

SECURING THE SYSTEM: IDEAS IN LAW AND POLICY TO CONTINUE MOMENTUM FOR SAFEGUARDING THE GREAT LAKES

CAMERON DAVIS¹

It is ironic that, with six quadrillion gallons of water in bodies visible from outer space, holding roughly twenty percent of the Earth's fresh surface water, and a shoreline nearly 11,000 miles long, the Great Lakes are still often overlooked.²

For close to two centuries, the Lakes have been neglected and viewed primarily as a *source* of materials, supplying fish, sand for manufacturing, clean water, and other building blocks for commerce. But the Lakes are much more than that. They are also a *resource* that requires maintenance so they can keep renewing a region known for recreation, drinking water, and industry for products exported on a global scale.

The effort of this renewal—restoring ecological function, which in turn can support a more sustainable regional, national and even binational economy—is critical to strengthen the Lakes as our region's life support system. This article is an abbreviated history of: (I) damage to the Great Lakes; (II) more modern efforts to restore the ecosystem; and (III) a brief roadmap for continuing these restoration efforts even more effectively into the future.

I. DAMAGE

To understand how to restore the Great Lakes, we have to go back two centuries to understand how they were damaged in the first place.

¹ Cameron Davis is the Senior Advisor to the Administrator of the U.S. Environmental Protection Agency. The views and positions expressed in this article are those of the author and do not necessarily represent the position of the U.S. EPA. Special thanks to Kate Balasa, special assistant at U.S. EPA, for assistance.

² Great Lakes Information Network, *Great Lakes Facts and Figures*, GLIN, <http://www.great-lakes.net/lakes/ref/lakefact.html> (last visited Oct. 2, 2016).

A. Fisheries & Invasive Species

Great Lakes uses and abuses are not coincidental. First, and most obvious, was the seemingly infinite supply of cold, fresh water for fish production. So abundant were some species of fish that they were burned to fuel ships' voyages. But with these uses, depletion of critical fish stocks was almost inevitable. Lake trout populations plummeted from overuse, but also from invasive species, such as sea lamprey that migrated into the Upper Great Lakes with the opening of the Welland Canal for cross-lake shipping. Lampreys, like vampire eels, parasitically attach themselves to fish and suck the life from them.³

B. Resource Extraction

Among other things, fish were harvested to feed growing urban centers, including some of the greatest municipal powerhouses of the 1800s and early 1900s, like Chicago, Milwaukee, Cleveland, Gary, Buffalo, Duluth...the list goes on. These cities were built from the vast supply of timber from the forests that blanketed much of the Great Lakes basin.⁴ And, that timber was easily transportable by ship over the same waters that housed the Lakes' seemingly endless supply of fish. These same vast supplies of timber led the Green Bay area to attract the largest concentration of pulp and paper mills in the U.S.⁵

³ GREAT LAKES FISHERY COMMISSION, *Sea Lamprey: A Great Lakes Invader*, GLFC.ORG, <http://www.glfc.org/sealamp/> (last visited Oct. 2, 2016).

⁴ See e.g. WILLIAM CRONON, *NATURE'S METROPOLIS* (2d ed. 1992); see also Smithsonian National Museum of American History, *Great Lakes, Mighty Rivers Exhibition*, AMERICANHISTORY.SI.EDU, http://americanhistory.si.edu/onthewater/exhibition/4_2.html (last visited Oct. 2, 2016).

⁵ WISCONSIN DEPARTMENT OF NATURAL RESOURCES, *Paper Sector*, DNR.WI.GOV, <http://dnr.wi.gov/topic/Sectors/Paper.html> (last visited Oct. 2, 2016).

Other raw materials from around the region were plentiful, too. Iron from Northern Minnesota was sent to steel mills in Gary and Cleveland, while limestone from Michigan's Upper Peninsula was likewise used in the coking process for steelmaking.⁶

Some cities sprang up as epicenters for beer brewing. Why? Water. But there was also nearby grain, another key ingredient for beer that was cultivated plentifully around the lands that drained into the Great Lakes. These were, and are today, the lands that support corn, soybean, and other crop production.

The world's largest collection of fresh water sand dunes, housed along Lake Michigan's southern and eastern shoreline and a support system for unique species, fell victim to extraction.⁷ Some viewed the formations as having limited use except as for industrial raw materials. Lake Michigan's dunes contained sand grains that were often uniform in shape and contained silica, both characteristics of which were prized for making auto, plane and train part molds. Glass companies in Indiana, for example, were also located to take advantage of the "singing sands." Consequently, dune after dune, from Northwest Indiana to Michigan, were leveled and carted away.⁸

These and similar manufacturing ingredients were also shipped over the Great Lakes, proving again that they were not just a source of raw materials. Thus, the Lakes were, and are, a transportation system used to get the raw materials to manufacturing plants for processing.

⁶ Randall Schaetzl, *Limestone Mining*, MICHIGAN STATE UNIVERSITY, DEPARTMENT OF GEOGRAPHY, <http://geo.msu.edu/extra/geogmich/limestone-mining.html> (last visited Oct. 2, 2016).

⁷ Alliance for the Great Lakes/Lake Michigan Federation, *Vanishing Lake Michigan Sand Dunes: Threats from Mining* (1993), <http://www.greatlakes.org/Document.Doc?id=119>.

⁸ *Id.*

C. Energy Production

The very same cool, fresh waters also attracted another use into the mid-1900s: energy production. Plentiful cold water was and remains an inexpensive way to cool power plants. Thus, it was little coincidence that nuclear and coal burning power plants emerged around Great Lakes shorelines.⁹ As a result, waste from energy production byproducts became closely associated with energy generation. Such byproducts included coal ash and fish “entrainment and impingement”—a more tasteful way of referring to turbines that pureed millions of fish before sending them back to the Great Lakes.¹⁰

D. Pollution

The Great Lakes were not merely where *resources* originated. They were also where *refuse* went to be moved away from city populations. In many instances, that refuse flowed toward drinking water sources for those same populations.¹¹ This posed a particularly pernicious problem for Great Lakes residents, as what flowed into the Great Lakes, tended to stay in the Great Lakes. Oil, grease, and other chemicals were freely discharged into tributaries. When, inevitably, sparks from trains passing over tributary bridges landed on these surface flammables, these very same tributaries caught fire.¹²

While the most famous burning river incident is the Cuyahoga River fire of 1969, it was not the only fire in Cleveland’s famous tributary. Close to a dozen other conflagrations plagued

⁹ Great Lakes Environmental Assessment and Mapping Project, http://www.greatlakesmapping.org/great_lake_stressors/4/coastal-power-plants (last visited Oct. 2, 2016).

¹⁰ *Id.*

¹¹ National Oceanic and Atmospheric Administration, A Brief History of Pollution, NOAA OCEAN SERVICE EDUCATION (Revised March 25, 2008), <http://oceanservice.noaa.gov/education/kits/pollution/02history.html> (last visited Oct. 2, 2016).

