



Environmental Management of Baltimore Harbor

Learning from the past,
Planning for the future

Foreword

In today's climate, there is an increased need for sustainability professionals across diverse sectors. The Science for Environmental Management course focuses on using science to inform decision-making. Through a combination of hybrid lectures and interactive online exercises, students are exposed to various management ideas and tools. By analyzing case studies and engaging with professionals, students develop skills for integrating science into environmental management. The 2024 class of students applied these skills to create this booklet on Baltimore Harbor.

This graduate course is offered by the Marine and Estuarine Environmental Science (MEES) Program and the Master in Environmental Management (MEM) in Sustainability Program. The MEES Program at the University of Maryland Center for Environmental Science (UMCES) is an interdisciplinary program that trains students to become future scientific leaders. The MEM Program, jointly offered through Frostburg State University and UMCES, trains students in teamwork, practical experience, and environmental management and justice.



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Screenshot image of the Science for Environmental Management class

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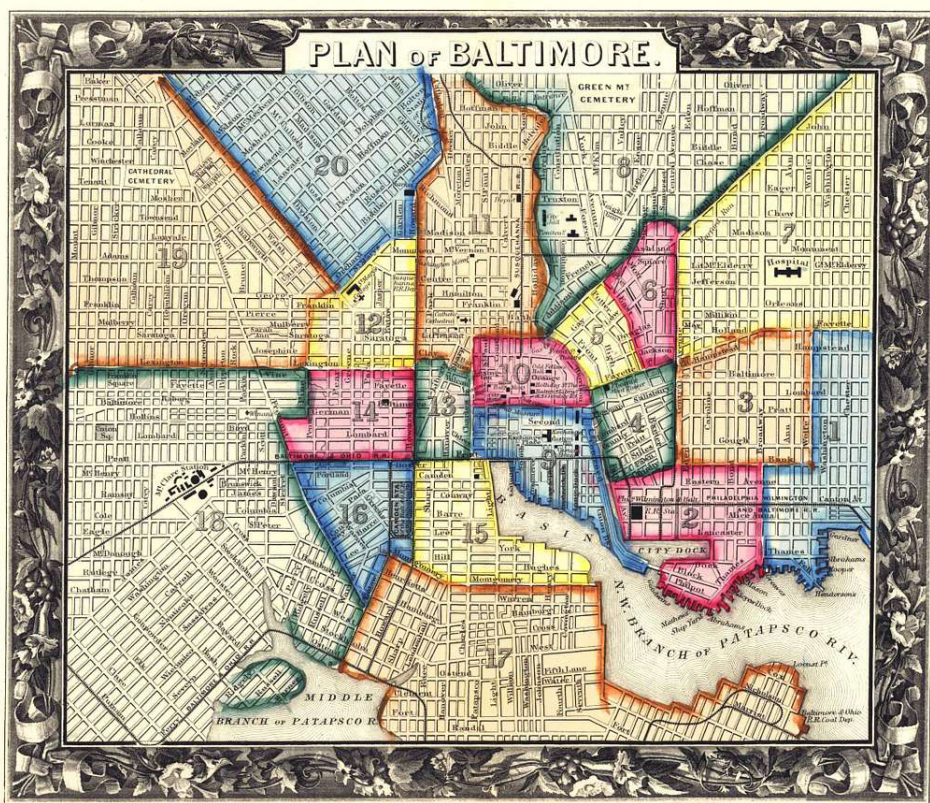
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Baltimore has a legacy of waterfront culture

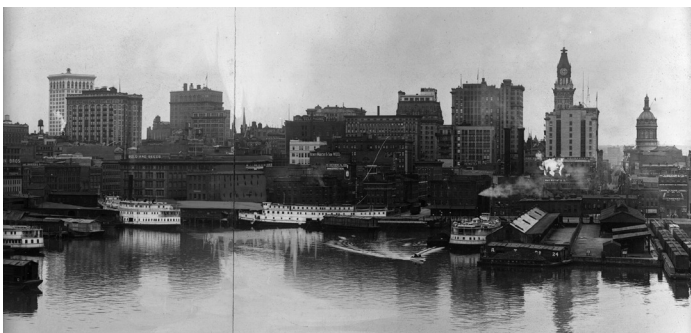
Beginning with the Indigenous peoples of the Piscataway, Cherokee, Lumbee, and Susquehannock tribes over 12,000 years ago, Baltimore Harbor continues to be an important resource (1,2). The harbor is home to hundreds of miles of waterfront and about 570,000 people (3). The Patapsco River, Gwynn Falls, and Jones Falls are three important tributaries of the harbor. The harbor's location and its prime fishing grounds positioned it to be an important hub of fishing and industry.

Environmental injustices like pollution, redlining, over development, and neglect continue to impact the harbor. Most fish from this water are under consumption advisories. Some residents cite decreases in wildlife and prevalence of pollution. Ongoing environmental efforts have led to noticeable improvements. More research, monitoring, and inclusive management are needed to continue improvements.



Historic map of Baltimore City and county from 1880. The colorful blocks represent different areas. The harbor is the colorless area that starts in the center and trails off to the bottom-right.

