the resources available to those who would implement it, the management goal (eradication, suppression, or containment), and the level of support from the community for the strategy's implementation. As is true with any type of management, there is risk associated with taking action, whether social, physical, or ecological. It is important to be mindful of the possible negative consequences before moving forward with any management strategy (Zimmerman et al., 2011).

In the Les Cheneaux Watershed, multiple management techniques have been applied to combat existing invasive species. The management strategies employed for phragmites and Eurasian watermilfoil here are drastically different due to their severity.

To date, EWM has been intensively managed largely through biological control methods. Efforts to control this invasive weed began in 2007 when the community funded the purchase and planting of 15,000 naturally occurring aquatic weevils in two pilot locations. From 2007 to 2011, the weevil pilot project was largely successful, reducing EWM growth by 85% (Smith Interview, 2013).
With the help of a grant from the U.S. EPA in 2011, the community was able to plant

100,000 additional aquatic weevils, this time across a larger area of the watershed. Despite these efforts, the EWM returned with a vengeance in the summer of 2012, growing in dense carpets just below the water's surface like those observed in 2006 ("Local watershed council targets milfoil"). Since then the local watershed council has convened a series of public meetings to discuss the future management of EWM, and with the support of the community has decided to pursue only biological and mechanical control strategies (Smith Interview, 2013). However, some residents have independently used both chemical and mechanical control methods, with limited success and public approval ("Les Cheneaux Continues to Weigh Water Milfoil Reduction Plans"). At this juncture, the invasion of EWM in Les Cheneaux has become so prolific that eradication is perceived to be unrealistic, yet the community has determined that control is still worth pursuing because residents significantly value the watershed and its contributions are vital to the local economy. Since 2009, an estimated $600,000 in community investments and grant funding has been spent on the management of this invasive species in the watershed (Smith Interview, 2013).

Ongoing Mechnical Removal of Invasive Species

Courtesy of the Les Cheneaux Watershed Council

Unlike the extensive biological control strategy that has been implemented for EWM, the phragmites present in the region have largely been treated through chemical removal. As of 2013 this invasive weed has only been found in small isolated patches in the watershed. To date, the management strategy used has been largely effective and eradication is considered possible (Smith Interview, 2013).

For more information on invasive species-specific management techniques, a Global Invasive Species Database was developed as part of the global initiative on invasive species led by the Global Invasive Species Programme (GISP). Since the closure of its Secretariat, the Invasive Species Specialist Group (ISSG) of the IUCN Species Survival Commission has taken over the development and management of the database. For additional information

on grants and funding opportunities available for invasive species management, the U.S. Department of Agriculture has compiled and made available a comprehensive list. The funding opportunities it contains are posted by an array of federal, state, academic, and non-governmental organizations, and many are open to applications from community-based management programs. In recent years, the Great Lakes Restoration Initiative has been an important sources of financial support for invasives management. Finally, for further guidance on the ways public engagement may be used to promote invasive species awareness, as well as information on consensus-based management decision-making and public understanding of management risks and benefits, NOAA has created a series of social science tools for coastal resource managers. When used in conjunction with existing outreach websites, customizable outreach templates, and guidelines for volunteer coordination, these tools could be leveraged to formulate a strong outreach and engagement campaign with the power to encourage citizens to take action on invasive species management and support community-based stewardship efforts.

Les Cheneaux Watershed Update

May 2016

The Les Cheneaux Watershed Council has coordinated management of milfoil using four primary methods:

1. Bottom dragging in channels.
2. Mechanical harvesting where appropriate.
3. Native biological control fungus produced by the USDA
4. Encouraging property owners to reduce milfoil by keeping their beaches clean.

DNA Researchers on Pier
Courtesy of Rob Smith

Phragmites has been kept in control over the past five years by destroying new patches of growth as they appear. Boaters and land owners have been particularly helpful in identifying and reporting new stands. The Watershed Council is partnering with the Chippewa-Mackinaw Soil Conservation District which has been conducting the phragmites management program under a Michigan State University grant.

The Watershed Council has undertaken a collaborative project with Michigan Tech University to test making it quicker and easier to identify the footprints of invasive water species using Unmanned Aerial Vehicles (drone) technology. The Council also collaborates with researchers from Michigan State University who are developing methods to detect invasive species by monitoring environmental DNA, or eDNA.

UAV (drone) on Boat
Courtesy of Rob Smith

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Related Data & Tools

GLRI Phragmites Decision Support Tool Mapper [http://greatlakesresilience.org/maps-tools-data/maps/glri-phragmites-decision-support-tool-mapper]

Coastal County Snapshots [http://greatlakesresilience.org/maps-tools-data/tools/coastal-county-snapshots]

The Great Lakes Early Detection Network [http://greatlakesresilience.org/maps-tools-data/maps/great-lakes-early-detection-network]

Global Invasive Species Database [http://greatlakesresilience.org/maps-tools-data/data/global-invasive-species-database]

Great Lakes Aquatic Nonindigenous Species Information System [http://greatlakesresilience.org/maps-tools-data/data/great-lakes-aquatic-nonindigenous-species-information-system]

Great Lakes Lake Level Viewer [http://greatlakesresilience.org/maps-tools-data/tools/great-lakes-lake-level-viewer]

Related Publications

The 2012-2017 Michigan Tourism Strategic Plan [http://greatlakesresilience.org/library/reports/2012-2017-michigan-tourism-strategic-plan]

Effects of Climate Change on Aquatic Invasive Species and Implications for Management and Research [http://greatlakesresilience.org/library/general-reference/effects-climate-change-aquatic-invasive-species-and-implications]

An Invasive Plant Management Decision Tool [http://greatlakesresilience.org/library/general-reference/invasive-plant-management-decision-tool]

Pulling Together in Alaska: A Volunteer's Guide To Community Weed Pulling Events [http://greatlakesresilience.org/library/best-practices/pulling-together-alaska-volunteer%E2%80%99s-guide-community-weed-pulling-events]

The Costs of Aquatic Invasive Species to the Great Lakes States [http://greatlakesresilience.org/library/reports/costs-aquatic-invasive-species-great-lakes-states]

Related Stakeholders

Smith, Robert [http://greatlakesresilience.org/people-and-organizations/local/smith-robert], Les Cheneaux Watershed Council

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