¹² *Id.*

the Cuyahoga.¹³ Nor was it the only river to be combustible. Michigan's Rouge River, New York's Buffalo River, and Illinois' Chicago River all caught fire through the late 1800s to the early 1900s.¹⁴

Even where a pollutant was non-flammable, it could still lead to a chain reaction of harm. Long known for their ability to withstand heat and to serve as lubricants, potentially carcinogenic polychlorinated biphenyls (PCBs) settled into the sediment of industrialized urban harbors and rivers. There, the PCBs were taken up by sediment-dwelling organisms that were eaten by fish, which were then eaten by wildlife and people.¹⁵ These and other toxicants were so extensively used, that the U.S. and Canada declared forty-three urban harbor and river communities as "Areas of Concern" to be targeted for cleanup.¹⁶

In the 1960s, scientists warned that Lake Erie—the shallowest and most sensitive of the Lakes—was dying, if not already biologically dead. Inputs of nutrients, such as phosphates, were causing "eutrophication," excessive plant growth and decomposition. Eutrophication can ultimately starve water and aquatic life of oxygen, among other impacts.¹⁷ If this fate could befall Lake Erie, could it not befall the other Lakes and their shallower, more sensitive estuaries like Green Bay and Saginaw Bay? Citizens, agencies, and legislators around the Great Lakes region worried that the answer was an undeniable "yes."

¹³ Jonathan H. Adler, *Fables of the Cuyahoga: Reconstructing a History of Environmental Protection*. 14 FORDHAM ENVTL L J 89 (2002), available at http://scholarlycommons.law.case.edu/faculty_publications/191/.

¹⁴ HARTIG, JOHN D., BURNING RIVERS: REVIVAL OF FOUR URBAN INDUSTRIAL RIVERS THAT CAUGHT FIRE, (Ecovision World Monograph Series), Multi-Science Publishing Company (May 17, 2010).

¹⁵ U.S. ENVIRONMENTAL PROTECTION AGENCY, *How do PCBs get into plants and animals?*, <https://www.epa.gov/ge-housatonic/understanding-pcb-risks-ge-pittsfieldhousatonic-river-site#HowEnvironment> (last visited Oct. 2, 2016).

¹⁶ ENVIRONMENT AND CLIMATE CHANGE CANADA, *Great Lakes Areas of Concern, EC.GC.CA* (last modified April 4, 2015), <http://www.ec.gc.ca/raps-pas/> (last visited Oct. 2, 2016).

¹⁷ Great Lakes Information Network, *Water Pollution in the Great Lakes*, GREAT-LAKES.NET, <http://www.great-lakes.net/teach/pollution/water/water5.html> (last visited Oct. 2, 2016).

Whether for their water or other natural attributes, the Great Lakes have been an attraction for extraction for the past two centuries. But, as one law of physics reminds us, for every action there is an equal and opposite reaction. That reaction was, as if in slow motion, the gradual destabilization of the Great Lakes system.

These same citizens, agencies, and legislators set to work to attempt to reverse the damage. Municipalities enacted bans on phosphate discharges. Consequently, Lake Erie exhibited a remarkable response, returning from the brink of biological demise.¹⁸ Its world-renowned walleye fishery rebounded. Hope for the biological integrity of Lake Erie and its sister Lakes returned.

The rebound was short-lived, however, in geological terms at least. By the early 2000s, Lake Erie began showing signs of eutrophic stress similar to the stress seen in the 1960s and 1970s. This time, it was largely, though not exclusively, a function of phosphorus-based runoff from farms.¹⁹

Other setbacks ensued. Cleanups of toxic hotspot “Areas of Concern” seemed to stall since the list of hotspots was established more than a decade prior. As binational efforts to control invasive sea lamprey began to take effect, invasive zebra mussels became commonplace after first showing up in the mid-1980s from oceangoing vessel discharges.²⁰ It appeared that the Lakes’ vital signs were showing signs of weakness again.

¹⁸ US ENVIRONMENTAL PROTECTION AGENCY, *Lake Erie*, EPA.GOV, <https://www.epa.gov/greatlakes/lake-erie> (last visited Oct. 2, 2016).

¹⁹ PHOSPHOROUS REDUCTION TASK FORCE REPORT TO THE GREAT LAKES COMMISSION, “Priorities for Reducing Phosphorous Loadings and Abating Algal Blooms in the Great Lakes – St. Lawrence River Basin: Opportunities and Challenges for Improving Great Lakes Aquatic Ecosystems,” *available at* <http://glc.org/files/docs/2012-priorities-reducing-phosphorus-loadings.pdf>.

²⁰ Barbara Wilcox, *USGS Targets Tiny Stowaways in Ships’ Ballast Water*, usgs.gov (April 8, 2013), https://www.usgs.gov/blogs/features/usgs_top_story/usgs-targets-tiny-stowaways-in-ships-ballast-water/ (last visited Oct. 2, 2016).

While failure can happen *in* life, failure is not an option *for* life. Fortunately, dedicated representatives from states, tribes, municipalities, businesses, environmental organizations, and academic institutions, among others, rallied to re-double their defense of the Great Lakes.

II. MODERN RESTORATION EFFORTS

Clearly, had the Great Lakes been subjected to a comprehensive ecological stress test, they would have failed.

A. The Executive Branch Signs the U.S.-Canada Great Lakes Water Quality Agreement

The unification of interests in bringing the ecosystem back to life around the region led to the U.S. and Canada signing the Great Lakes Water Quality Agreement (Agreement) for the first time in April 1972.²¹ Updated in 1978, 1983, and 1987, the Agreement committed the U.S. and Canada as the “Parties” to coordinate to minimize harm. The overall goal of the Agreement has not changed since 1972, and its “Purpose” to “restore and maintain the chemical, physical and biological integrity of the Waters of the Great Lakes” has not changed since 1978. The Parties called attention to sewage overflows as a key culprit in the Lakes’ ailing ecosystems.²²

By the time of the 1987 version of the Agreement, the Parties were approaching the Lakes more holistically. They called for recognition that *biological linkages*—the relationship between setting and species, predator and prey, among other individual pieces of the whole—had to be restored and protected to improve water quality. In other words, the Agreement espoused the “ecosystem approach” to restoring Great Lakes integrity.²³

²¹ See ENVIRONMENT AND CLIMATE CHANGE CANADA (July 12, 2013), <https://www.ec.gc.ca/grandslacs-greatlakes/default.asp?lang=En&n=647DC488-1> (last visited Oct. 2, 2016).

²² Great Lakes Water Quality Agreement of 1972, U.S.-Can., Apr. 15, 1972, 23 U.S.T. 301.

²³ *Id.* See also, Botts, Lee, & Muldoon, Paul, EVOLUTION OF THE GREAT LAKES WATER QUALITY AGREEMENT, Michigan State University Press (November 8, 2005).