Credit: Wikimedia Commons



Left: The Inner Harbor of Baltimore around 1920 showcasing the dome of Baltimore's City Hall and Pratt Street Pier 3. Right: The same area in 2008 showcasing new tourist attractions like the National Aquarium.
Credit: Maryland Center for History and Culture (left) and kymagirl, Flickr (right)

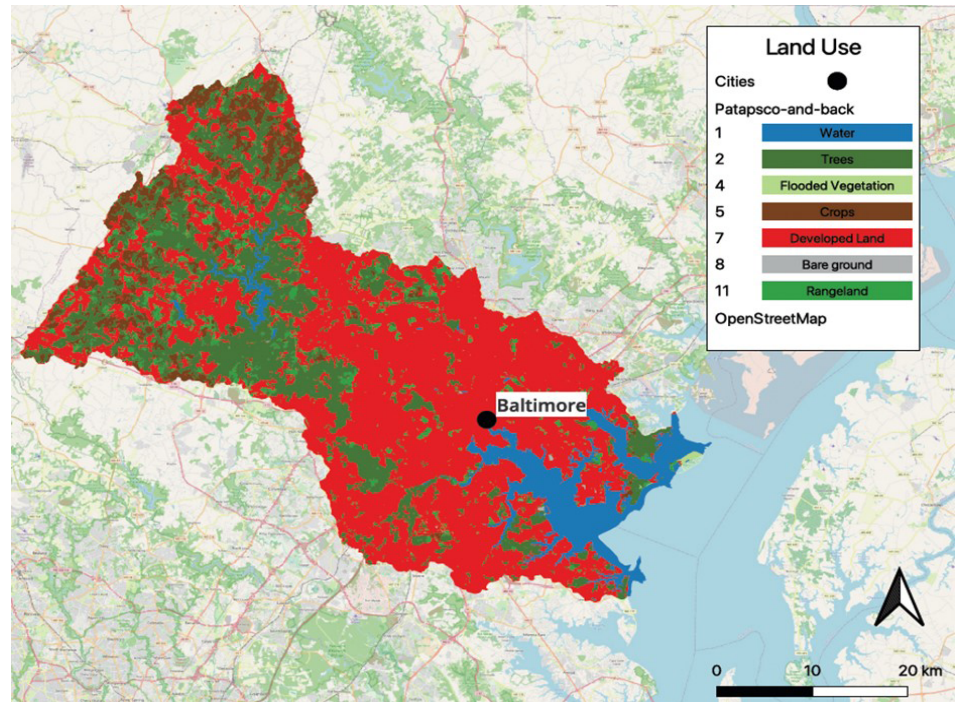
Baltimore's history has been shaped by its unique location

Baltimore's waterfront has always offered social, economic, and environmental benefits (4). The 2006 Baltimore Comprehensive Master Plan gives an overview of the city's history and changes.

From 1800 to 1950, Baltimore emerged as a hub for industry and commerce. This was due to new trade routes, Midwest railroads, and an influx of immigrants. The city became a center for maritime activity with warehouses lining the water. This signified Baltimore's shift into an industrial center focusing on textiles, machinery, and iron goods.

By the mid-1900s, Baltimore was a major manufacturing center for the United States. In 1904, a fire devastated the city. This led to Baltimore's reconstruction, including the development of modern buildings and improvement of infrastructure. Despite a decline in manufacturing and people moving to the suburbs, the city's reconstruction continued.

In the 1970s, the previously neglected Inner Harbor was revitalized. Projects like the National Aquarium and Harbor Place transformed it into a center for tourism, dining, and entertainment.



The diagram shows land usage in the Patapsco River Watershed. Baltimore and the surrounding areas are almost entirely red, or developed land.

Credit: Sidney Anderson; Data: ESRI Land Cover Explorer

The comprehensive plan also highlights significant changes in Baltimore. These include a decrease in the number of white residents and an increase in the number of black residents. Only half of the residents own their homes.

Many residents are worried about empty and uninhabitable properties. There are fewer jobs in manufacturing, and more people are working in service and office jobs. The city is also facing challenges related to rising housing costs and public safety.

Despite the challenges, there are signs of hope for Baltimore's future. The city has cultural attractions and the crime rate has been decreasing. This shows potential for growth and improvement. Despite changing demographics, reduced investment, and social injustice, there has been improvement in recent years. Community efforts are now focused on fair development, affordable housing, and green spaces.