B. Congress Passes and Amends the Clean Water Act

Just six months later, in October 1972, Congress passed the Federal Water Pollution Control Act (Clean Water Act), pumping billions of dollars into sewage treatment upgrades, which showed dramatic results for Lake Erie, the remaining Great Lakes and many of the nation's waterways.²⁴ It included provisions establishing a National Pollutant Discharge Elimination System (NPDES) to keep track of, minimize and nominally, if not ultimately, eliminate pollution.²⁵ It also included a call for agencies to designate waters as "impaired" if they did not meet minimum criteria, then to develop pollution budgets called Total Maximum Daily Loads or "TMDLs" for such impaired waters. While requiring the regulation of discernible "point" discharges under the NPDES, Congress stopped short of authorizing the regulation of land-based pollution not discharged through a discernible point (non-point sources).²⁶

In 1990, Congress passed the Great Lakes Critical Programs Act (GLCPA), a Clean Water Act amendment directing the U.S. Environmental Protection Agency's (EPA's) Great Lakes National Program Office (GLNPO) to lead efforts to achieve the purpose of the Agreement. Specifically, it tasked GLNPO with developing Lakewide Management Plans and overseeing states' regulation of toxic pollutant discharges into the Great Lakes by certain dates.²⁷

²⁴ Federal Water Pollution Control Act 33 U.S.C. §§ 1251 - 1376; (1948). *Amended* by P.L. 92-500, October 18, 1972, Titles II and VI. See also U.S. Environmental Protection Agency, *History of the Clean Water Act*, EPA.GOV, <https://www.epa.gov/laws-regulations/history-clean-water-act> (last visited Oct. 2, 2016).

²⁵ *Id.* at Title IV.

²⁶ *Id.* at § 303(d).

²⁷ Great Lakes Critical Programs Act, § 2 Amendments to 33 U.S.C. § 1268, *available at* <https://www.congress.gov/bill/101st-congress/senate-bill/1646/text>, which amended Section 118 of the Clean Water Act.

C. The Road to the Great Lakes Restoration Initiative

Still, while stakeholders registered some ecological progress on a local basis, the agencies and citizens made little headway in comprehensively tackling the Lakes' woes at a pace commensurate with the Lakes' needs.

More than a decade after Congress passed the GLCPA, progress toward restoring the Lakes' ecological function remained elusive. A 2003 U.S. General Accounting Office (GAO) report found more than 100 federal and state programs in existence, most of which were uncoordinated.²⁸ What was needed, the GAO stated, was a "master plan" for the system.²⁹ During a hearing about the GAO report, U.S. Senator George Voinovich (R-OH) of the U.S. Senate Committee on Governmental Affairs' Subcommittee on Oversight of Government Management, the Federal Workforce, and the District of Columbia asked the question: Who's in charge?³⁰

Sen. Voinovich likened efforts to restore and protect the Great Lakes to an orchestra with musicians playing discordant instruments. He then asked the panel of experts testifying whether an "orchestra leader" existed to coordinate Great Lakes efforts.³¹ A booming silence befell the witnesses, who were unable to provide a reassuring answer. Frustrated by continuing fragmented requests of Capitol Hill, Sen. Voinovich urged the region's constituents to band together to prioritize and unify their requests.³²

²⁸ U.S. GENERAL ACCOUNTING OFFICE, *Great Lakes: An Overall Strategy and Indicators for Measuring Progress Are Needed to Better Achieve Restoration Goals*, GAO-03-515 (Apr. 2003), pp. 6-9, <http://www.gao.gov/new.items/d03515.pdf>.

²⁹ *Id.*

³⁰ *Great Lakes Restoration Management: No Direction, Unknown Progress: Hearing 108-201 Before the S. Subcomm. on Oversight of Government Management, the Federal Workforce and the District of Columbia*, (July 16, 2003), <https://www.gpo.gov/fdsys/pkg/CHRG-108shrg88934/pdf/CHRG-108shrg88934.pdf>.

³¹ *Id.* at 41.

³² *Id.*

The next year, then-President George W. Bush, facing a difficult general election and hoping for support from Midwestern swing states, issued Executive Order 13340. The Executive Order called for the creation of a Great Lakes Interagency Task Force (Task Force) to develop “outcome-based goals” and coordinate programmatic implementation for a healthier system. The Executive Order designated the Administrator of the U.S. EPA to serve as chair of the Task Force. In short, the Executive Order sought to bring coordinated harmony to the cacophonous sounds of the programmatic and institutional disorder highlighted by the previous year’s GAO report and Sen. Voinovich’s hearing.³³

The Executive Order may have answered Sen. Voinovich’s question about an “orchestra leader” for nearly one dozen federal departments in charge of many of the programs cited in the GAO report the year before. It did not, however, mention any additional resources to support either the EPA—now the coordinator—or the agencies to achieve Great Lakes restoration. Instead, the Executive Order identified the conductor and band members, but did not acknowledge the funding imperative for actual music—the endeavor of Great Lakes restoration and protection—to be performed.

Again, the region’s constituents—simultaneously disheartened by the lack of restoration progress, yet heartened by Washington’s call for a unified, prioritized plan—got to work. In December 2005, political leaders gathered at Chicago’s John G. Shedd Aquarium to sign a strategy that also responded to GAO and fulfilled Sen. Voinovich’s call to action.³⁴ It contained a prioritized list of Great Lakes injuries to be addressed and estimated the cost to be \$26 billion. Even more, it had the unified support of the region: members of Congress, governors, mayors, environmentalists, businesses, academia, and others supported the plan.

³³ E.O. 13340 Sec. 3(a)(iv), 69 FR 29043 (2004).

³⁴ Great Lakes Regional Collaboration, *Great Lakes Regional Collaboration Strategy*, DNR.WI.GOV (Dec. 2005), <http://dnr.wi.gov/topic/greatlakes/documents/GLRCstrategy.pdf>.

Despite the reports, strategies, and hearings, the scientific case for comprehensive Great Lakes restoration was diffuse. To address this, some of the region’s most eminent scientists warned that the ecosystem—the fragile linkages among living things and their environment—was compromised. Consequently, in their 2006 report, the scientists warned of “ecosystem collapse.”³⁵ It was good to have a plan with strong political and public backing. It was good that the plan prioritized actions with cost estimates. And now a new, rigorous scientific foundation existed for the master strategy.

In one final push for comprehensive Great Lakes restoration, researchers from The Brookings Institution strategically treated ecosystem restoration as an investment, rather than a cost. The return on the \$26 billion strategy investment would be \$50 billion in direct economic benefits—or nearly double the cost. Indirect benefits would push the return on investment to roughly 3:1.³⁶

The political leadership had marshaled behind a comprehensive strategy. In turn, a compelling scientific and economic case had been made.

Still nothing changed.

At least not right away.

III. ROADMAP FOR MAINTAINING RESTORATION EFFORTS

For two years, the plan and the case for comprehensive Great Lakes restoration seemed to languish. Then, three elements came together to make all of the previous efforts worthwhile: funding, achieving results, and a sustained emphasis on collaboration. All three ingredients are

³⁵ Bails, et al., *Prescription for Great Lakes Ecosystem Protection and Restoration (Avoiding the Tipping Point of Irreversible Changes)*, Healthy Lakes Report, (2005), <http://www.healthylakes.org/wp-content/uploads/2011/01/Prescription-for-Great-Lakes-RestorationFINAL.pdf>.

³⁶ Austin, J, et. al, *Healthy Waters, Strong Economy: The Benefits of Restoring the Great Lakes Ecosystem*, The Brookings Institution (Sep. 2007), https://www.brookings.edu/wp-content/uploads/2016/06/0904gleiecosystem_austin.pdf.

necessary to maintain restoration and protection efforts going forward. Without each one of them, the recipe for success can stall.

A. Funding: The Great Lakes Restoration Initiative is Born

If an incumbent president could sign an executive order in an election year calling for increased Great Lakes coordination, then a presidential candidate could call in an election year for increased Great Lakes funding. On September 16, 2008, then-Presidential Candidate Obama—who had had a strong interest in Great Lakes restoration as a U.S. senator and as a state senator representing a South Side Chicago lakefront district—issued a campaign platform pledging to create a \$5 billion trust fund for the Great Lakes.³⁷ His proposed fiscal year 2010 budget called for \$475 million to go toward this restoration trust fund. An eager Congress passed an appropriation for that exact amount.³⁸ In February 2010, in the company of Michigan and Wisconsin governors, former U.S. EPA Administrator Lisa P. Jackson released a Great Lakes Restoration Initiative (GLRI) Action Plan to detail how the money would be invested.³⁹

The Action Plan identified the key stresses to the Great Lakes mentioned in the strategy. Only this time, the Action Plan had the force of real funding behind it.⁴⁰ The Action Plan signaled the ways in which the federal agencies would invest the new federal funding:

- Focus Area 1—Toxic Substances and Areas of Concern. The eleven federal departments—primarily the U.S. EPA and U.S. Army Corps of Engineers—committed to cleaning up

³⁷ Tom Henry, *Obama rolls out plan for Great Lakes*, Toledo Blade, (Sep. 17, 2008), <http://www.toledoblade.com/Politics/2008/09/17/Obama-rolls-out-plan-for-Great-Lakes.html> (last visited Oct. 2, 2016).

³⁸ U.S. WHITE HOUSE OFFICE OF MANAGEMENT AND BUDGET (OMB), Great Lakes Restoration Crosscut, (2014), https://www.whitehouse.gov/sites/default/files/omb/assets/legislative_reports/fy-2015-great-lakes-report.pdf.

³⁹ U.S. ENVIRONMENTAL PROTECTION AGENCY, FY10-14 Great Lakes Restoration Initiative Action Plan (February 22, 2010), <https://yosemite.epa.gov/opa/admpress.nsf/0/8f1d360db17327c1852576d20053ca01>, available at [https://yosemite.epa.gov/sab/sabproduct.nsf/fedrgstr_activites/750D38466C98D0818525771A0068B925/\\$File/glri_actionplan.pdf](https://yosemite.epa.gov/sab/sabproduct.nsf/fedrgstr_activites/750D38466C98D0818525771A0068B925/$File/glri_actionplan.pdf).

⁴⁰ White House OMB, *supra* note 39 at 3.

sediment in toxic hotspot Areas of Concern, relics of the industrial era that continued to infect the region with recontamination of certain kinds of fish and imperil the health of those who ate them.

- Focus Area 2—Invasive Species. With leadership by the U.S. Fish & Wildlife Service (FWS) and others, this focus area prioritized the control of alien species that could cause significant disruption to the native ecosystem. Ironically, even before former Administrator Jackson released the Action Plan, genetic material from non-native silver and bighead carp in the Chicago Area Waterway System began to appear near Lake Michigan. This suggested that these fish—which eat massive amounts of plankton, one of the bases of the food chain—could invade the Great Lakes.
- Focus Area 3—Nearshore Health and Nonpoint Source Pollution. Nutrients, largely from farm fields, were looking to set back the clock some two decades in areas, such as Lake Erie’s Western Basin, where excess phosphorus was fertilizing downstream waterways to create equally excessive algae growth.
- Focus Area 4—Habitat and Wildlife Protection and Restoration. In the complex world of protecting the Great Lakes, few singular solutions stand out to address critical stresses. One of them, however, is the protection and creation of high-quality wetlands. Marshes, fens, and bogs provide fish and wildlife spawning areas, reduce flooding that damages property, and improve water quality. This focus area in the Action Plan invested in wetland protection and creation for these reasons.
- Focus Area 5—Accountability, Education, Monitoring, Evaluation, Communication, and Partnerships. Somewhat of a “catch-all” section, the federal agencies committed to investing

in collaborations, education, research, and the underpinnings necessary to ensure that the GLRI could be implemented with accountability.⁴¹

Immediately upon its release, the GLRI and its Action Plan won praise from the commentator class. The late David Broder of the *Washington Post* wrote that the GLRI “is a truly bipartisan and binational enterprise, involving leaders and groups from eight states, innumerable communities, [and] the two major U.S. political parties...The 30 million people who live in this region make it a major political battleground. In an age of rampant distrust, I can’t think of a better way to show that government can work.”⁴²

B. Results: The Rewards of Restoration and Protection

With the “easy” part out of the way—Congressional funding approved and the Action Plan complete—the agencies turned their sights to the difficult part: starting and completing the work.

As if to say, “we’re good for the money,” the agencies provided in the Action Plan annual “measures of progress” so that taxpayers and Congress could hold the eleven federal Task Force departments accountable.⁴³ Legislator after legislator from both sides of the political aisle expressed interest in supporting the effort if the agencies could keep showing results.

By the end of the first five years of the GLRI, the agencies and their partners had delivered on most of their commitments. For example, the agencies had met or exceeded commitments for nineteen of the twenty-eight measures of progress. The agencies did not meet six of the measures. And for three of the measures, each had become inapplicable or data were

⁴¹ U.S. EPA, *supra* note 39.

⁴² David S. Broder, *Great goals for the Great Lakes*, *Washington Post* (Feb. 25, 2010), <http://www.washingtonpost.com/wp-dyn/content/article/2010/02/24/AR2010022403480.html> (last visited Oct. 2, 2016).

⁴³ U.S. EPA, *supra* note 40.

not available to assess achievement.⁴⁴ Where measures of progress were not met, that was not the end of the story. Explanations were provided to help strengthen work in the future.

As important as the data, the on-the-ground results spoke for themselves. For example, Pennsylvania's Presque Isle Bay, and Michigan's Deer and White Lake Areas of Concern were delisted. This progress in the first six years of the GLRI far outpaced the one Area of Concern delisting that took place in the twenty-five years prior to the program's establishment.⁴⁵

Delivering on past results helped move the program into another five years. U.S. EPA Administrator and Interagency Task Force Chair, Gina McCarthy, announced a second five-year GLRI Action Plan in September 2014, in the wake of excessive nutrients leading to the disruption of public water delivery in the Toledo area.⁴⁶ This plan, which incidentally was announced at Chicago's Shedd Aquarium nearly a decade after the Great Lakes Regional Collaboration Strategy debuted there, was based on a budgeting assumption of \$300 million per year over federal fiscal years 2015-2019. The plan was dedicated largely to sustaining momentum in the same five focus areas as the first GLRI Action Plan.⁴⁷

Under the second Action Plan, the results have continued. In August 2016, the U.S. FWS reported that piping plover had been found in the Lower Green Bay area for the first time in 75 years. Small shoreline birds, the plovers' numbers had dropped consistently for years, as

⁴⁴ GLRI FY2010-2014 Report to Congress, Appendix A, p. 22. http://glri.us/pdfs/21050720-report_to_congress.pdf.

⁴⁵ U.S. ENVIRONMENTAL PROTECTION AGENCY, *Great Lakes Areas of Concern*, epa.gov, <https://www.epa.gov/great-lakes-aocs> (last visited Oct. 2, 2016).

⁴⁶ Michael Wines, *Behind Toledo's Water Crisis, a Long-Troubled Lake Erie*, The New York Times (August 4, 2014), http://www.nytimes.com/2014/08/05/us/lifting-ban-toledo-says-its-water-is-safe-to-drink-again.html?_r=0 (last visited Oct. 2, 2016).