Baltimore Harbor is an economic powerhouse for Maryland and the United States

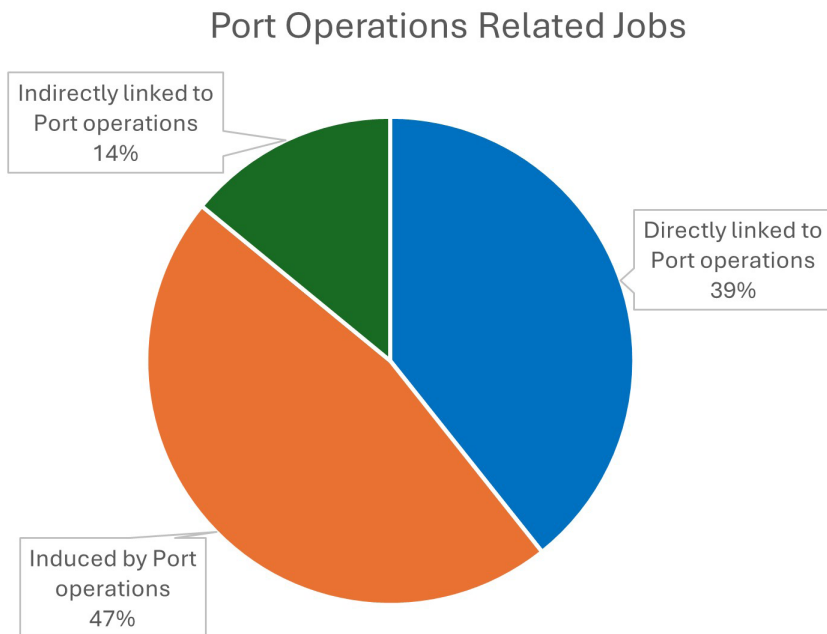
The Port of Baltimore is located on the Chesapeake Bay. It is a large economic driver for the city and region. It has a network of state and private marine terminals. These terminals handle different cargo like manufactured goods, automobiles, and raw materials.

This port is an important source of jobs and income for the city and country. Cargo and cruise activities at the port supported a total of 51,365 jobs in 2023 (5). Port activity also supports 346,137 state jobs.



A row of port cranes lining the Baltimore Harbor. These cranes load large shipping containers from ships to land.

Credit: xbrucexx, Flickr



This diagram shows the amount of jobs generated by the Port of Baltimore. Direct jobs are created within the port. Indirect jobs are created in the port supply chain. Induced jobs are created from spending to the port.

Credit: Veronica Malabanan Lucchese;
Data: Maryland Port Administration

These jobs span various industries, including manufacturing, coal mining, and automobile dealerships.

Cargo activity generated \$5.33 billion in personal income for Maryland residents and \$3.88 billion for maritime businesses. The Port of Baltimore is valued at \$70.3 billion dollars.

The collapse of the Key Bridge has eliminated a key trucking route and blocked the port, costing about \$15 million a day. This tragedy resulted in the loss of six lives. The bridge is planned to be rebuilt in 4 years. Currently, areas under the bridge have been cleared to resume shipping.

Baltimore Harbor Ecosystem has been intensely studied

Since 1998, the Baltimore Ecosystem Study (BES) enhanced the understanding of urban ecosystems. Main areas of focus for the study were structure, function, and people (6). The BES studied communities to apply and advance comprehensive urban theory.

Structure: How ecological, physical, and socio-economic elements are organized in urban areas.

Function: The flows of energy, materials, and populations within different parts of the city.

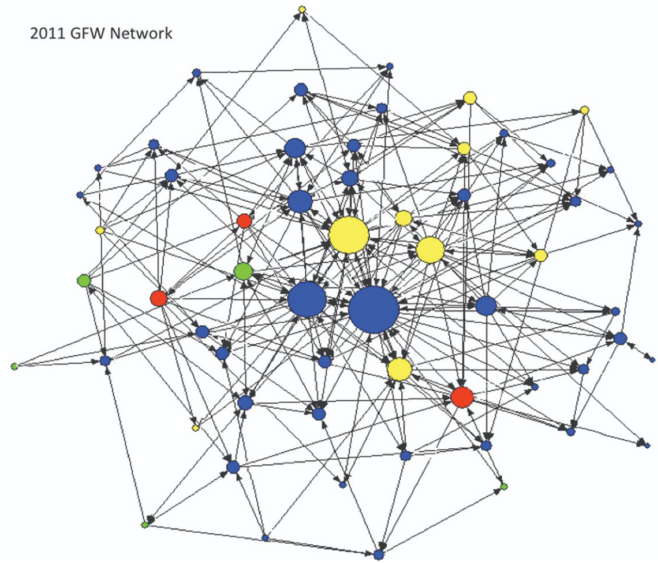
People: The decisions and actions of individuals and organizations that impact the urban ecosystem. These include how ecological processes influence human activities in cities.



A natural buffer is planted on the side of MedStar Hospital in South Baltimore. This is a successful example of a collaborative green infrastructure project.

Credit: Will Parson, Chesapeake Bay Program

2011 GFW Network



A map of the social connections between different stakeholders in Baltimore City. Stakeholders can be individuals or groups. Lines show relationships that link different entities. Arrowheads show the directions of relationships between groups. Not-for-profit organizations (blue) and city agencies (yellow) are the most connected and central. State (red) and federal (green) agencies are also represented.

Credit: Baltimore Ecosystem Study

The BES highlights the need for better frameworks and collaborations to advance our understanding of urban ecology. It also recognized the need for a new land classification system.

A survey of environmental stewardship organizations in Baltimore highlighted environmental justice issues. It shows the repercussions of historical patterns of social exclusion and race-based zoning.