⁴⁷ Great Lakes Restoration, *Great Lakes Restoration Initiative Action Plan II* (Sept. 2014), <https://www.glri.us/actionplan/pdfs/glri-action-plan-2.pdf>.

shorelines had become more disturbed and inhospitable to nesting. The situation deteriorated to the point where the plover had been placed on the Endangered Species list for the Great Lakes.⁴⁸

Agencies and their partners also began showing results on another high-profile threat: the migration of silver and bighead carp toward the Great Lakes. In May 2016, the Asian Carp Regional Coordinating Committee, U.S. Department of Agriculture, Little River Wetlands Project and others announced the completion of a berm to block the migration of carp from Indiana’s Wabash River to Ohio’s Maumee River during flooding that could have allowed the fish to move into Lake Erie. Roughly \$2.3 million in GLRI funding helped to drive home the result.⁴⁹

These were not merely theoretical or philosophical victories. The results were tangible, helping to save individual species and defeat others; to save important places; and to protect public health.

C. Collaboration: The Foundation for Restoration and Protection

Of course, neither funding nor results occur without people working cooperatively to secure the funding and achieve the results. As such, effective collaboration continues to be another lynchpin for the GLRI.

“Collaboration,” like “transparency” and “consensus,” is a word with an elusive meaning. Even the *Merriam-Webster Dictionary* provides definitions with different connotations:

- To work with another person or group in order to achieve or do something.

⁴⁸ U.S. FISH & WILDLIFE SERVICE, *Piping Plover* (April 23, 2015), <https://www.fws.gov/midwest/endangered/pipingplover/pdf/piplfactsheet.pdf>, *see also* (August 9, 2016), <https://www.fws.gov/midwest/news/848.html> (last visited Oct. 2, 2016).

⁴⁹ Brian Francisco, *Team Declares Victory with Asian Carp Berm*, JOURNAL GAZETTE (May 12, 2016), <http://www.journalgazette.net/news/local/Team-declares-victory-with-Asian-carp-berm-13012779> (last visited Oct. 2, 2016).

- To give help to an enemy who has invaded your country during a war.⁵⁰

Given the differing expertise and interests necessary to achieve complex solutions for complex ecological problems, collaboration is more than a good idea. It is vital. In the context of Great Lakes restoration, successful collaboration is defined by and based on several factors:

- Identifying a problem to be solved or goal to be achieved, along with the scientific, economic, and policy case for why the problem or goal must be addressed.
- Identifying jurisdictions and organizations that might have a stake in the problem to be solved or goal to be achieved. On the U.S. side of the Great Lakes border, states, tribes, municipalities, environmental organizations, businesses, academia, and others all have a reason to care about Great Lakes decision-making.
- Assessing and understanding the overlapping interests that the jurisdictions and organizations might have in the problem to be solved or the goal to be achieved.
- Pursuing decisions and an agenda that helps to advance these overlapping interests.
- Committing a plan to writing that captures the problem to be solved or the goal to be achieved in a way that serves these overlapping interests. The plan should also have milestones and an accountability system for understanding whether those milestones are being met, and by whom.
- Providing adequate time and financial support to achieve the plan.
- Ensuring one of the most important components to effective collaboration in ecological restoration and protection: trust and mutual respect among the stakeholders. In a Great Lakes context, core stakeholders are honest with each other, listen to each other, and earnestly communicate ideas and feedback to achieve goals. Without this intangible factor, delivering under the other factors becomes difficult, if not impossible.

⁵⁰ “Collaboration.” Merriam-Webster Online Dictionary. 2004. <http://www.merriam-webster.com/dictionary/collaborate> (last visited Oct. 2, 2016). The term “collective action” is now trending as a synonym for “collaboration.” *See also* MANCUR OLSON, *THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS*, (Harvard University Press, Revised ed. 2002).

As important as many of the GLRI’s “on-the-ground” and “in-the-water” results have been, the GLRI has also lead to several institutional and governance results, each of which has garnered strong support so important for future programmatic success.

1. Asian Carp Regional Coordinating Committee

In August 2009, a budding technology to identify environmental deoxyribonucleic acid (eDNA) began detecting genetic material from silver and bighead carp in the Chicago Area Waterway System (CAWS).⁵¹ Detection of eDNA downstream in the Illinois River, where these carp were pervasive, would not have been surprising. The August 2009 detection was, however, unanticipated in the CAWS far upstream of where the U.S. Army Corps of Engineers (ACE) built an electric fence “array” in the Chicago Sanitary and Ship Canal (Canal). ACE built the fence to repel the transfer of invasive species between the Great Lakes and Mississippi River basins, which are linked by the CAWS and Canal.

Natural resource experts had long been concerned about the migration of Asian carp upstream in the Mississippi River, ever since the fish escaped from aquaculture ponds in Southern Mississippi states decades before.⁵² Experts feared that the fish, as voracious feeders and breeders, could gain access to the Great Lakes and devastate its already-fragile native fisheries.

Though ACE’s fence system had been shown to be effective in repelling some fish, the electric barriers seemed to have more limited effectiveness against smaller fish, larvae or eggs transiting the barrier system array.⁵³

⁵¹ ASIAN CARP REGIONAL COORDINATING COMMITTEE, *Asian Carp Response in the Great Lakes* (2011), <http://www.asiancarp.us/edna.htm#> (last visited Oct. 2, 2016).

⁵² U.S. FISH & WILDLIFE SERVICE, *Aquatic Nuisance Species Summit Held in Chicago* (May 15, 2003), https://www.fws.gov/fieldnotes/print/print_report.cfm?arskey=8909 (last visited Oct. 2, 2016).

⁵³ The U.S Army Corps of Engineers states that “the electric barriers are an effective fish deterrent.” See U.S. ARMY CORPS OF ENGINEERS, *Electric Barriers*, <http://www.lrc.usace.army.mil/Missions/Civil-Works-Projects/ANS->

The timing could not have been less fortunate for another reason. ACE was due to shut off the electricity to its electric barriers for maintenance. In addition to the detection of eDNA upstream of the fences, the planned shutdown created virtual panic around the Great Lakes that the fish could access Lake Michigan almost unimpeded.⁵⁴

In early December 2009, several agencies stood near the site of the electric fences to apply rotenone, a piscicide. The objective was to kill all aquatic life in the Chicago Area Waterway System from a point beginning approximately six miles upstream of the electric fences at Romeoville, Illinois, all the way downstream to Lockport lock and dam. The river would be detoxified, then, too.⁵⁵

In addition, advocates and attorneys general from other states called for several of the Chicago area's Chicago River flow management gates to be closed. When ACE contended that the locks were never designed to block fish and would not be effective for such, the attorneys general sued. The case went all the way to the U.S. Supreme Court.⁵⁶

Several of the participating agencies, including the U.S. EPA, U.S. FWS, Illinois Department of Natural Resources, and others concluded that an interagency team dedicated to the long-term defense of the Great Lakes against Asian carp invasion was necessary. In late December, the U.S. EPA's Great Lakes National Program Office in Chicago hosted a conference call, in part to debrief from the electric fence maintenance issue. On that call, federal agencies

Portal/Barrier/ (last visited Oct. 2, 2016). They have been shown, however, to only be effective in deterring certain sizes of fish and effective in deterring naturally swimming fish. They do not, for example, prevent aquatic organisms from getting dragged in between vessels that transit the barriers.