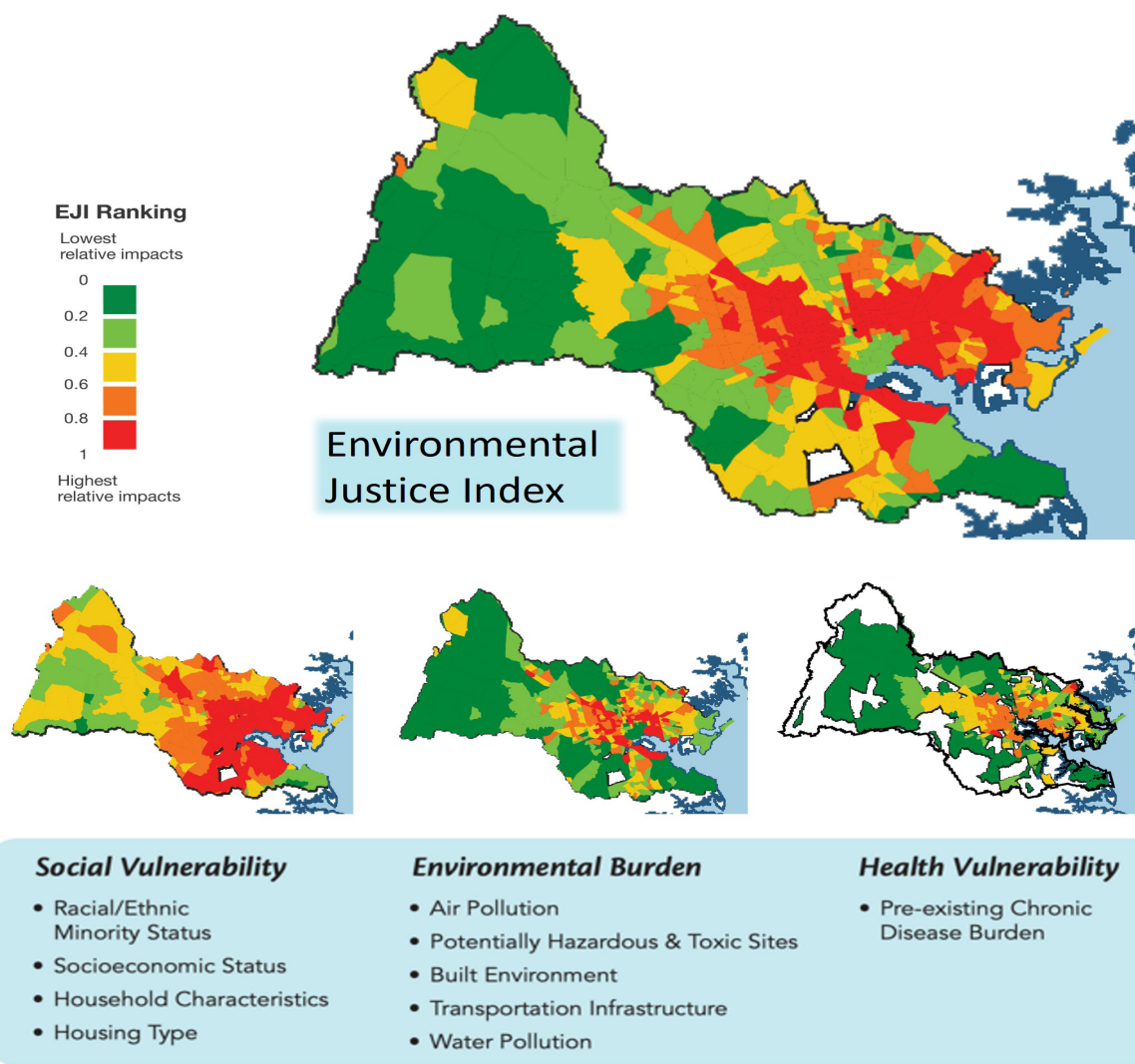
This study explored the interactions of fragmented urban communities, considering barriers and environmental stresses. This underscores the need for interdisciplinary approaches to understand the connections between people and the environment in urban ecosystems.

Environmental justice disparity exists in Baltimore

Creating a sustainable harbor requires inclusive management. This includes equitable sharing of resources and environmental burdens. Sustainable management also has inclusive decision-making processes.

The Centers for Disease Control and Prevention created the Environmental Justice Index (EJI) (7). This index is a tool to track environmental inequality. The EJI includes data for social vulnerability, health vulnerability, and environmental burden. This data highlights areas in need of intervention. Those closest to Baltimore City experience more negative impacts. Urban areas around Baltimore Harbor and, particularly, the Middle Branch face high environmental burden and health impacts. Suburban areas encounter less impacts.

Identifying and addressing these disparities is important for equity and sustainability in Baltimore and the broader Patapsco and Back Rivers watershed.



This map shows the environmental justice score for areas in Patapsco and Back Rivers Watershed. Red (poor score) versus green (good score) areas show significant disparities between communities. Areas located in or near the urban center have poor EJI ranking.

Credit: Lili Badri; Data: Centers for Disease Control and Prevention (CDC)

Baltimore has an industrial legacy and ongoing environmental challenges

Historically plagued by industrial and urban pollution, Baltimore Harbor faced significant environmental challenges. Sustainability-focused actions are transforming this industrial waterfront. One example are the four Mr. Trash Wheel pollution collectors (8). These floating cleaners lap up garbage and feature a fun cartoon face. Mr. Trash Wheel has helped combat plastic pollution in Baltimore Harbor since 2014.

Despite trash removal in the harbor, chemical contamination continues to be an issue. Legacy contaminants from Baltimore's industrial past further complicate the environmental landscape (9). Contamination sources may include industry, car exhaust, and storm-water runoff.

Non-point source pollution happens when runoff collects pollutants from the surrounding environment. This type of pollution is difficult to locate which makes it more complex to manage. Legislative changes have succeeded in reducing point source pollution from industrial sources.

Sectors like technology, health, education, and retail are growing in Baltimore. As the city transitions into a post-industrial hub, more targeted environmental management is needed.



Mr. Trash Wheel (introduced in 2014) in the Baltimore Harbor. The orange buoys help direct floating trash into his mouth. Professor Trash Wheel (2016), Captain Trash Wheel (2018), and Gwynnda the Good Wheel of the West (2021) are his 3 siblings also found in the harbor.

Credit: Global Public Affairs of the U.S. Department of State



The RESCO incinerator located in Baltimore City. This facility contributes to a large portion of air and water pollution. The Chesapeake Climate Action Network (CCAN) estimates it costs residents \$55 million annually in health issues.

Credit: Veronica Malaban Lucchese

Climate change impacts Baltimore's rising temperature and sea levels

Baltimore Harbor and Chesapeake Bay are experiencing the impacts of climate change (10). Rising sea levels and rising water temperatures affect the water, wildlife, and the people living near the harbor.

Rising water temperatures are primarily due to rising air temperatures. The result of warmer water is that the oxygen solubility is reduced, accentuating problems associated with low oxygen in water.

Warmer waters also affect key species like striped bass, oysters, eelgrass, and blue crabs. Species shifts are occurring as a result of rising temperatures, and this can affect fish abundance and distribution.

Rising sea levels are primarily due to the expansion of surface waters of the ocean from rising temperatures. The rates of sea level rise in Baltimore Harbor and Chesapeake Bay are higher than the global rates, which are accelerating each year.



High tide in Fells Point, Baltimore leads to street flooding. Climate change influences have made these flooding events more frequent and intense.

Credit: Andrew Roach, U.S. Army Corp of Engineers Baltimore District



A sign from the People's Climate March 2017 in Washington, D.C. in the shape of crab that says "Climate change means no more Baltimore."

Credit: Dcpeopleandeventsof2017, Wikimedia Commons

In addition to the flooding of built infrastructure around Baltimore Harbor, these rates of sea level rise also negatively effect coastal habitats like salt marshes.

Future planning and management of Baltimore Harbor needs to take these climate considerations into account.

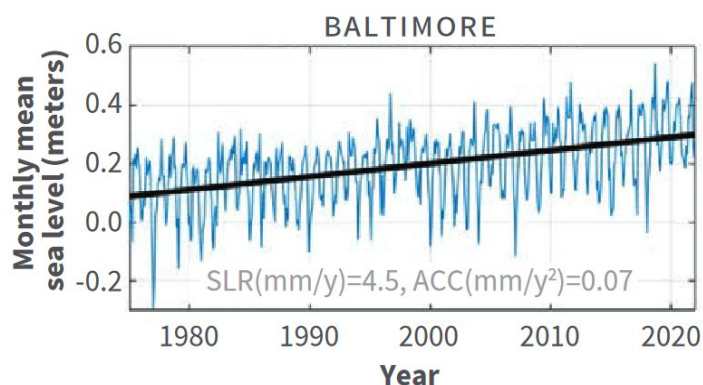


Diagram of rising sea levels in the harbor from 1980–2020 based on monthly means, or averages. Patterns show that water levels is steadily increasing.

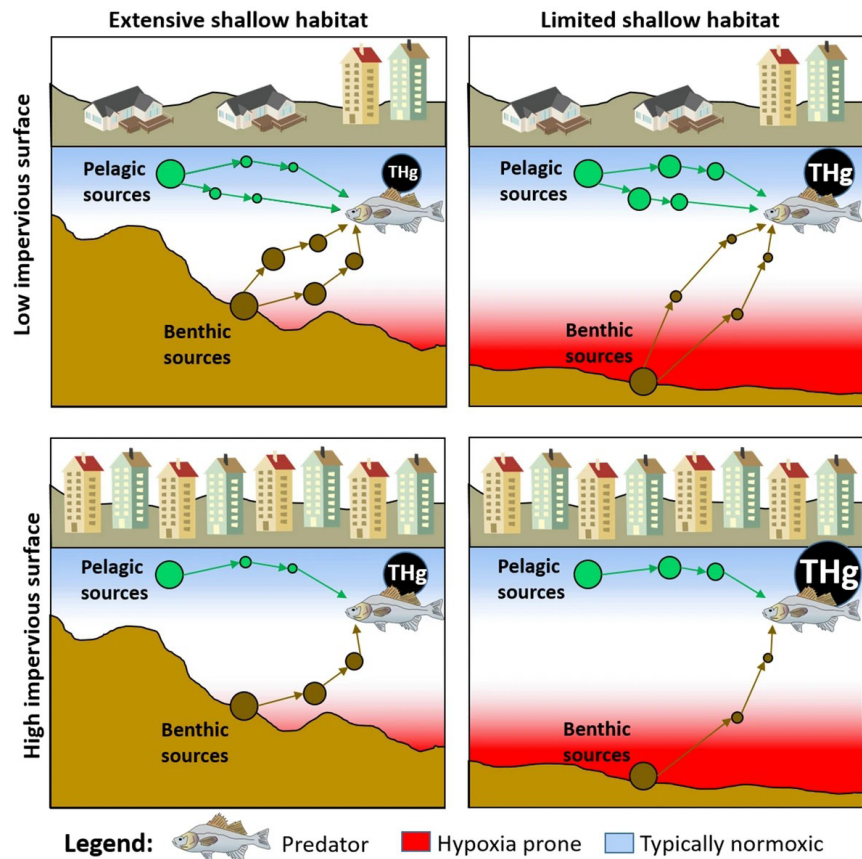
Credit: Sea-level Rise Projections for Maryland 2023

Harbor development creates food web disruption in the Patapsco River

The impacts of urban development on coastal estuary food webs were studied in the Patapsco River (11).