⁵⁴ See, e.g., Grand Rapids Press Editorial Board, "Stopping true Asian carp invasion of Great Lakes calls for extraordinary measures, including poison," (November 24, 2009), http://www.mlive.com/opinion/grand-rapids/index.ssf/2009/11/editorial_stopping_true_asian.html (last visited Oct. 2, 2016).

⁵⁵ Email from U.S. EPA GLNPO Senior Advisor Bill Bolen, one of the Incident Command System commanders during the 2009 exercise, to Cameron Davis, June 25, 2016.

⁵⁶ *Michigan v. Illinois*, 558 U.S. 1145, 130 S.Ct. 1166 (Mem) (2010) (denying Michigan's motion for preliminary injunction to ordering closure of the navigational locks at O'Brien Lock and Dam and Chicago Controlling Works), 130 S.Ct. 2397 (Mem) (denying Michigan's motion to reopen and for supplemental decree).

agreed to establish the Asian Carp Regional Coordinating Committee (ACRCC) to ensure methodical future coordination to protect the Great Lakes.⁵⁷

Today, co-chaired by the U.S. EPA and U.S. FWS, the purpose of the ACRCC is to prevent the introduction, establishment, and spread of Asian carp into the Great Lakes.⁵⁸

An invasion of a species like Asian carp, which could wreak havoc on the Great Lakes ecosystem, calls for strong preventative measures, especially with a Great Lakes sport fishery valued at billions of dollars annually on the upstream side of ACE's electric fences.⁵⁹ The federal agencies first identified a goal (invasion prevention). Then, they identified agencies that had a stake in achieving the goal. Together, they have pursued decisions to advance their own overlapping interests in achieving the goal. As such, the ACRCC, now with nearly 30 federal (U.S. and Canada), state, provincial and municipal members, is a model of collaboration. Establishing the ACRCC in law or policy will help the collaborative effort to continue to be effective in achieving its mission.

Today, other collective efforts, such as the Great Lakes *Phragmites* Collaborative and Invasive Mussel Collaborative, have been influenced by the ACRCC model.⁶⁰

2. Great Lakes Advisory Board

Beyond collaboratives dedicated to addressing one issue or one species, another important form of outreach and engagement exists for the entire Great Lakes Restoration Initiative: The Great Lakes Advisory Board (Board).

⁵⁷ The ACRCC addresses four forms of Asian carp: bighead, black, grass and silver carp.

⁵⁸ ASIAN CARP REGIONAL COORDINATING COMMITTEE, *Asian Carp Response in the Midwest*, www.asiancarp.us (last visited Oct. 2, 2016).

⁵⁹ ASIAN CARP REGIONAL COORDINATING COMMITTEE, *Asian Carp Regional Control Strategy Framework* (June 2014), p. 6, <http://www.asiancarp.us/documents/2014Framework.pdf> (last visited Oct. 2, 2016).

⁶⁰ Great Lakes Commission, *Great Lakes Phragmites Collective*, <http://greatlakesphragmites.net/>; *Invasive Mussel Collaborative*, <http://invasivemusselcollaborative.net/steering-committee/> (last visited Oct. 2, 2016).

The Board is comprised of sixteen members with expertise in different fields and representing state, tribal, municipal, academic, environmental, business and other interests. It provides advice to the Task Force of eleven federal departments.⁶¹ The Board is the only body established under the Federal Advisory Committee Act (FACA) for the benefit of the U.S. EPA and its companion agencies that is not managed out of the U.S. EPA's headquarters.⁶² Instead, it is managed by one of the agency's regional offices. Its purpose is to provide advice to the eleven Task Force departments on matters of U.S. domestic Great Lakes restoration and protection, particularly the GLRI.⁶³

In 2013, it provided comprehensive advice to the Task Force to aid in the development of the second GLRI Action Plan, covering federal fiscal years 2015-2019.⁶⁴ The U.S. EPA adopted all recommendations. Like the ACRCC, different stakeholders were identified who have overlapping interests and a common agenda in achieving a more sustainable Great Lakes ecosystem.

The process for providing advice typically includes the federal departments submitting "charge questions" to the Board, the answers to which are considered advice to the agencies. In another unconventional aspect, the Board may provide back to the Task Force clarifying counter-questions or suggestions that additional charge questions be asked. Though not unprecedented, this approach is unusual in the world of U.S. EPA federal advisory committees, and reflective of the collaborative approach that serves as a trademark for the GLRI.

⁶¹ GREAT LAKES RESTORATION, *Great Lakes Advisory Board*, <https://www.glri.us/advisory/index.html>.

⁶² Federal Advisory Committee Act, Pub. L. No. 92-463, 86 Stat. 770 (2013).

⁶³ FR Doc. 2016-15003 (June 24, 2016) (last visited Oct. 2, 2016); see Federal Register, *EPA Great Lakes Advisory Board; Notice of Charter Renewal*, <https://www.federalregister.gov/articles/2016/06/24/2016-15003/epa-great-lakes-advisory-board-notice-of-charter-renewal> (last visited Oct. 2, 2016).

⁶⁴ GREAT LAKES ADVISORY BOARD, *Recommendations to the Great Lakes Interagency Task Force on the Development of the FY2015-2019 Great Lakes Restoration Initiative Action Plan*, (Dec. 23, 2013), <https://www.glri.us/pdfs/qlab-report-20131223.pdf>.

With the agencies serving as trustees of \$300 million per year in taxpayer dollars, the Board serves as a surrogate for taxpayers to ensure their funds are being directed wisely. The only formal statutory reference to the Board is an appropriations committee report that lauded the U.S. EPA's establishment of the Board. Yet, like the ACRCC, no formal law or policy mandates the body's maintenance.⁶⁵

D. Restoration = Prevention = Protection

Ultimately, these key factors for success—funding, results, and collaboration—are underpinned by a clear, common understanding of what the work is meant to achieve.

1. Define Restoration & Protection

Though the name of the program explicitly uses the term “restoration,” the Task Force of eleven federal departments created under Executive Order 13340 is obligated to protect the Great Lakes, not just try to fix the problems of the past.

Some could argue that the GLRI Action Plan should not be rigid. Still, others could argue that only rigidity can bring accountability for results. Regardless, the difference between “restoration” and “protection” presents a false choice in the context of the GLRI. Instead, “restoration” and “protection” may be viewed as part of a continuum, with the Task Force investing more in protection and prevention measures as more projects to remedy past ecosystem injuries are completed. Through it all, the success of a collaboration like the ACRCC or Great

⁶⁵ The only legislative mentions of the Board are: (1) by the U.S. House appropriations subcommittee with oversight over U.S. EPA: “The Committee is pleased that EPA has established a non-governmental advisory board to solicit stakeholder input.” STAFF OF H. COMM. ON APPROPRIATIONS, 113TH CONG., REP. ON DEP'T. OF THE INTERIOR, ENV'T., AND RELATED AGENCIES APPROPRIATION BILL, 2014 (Draft Report, Comm. Print July 31, 2013) 51, available at <http://appropriations.house.gov/uploadedfiles/hrpt-113-hr-fy2014-interior.pdf>; and (2) a bill by the U.S. House of Representatives to authorize the GLRI in law. *The Great Lakes Restoration Initiative: A Review of the Progress and Challenges in Restoring the Great Lakes: Hearing Before the H. Subcomm. on Water Resources and Env't. of the Comm. on Transportation and Infrastructure*, 114th Cong. 7 (2015) (testimony of Chris Korleski, Director, Great lakes National Program Office, U.S. Environmental Protection Agency).

Lakes Advisory Board—or the management of the entire GLRI through the Task Force for that matter—often depends strongly on the clarity of the goal to be achieved or problem to be solved. In this case, that goal remains ecosystem restoration and protection as integrated imperatives.

2. The Prevention & Precaution Imperatives

When the U.S. and Canada began re-negotiating the Great Lakes Water Quality Agreement in 2009, they contemplated a time when the 1978 and 1987 versions' heavy emphasis on the cleanup of Areas of Concern would one day draw to an end as site cleanups were completed. To ready themselves for that time, they agreed to several forward-looking policies upon the document's signature in September 2012.

First, they included in the Purpose statement of the 2012 Agreement—for the first time ever—that the Great Lakes have multi-generational value:

The Parties, recognizing the inherent natural value of the Great Lakes Basin Ecosystem, are guided by a shared vision of a healthy and prosperous Great Lakes region in which the Waters of the Great Lakes, through sound management, use and enjoyment, will benefit present and future generations of Canadians and Americans.⁶⁶

To help ensure that the two countries would make this pan-generational provision meaningful, they further committed that it is necessary for them:

to take action to resolve existing environmental problems, as well as to anticipate and prevent environmental problems, by implementing measures that are sufficiently protective to achieve the purpose of this Agreement.⁶⁷

They further defined what they meant by including the Prevention Principle and the Precautionary Approach, respectively:

⁶⁶ Great Lakes Water Quality Agreement, art. 2(2), U.S.-Can., (Sept. 2012), http://binational.net/wp-content/uploads/2014/05/1094_Canada-USA-GLWQA-_e.pdf.

⁶⁷ *Id.*, Article 2(3).

prevention – anticipating and preventing pollution and other threats to the quality of the Waters of the Great Lakes to reduce overall risks to the environment and human health,⁶⁸

precaution – incorporating the precautionary approach, as set forth in the Rio Declaration on Environment and Development, the Parties intend that, “Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”⁶⁹

What the “Parties” had in mind with these two provisions is a commitment to *proactively* scope out future threats and *act* to address them before they became problems. That is a very different approach than the one under the previous versions of the Agreement.

a. Preparing for Prevention: Forecasting

The imperatives to prevent harm or act with precaution alone are not self-executing.

First, implementing these imperatives under the Agreement require knowledge to understand the probabilities of what could happen in the future.⁷⁰ Examples:

i. Harmful Algal Blooms

The National Weather Service (NWS) may be the National Oceanic and Atmospheric Administration’s (NOAA) best-known agency because NWS is known for providing weather forecasts.⁷¹

Using these and other models, NOAA then can anticipate the movement of harmful algae blooms as they grow, change, and migrate to threaten drinking water at intakes or recreation at beaches.

⁶⁸ *Id.*, Article 4(j).

⁶⁹ *Id.*, Article 4(i).

⁷⁰ Forecasting is different than predicting.

⁷¹ NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, *National Weather Service*, <http://www.weather.gov/> (last visited Oct. 2, 2016)

ii. Great Lakes Aquatic Nuisance Species Information System

As mentioned above, aquatic nuisance species, organisms that had not existed in the Great Lakes, but managed to enter via different vectors, can have extremely disruptive impacts. For example, they outcompete native species for food, spawning space, and other vital resources. Consequently, invasive species resulted in untold ecological damage to the delicate Great Lakes ecosystem. They have also resulted in significant economic damage. Although the full extent of such economic damage is difficult to estimate, it is likely on the order of billions of dollars over the past several decades.

In the past, invasive nuisance species such as sea lamprey and quagga mussels used to simply get in without much warning. Agencies are trying to do better, however, so that resource managers have adequate time to “prespond” to the information by keeping invasive species out or reducing their harmful impacts.

One example is the Great Lakes Aquatic Nonindigenous Species Information System (GLANSIS).⁷² Engineered by NOAA, GLANSIS is a database of aquatic invasive species (AIS) that currently exist in the Great Lakes below the ordinary high water mark. The database also contains a “Watch List” of potential AIS that either do not exist in the Great Lakes or do not exist in numbers that could allow the species to be considered “established.” Ultimately, uses for GLANSIS are to prevent the introduction or spread (if already established in one part of the Great Lakes, but not in others) of invasive species, based on a variety of considerations.

Whether through the use of harmful algal bloom bulletins or GLANSIS, others have the option of using NOAA’s knowledge to decide if, when, or how to take action, such as municipal drinking water agencies taking extra precautionary measures or recreational beach managers

⁷² NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, *Great Lakes Aquatic Nonindigenous Species Information System*, <http://www.glerl.noaa.gov/res/Programs/glansis/glansis.html> (last visited Oct. 2, 2016).

posting swimming advisories. In either regard, the authority to take action is vested in other entities as such decisions rest beyond NOAA's authorities.⁷³ Consequently, forecasting for readiness presents a different approach than action forecasting.

b. Action Forecasting

Second, implementing these imperatives compel taking action based on the knowledge provided. Weather forecasting provides users with information to make travel, farming, and other actionable decisions. If we can forecast something as complex as the weather to take action, can we forecast trends in landscape or lake changes to make decisions so that agencies can prevent harmful results from those changes? Here is an answer that some may not have forecasted: yes, we can, at least depending on *what* we are trying to forecast. Here are some examples.

i. Other Pathways Study

Though it is unclear whether GLANSIS has resulted directly in precise actions to prevent specific AIS from entering the Great Lakes, another platform has provided action forecasting: the U.S. Army Corps of Engineers (ACE) has developed the Great Lakes and Mississippi River Interbasin Study (GLMRIS) "Other Pathways" study to identify waterways that connect the Great Lakes to external watersheds so that AIS could enter through them.⁷⁴ The ACE then can use its own authorities to work with others to address such pathways.

The "Other Pathways" study identified eighteen artificially-connecting waterways and ranked them according to risk level, particularly for Asian carp invasion. The Other Pathways

⁷³ NOAA's bulletins can be found at http://www.glerl.noaa.gov/res/HABs_and_Hypoxia/bulletin.html (last visited Oct. 2, 2016).

⁷⁴ GREAT LAKES AND MISSISSIPPI RIVER INTERBASIN STUDY, <http://glmr.is.anl.gov/> (last visited Oct. 2, 2016), and GREAT LAKES AND MISSISSIPPI RIVER INTERBASIN STUDY, *Focus Area 2 Other Aquatic Pathways*, <http://glmr.is.anl.gov/other-pathways/> (last visited Oct. 2, 2016).

study ranked the Chicago Area Waterway System (CAWS) as the highest risk for invasion. It likewise ranked Eagle Marsh in Indiana as high. Eagle Marsh floods during heavy precipitation to create an aquatic linkage for organisms, including Asian carp, to migrate from the Wabash River, connected to the Mississippi River, to the Maumee River in Ohio. From there, they could migrate to a hospitable Lake Erie.