Researchers focused on white perch as they are common and feed on various animals. Chemicals from their organs were tested to identify exactly what the perch eat. Based on this, they created a food web of different estuary areas.

White perch in areas with more impervious surfaces were lighter and had emptier stomachs. Mercury levels were higher in perch from areas with more impervious surfaces and deeper waters.



This diagram illustrates how environmental changes, like land use changes and habitat availability, impact mercury (THg) accumulation in predators like white perch. Continued changes to the ecosystem from urban pressures can lead to increased heavy metal contamination in fish.

Credit: R. J. Woodland, L. Harris, E. Reilly, A. Fireman, E. Schott, and A. Heyes (11)



White perch caught in the Middle Branch Marina, Baltimore.

Credit: Dr. Eric Schott

Urban areas have many impervious, or paved, surfaces that do not naturally drain water. Areas with high amounts of impervious surface can lead to hypoxia, or very low oxygen levels in the water. Hypoxia limits where wildlife can live. This results in a decline in animals that live on the riverbed and in the water column.

Perch from the urban areas of the Patapsco had higher mercury levels compared to perch further out in the Chesapeake Bay. This study shows that limited shallow habitats and impervious surfaces contribute to food web degradation. Effects of urban development reduce the quality of wildlife.

Buried headwater streams negatively affect the downstream of Baltimore Harbor

Headwater ecosystems are made up of the smallest streams that contribute to a larger river (13). Headwaters are ecologically important areas, home to diverse species of aquatic life.

Urban development negatively alters headwater streams. Physical and chemical alterations have detrimental effects on downstream water bodies.

Stream burial occurs when headwater streams are paved over or redirected for development. There are no solid laws that protect these areas, highlighting the need for more research and regulations. Stream burial will likely increase as urban populations increase.



The beginning of a buried stream under Maryland State Road 322. These streams are redirected into pipes below the pavement.

Credit: Jane Hawkey

Baltimore City is highly developed and contains a large number of impervious surfaces. Impervious surfaces include pavement that does not allow the natural draining of water. Researchers at the University of Maryland Center for Environmental Science used remote sensing and computer models to measure the impact of Baltimore's buried streams (13). The study shows that stream burial is much more common in developed areas. Over 70% of headwater streams in Baltimore are buried. Larger water bodies are less likely to be buried, unlike smaller headwater streams.



Artist Bruce Willen created the Baltimore Ghost River Project, highlighting some of the city's buried streams. This image is from an installation located in the neighborhood of Remington titled "Ghost Rivers Flow Below These Streets". This project reminds pedestrians of the natural landscapes that were hidden to build Baltimore.

Credit: Veronica Malabanan Lucchese

Baltimore has high wastewater contamination compared to other world harbors

Most of the world's people live on the coast. With steady increases in population, local governments have to find ways to manage the increasing waste. Many wastewater treatment plants are not able to keep up with demands. When waste systems are overtaxed, they release nutrients and bacteria into waterways. New technology, research, and practices show unique ways to identify contaminants like feces and polyfluoroalkyl substances (PFAS) (14). Identifying contaminants can reveal how well treatment plants are cleaning our waters.

Past indicators used to detect wastewater contamination were too vague. Typically, the only measurement used by wastewater treatment plants is the amount of *E. coli*. Presence of this bacteria that is a sign of fecal contamination. Using more and different markers to identify contamination is needed to address water pollution.

McLellan et al. (2024) and the World Harbour Project looked at human fecal contamination from wastewater treatment plants. It studied Baltimore and 17 other large cities around the U.S. and the world. Baltimore showed the 5th highest level of human fecal contamination worldwide (14).



A "Temporary Health Warning" sign posted at Jones Falls, Baltimore due to a sewage outbreak in the water.

Credit: charmcity123, Flickr



Back River Waste Water Treatment Plant is located in Baltimore. They are also known as the "golden eggs".

Credit: Mark Jonas, Flickr

Sewage contamination and agricultural runoff are the leading sources of pathogens and nutrients. The study used two markers besides *E. coli*. These two markers showed higher concentrations than standard *E. coli* measurements.

Back River is one of the tidal rivers that drains into Baltimore Harbor. Back River Wastewater Treatment Plant received \$264 million dollars to improve its removal of excess nutrients like nitrogen and phosphorus. These nutrients cause harmful algal blooms that grow uncontrollably, reduce oxygen levels, and cause wildlife die-offs. Beyond public health issues, *E. coli* can be a host for these excess nutrients. Despite investments, *E. coli* continues to be discharged from the treatment plants.

PFAS are another water pollutant. They are man-made substances that slowly degrades and are dangers to health. PFAS remain in the soil, water column, and wildlife forever. These substances can be transferred across the food web from other animals to humans. Many fish and blue crabs have shown concentrations of PFAS in their bodies.

Improvements in the ecosystem health of Baltimore Harbor could lead to a Renaissance

In 2009, the Waterfront Partnership of Baltimore started the Healthy Harbor Initiative (8). This initiative aimed to make Baltimore's Harbor swimmable and fishable by 2020. Starting in 2010, the Healthy Harbor Initiative creates a yearly report card. It shows progress and challenges of improving the health of Baltimore Harbor. An A (Very Good) through F (Very Poor) grading scale is used to measure different aspects of the ecosystem. Ecological and social indicators are used to measure the health of Baltimore Harbor.

In 2010, the harbor water quality was in poor health (12). This was due to high bacteria levels, nutrients, and sediment runoff from urban areas. Excess algae, in the form of algal blooms, takes over waterways and reduces oxygen levels. The reduction of oxygen levels can lead to mass die-offs of different aquatic animals and plants. High levels of bacteria were also found in the stream, making it unsafe to swim.



Overflowing trash at Middle Branch Trailhead 9 fishing piers. Trash was also identified as a persistent pollution problem both in the inner harbor and on land.

Credit: Veronica Malabanan Lucchese



Blue Water Baltimore staff perform monthly water quality monitoring at the intersection of Gwynn Falls and Maidens Choice Run, Baltimore.

Credit: Will Parson, Chesapeake Bay Program



Environmental educators from the Living Classrooms Foundation at Masonville Cove teach elementary school students about water quality methods. Here, a fourth grade student analyzes the dissolved oxygen from a water sample.

Credit: Will Parson, Chesapeake Bay Program

Sewage, storm-water, and trash upgrades have led to improved Baltimore Harbor water quality

A healthy harbor faces many obstacles like trash, sewage, and runoff. New technologies and updates to Baltimore’s aging sewer systems help address these obstacles (15). Since 2018, sewer overflows were reduced by 97% . Over 450 tons of trash are removed from the Baltimore’s waters each year with the help of Mr. Trash Wheel and Friends. Healthy Harbor has also reintroduced Harbor wildlife habitat. This is a result of improved water quality, increased salinity levels, and decreased turbidity.

Despite the improvements, there is still more needed to improve the Harbor’s health. Sewer treatment, eliminating single-use plastics, and reducing sediment and nutrient loads are some of the necessary changes.



Maryland Comptroller Brooke Lierman and other registrants jump into Baltimore’s Inner Harbor during the 2024 Harbor Splash Event hosted by the Waterfront Partnership of Baltimore.

Credit: Corey Jennings, Maryland Comptroller Flickr

Grading Criteria	2010	2024
Overall Ecosystem Grade	D	C
Oxygen	D	B
Chlorophyll a	C-	D
Water Clarity	C-	C
Nitrogen	F	C
Phosphorous	D-	C

This table shows the Overall Ecosystem Grades of Baltimore Harbor from the first (2010) and most recent (2024) environmental report card. Over the course of 14 years, the harbor has improved in almost all categories (except for Chlorophyll a).

Credit: Veronica Malabanan Lucchese; Data: Waterfront Partnership of Baltimore and IAN-UMCES

Channeling of streams into storm drains under Baltimore City also creates ecological issues like habitat loss and water contamination. Effective plans are needed to improve the ecological health and sustainability of Baltimore Harbor.

While past efforts have helped, more is needed to improve harbor sustainability. Coordination with all stakeholder groups is necessary to address ongoing environmental injustices.

The Healthy Harbor Initiative highlights collaborations between stakeholders and its contribution to the program’s success. The first Harbor Splash event was held on June 23, 2024 in Baltimore Harbor. This event celebrated the progress the Healthy Harbor Initiative has helped foster.

Baltimore City is undergoing a transformation

Baltimore is undergoing a transformation, with recent environmental report cards showing improvements in the local environment (16).

The Chesapeake Bay and Watershed Report Card plays a key role in this by assessing the health of the bay's ecosystem. It evaluates factors like water quality, habitat health, fish populations, pollution levels, and climate resilience, giving each a score that combines into an overall grade. This makes complex environmental data easy to understand, helping policymakers, scientists, and the public track progress and identify areas needing improvement.

The 2023/24 Chesapeake Bay and Watershed Report Card shows that the Patapsco and Back watershed has an overall improving ecosystem health trend, despite having a poor overall grade (16).



Floating wetlands installation at the National Aquarium in Baltimore Harbor as of summer 2024. These planted areas improve habitat, water quality, and the general environment. Otters have been documented using this new greenspace.

Credit: Veronica Malabanan Lucchese

Patapsco and Back



The Patapsco and Back River Watershed have poor water quality. This D- grade is based on the health of wildlife and nutrients in the water.

Credit: 2023/24 Chesapeake Bay and Watershed Report Card, IAN-UMCES

One significant initiative contributing to Baltimore's transformation is the Reimagine Middle Branch Plan, one of the first urban renewal efforts in the country, led by a diverse group of community partners. This project aims to revitalize the area and promote sustainability, showcasing both successes and challenges while encouraging ongoing efforts to protect and restore the bay.