While federal, state, provincial, and municipal agencies work to reduce the risk of invasion through CAWS, in May 2016, several agencies announced the completion of a berm to prevent Wabash-to-Maumee River Asian carp migration.⁷⁵ This project was a direct result of ACE's Other Pathways study using GLRI and other funding sources.

iii. Lacey Act Listing

On September 30, 2016, FWS took an unusual, if not unprecedented, step toward preventing harm to the Great Lakes using its powers under the Lacey Act.⁷⁶ FWS identified eleven species that *could* get into the Great Lakes, but had not yet done so to the best of the agency's knowledge.

This was a significant departure from previous Lacey Act listings that identified and sought limitations on the movement of AIS already in the United States. Conversely, the September 30 Lacey Act listing proactively identified and listed AIS that had not already entered, or very few of which had entered, the United States. The proactive listing of certain

⁷⁵ Brian Francisco, *Team declares victory with Asian carp berm*, JOURNAL-GAZETTE (May 12, 2016), <http://www.journalgazette.net/news/local/Team-declares-victory-with-Asian-carp-berm-13012779> (last visited Oct. 2, 2016).

⁷⁶ U.S. FISH & WILDLIFE SERVICE, *Lacey Act*, 16 U.S.C. §§ 3371–78 (2006) available at <https://www.fws.gov/international/laws-treaties-agreements/us-conservation-laws/lacey-act.html> (last visited Oct. 2, 2016).

injurious species was based on information such as the hospitability of the Great Lakes under future climactic and other dynamics, such as organism life stages.⁷⁷

Again, the proposal for listing did not just happen. Using significant GLRI funding, FWS prepared risk assessments for each of the eleven species, identifying transportation routes, patterns of commerce, and compatibility of native and Great Lakes ecosystems to forecast that the organisms, if left unchecked, were likely to enter the Great Lakes. This risk assessment forecasting, tied to the use of Lacey Act authority, is a textbook example of action forecasting.

c. Readiness

Simply providing knowledge about prospective injury and taking action to prevent such injury, in some cases, may not be enough. In many instances, agencies and other partners may need to be ready to respond to harm, despite gathering information and even proactively attempting to prevent harm in the first place. Fortunately, several examples of readiness exist.

i. Evergreen

Originally conceived as Project Longview in 1999, today, “Evergreen” is a scenario planning effort to attempt the U.S. Coast Guard’s readiness for operating in a “highly dynamic and constantly evolving operating environment.” Whether responding to an oil spill or conducting a search and rescue mission, a U.S. Coast Guard team, including contractors, looks at trends and drivers to discern what kinds of situations might require agency personnel to mobilize.⁷⁸ Today, more than twenty initiatives can be linked to Evergreen.

⁷⁷ 81 Fed. Reg. 190 (Sep. 30, 2016); see U. S. Fish & Wildlife Service, *Fish and Aquatic Conservation*, available at <http://www.fws.gov/injuriouswildlife/11-freshwater-species.html> (last visited Oct. 2, 2016).

⁷⁸ U.S. COAST GUARD, *Evergreen* (last modified August 13, 2016), <https://www.uscg.mil/strategy/evergreen.asp> (last visited Oct. 2, 2016).

ii. Mutual Aid Agreement

In 2015, the Great Lakes and St. Lawrence River Governors and Premiers established a Mutual Aid Agreement (MAA) to prevent the introduction and spread of AIS, recognizing that the prospect of such biological invasion could strain the resources of any one jurisdiction. The MAA empaneled an AIS Task Force to: (1) prepare protocols for implementation of the MAA, (2) ensure monitoring networks are in place to detect the presence of AIS, and (3) coordinate effective actions to fulfill the MAA’s purpose, among other efforts.⁷⁹

iii. Strategic Foresight

U.S. EPA is also working on forecasting under its “Strategic Foresight” initiative. At the urging of the National Academy of Sciences, Science Advisory Board, and National Advisory Council for Environmental Policy and Technology, U.S. EPA has brought together a team under its Office of Research and Development and Office of the Chief Financial Officer to anticipate future environmental problems and continually build in to its ongoing operations so that it can be ready for tomorrow’s challenges. To do this, it is developing a pilot project to identify emerging opportunities, challenges, and “actionable recommendations.”⁸⁰

Fortunately, these and other initiatives can lead to readiness and action forecasting. For example, just as NOAA’s National Weather Service is known for forecasting meteorological changes, NOAA is now working to provide ecosystem forecasting. This NOAA effort is dedicated to anticipating changes for coastal resilience, providing coastal intelligence for more informed decisions, and supporting place-based conservation with a special focus on harmful algal blooms, pathogenic pollution, hypoxia (underwater oxygen depletion), and habitat

⁷⁹ *Mutual Aid Agreement for Combating Aquatic Invasive Species Threats to the Great Lakes – St. Lawrence River Basin*, <http://www.cglslgp.org/media/1564/ais-mutual-aid-agreement-3-26-15.pdf>.

⁸⁰ U.S. ENVIRONMENTAL PROTECTION AGENCY, *Fiscal Year 2015 Agency Financial Report*, (Nov. 16, 2015), p. 14, https://www.epa.gov/sites/production/files/2015-11/documents/epa_fy_2015_afr.pdf.

changes.⁸¹ Likewise, the interagency Upper Midwest/Great Lakes Landscape Conservation Cooperative supports “Great Lakes Inform,”⁸² and The Nature Conservancy and Great Lakes Commission have established “Blue Accounting,”⁸³ both of which could lead to systems to help all members of the Great Lakes community better identify, prepare for, and take action to prevent ecosystem harm.

IV. CONCLUSION

The Great Lakes community has a long, proud history of addressing its ecological challenges. This history plays out in a common progression: first, the community identifies ecological problems that can undermine the region’s economy and ecology. It then scopes potential solutions for such problems, implements those solutions and monitors to determine whether they have worked. Where they have not worked, the community takes additional action. This process, however, can take years if not decades, and significant resources, to execute. In the meantime, unnecessary ecological and economic damage can result.

Lessons learned the hard way point to a more effective approach. “Collaboratives” for collective planning and implementation of key goals, including securing adequate funding, are critical. Tabulating and reporting results after collaborative implementation is just as important. These efforts must happen based on action forecasting, including readiness. The long progression from identifying to retroactively fixing yesterday’s painful and expensive injuries

⁸¹ NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, *NOAA Ecological Forecasting*, <http://oceanservice.noaa.gov/ecoforecasting/> (last visited Oct. 2, 2016); NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, *A Strategic Vision For NOAA’s Ecological Forecasting Roadmap*, <http://oceanservice.noaa.gov/ecoforecasting/noaa-ecoforecasting-roadmap.pdf>.

⁸² GREAT LAKES INFORM, *Upper Midwest/Great Lakes Landscape Conservation Cooperative*, <https://greatlakesinform.org/knowledge-network/504> (last visited Oct. 2, 2016).

⁸³ GREAT LAKES COMMISSION, *Great Lakes Blue Accounting*, <http://glc.org/projects/water-econ/blue-accounting/> (last visited Oct. 2, 2016).

must be turned on its head. As demands and strain on the Great Lakes grow, the vitality of the region's economy and ecology depends on it.