The Baltimore Ecosystem Studies, Floating Wetlands, and the Reel Rewards Program are part of these efforts. There is a lot happening in the city. With the rebuilding of the Key Bridge, there is an increased interest in Baltimore. Both the society and ecosystems of Baltimore are evolving landscapes.

Baltimore continues to have a diverse angler community

Many fishing piers dot Baltimore's landscape, including Middle Branch Park. This highlights the present community value of local fishing. The area offers diverse catches including striped bass (rockfish), white perch, channel catfish, largemouth bass, and blue crabs (17). Baltimore's rich maritime heritage and wildlife is reflected in its communities today.

Invasive fish species threaten the Baltimore Harbor ecosystem and economy. Invasive northern snakehead, blue catfish, and flathead catfish eat and compete for resources with native wildlife (18,19). These native species are important to anglers, businesses, and the environment.

Studying and removing these invasive fish is important to addressing their impact on the harbor and Chesapeake Bay. Public awareness of these invasives and how to stop the spread of these fish is also important.

To address this, the Environmental Justice Journalism Initiative (EJJI) and partners hosts the Reel Rewards Invasive Fish



EJJI and IAN-UMCES staff host a Reel Rewards community outreach event in Middle Branch Park, Baltimore on July 20, 2024.

Credit: Donzell Brown



EJJI staff, Christien Martin, holds the head of a large, invasive blue catfish. This is one of hundreds of fish turned in for the 2024 Reel Rewards Invasive Fish Bounty Program.

Credit: Veronica Malabanan Lucchese

Bounty Program (20). Beginning in 2024, this program pays anglers to remove these three invasives from the Middle Branch Harbor of the Patapsco River. This community-based program compensates residents for their efforts in Middle Branch restoration.

Participants can also receive a monetary reward for participating in the Angler Survey. The survey aims to better understand community behaviors and awareness of the local environment. Reel Rewards provides resources to the community and important data to researchers.

Data from the Reel Rewards Program gives insight to community and ecosystem needs. 300 invasive fish have been logged with Reel Rewards during its first 2 months. Snakehead fish make up 86% of turned in catch with the rest being blue catfish (12%) and flathead catfish (2%). About \$9,000 was paid to community members removing these invasives from the Middle Branch. This program is an example of a successful restoration initiative with both human and environmental benefit.

Looking to the future: Re-imagining of Middle Branch Harbor of Baltimore



Artist rendition of future waterfront improvements in the Middle Branch.

Credit: Reimagine Middle Branch

The Middle Branch Harbor is a historic water body located in South Baltimore. It is the main basin of the Patapsco River and is one of the most neglected shorelines in the Chesapeake Bay. South Baltimore communities are cut off from the Middle Branch shorelines by development and industry. Environmental injustice, post-pandemic challenges, and systematic racism unequally impact local communities of color.

The Reimagine Middle Branch Plan aims to address environmental, societal, and economic issues in South Baltimore (21). It is a multi-decade restoration and development project. This plan has several methods and initiatives to combat environmental injustice.

Transformation of the Middle Branch is comprised of four equity-driven parts:

1. Restore and protect shorelines:



- Support and expand environmental education and citizen science
- Install living shorelines and green infrastructure

3. Activate inclusive parks:



- Coordinate capital projects and programming
- Connect parks and open spaces
- Expand water activities

2. Transform barriers into connections:



- Improve shipping routes
- Connect neighborhoods and parks to water, transit, and services

4. Equitable development:



- Establish an African American Heritage District
- Assemble capital for equitable housing development
- Expand investment in youth and workforce development

Shaping the future of Baltimore Harbor environmental management

While improving, Baltimore is in need of more resources to ensure a sustainable future. Based on the previous information, students have made the following recommendations. These recommendations focus on four key areas that need improvement; Environmental Justice, Pollution and Debris, Water Quality, and Food Security.



Environmental Justice

- Restore impacted habitats and communities.
- Long term studies of habitats and projects.
- Monitor projects' impact like using socio-environmental report cards.
- Include marginalized communities in stakeholders engagement and decision-making like citizen science projects.



Pollution and Trash

- Policies and projects that help eliminate single-use plastics.
- Collaborate on monitoring projects to evaluate and track pollution.
- Enforce strict regulations to prohibit illegal waste disposal in Baltimore's Harbor.
- Prioritize funding for remediation works in heavily contaminated areas of the harbor.



Water Quality

- Reduce sediment and nutrient loads to improve water health.
- Prioritize small streams and headwater health to improve harbor sustainability.
- Study and monitor new contaminants to better inform management.
- Upgrade Baltimore's infrastructure and sewers equip to deal with waste from the growing population.
- Create green infrastructure to mitigate the impacts of urbanization.



Food Security

- Develop a collaborative approach to structural changes to improving food access, income security, and community resilience. This must go beyond emergency aid.
- Dismantle discriminatory policies and enforce equitable practices by government and businesses.
- Protect and restore wildlife that provides food and income to the Baltimore community.

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Icon Credits by Heading (p. 19-20):

Will Parson, Chesapeake Bay Program - "Restore and protect shorelines"; "Activate inclusive parks"; "Equitable development"; and "Pollution and Trash"

Veronica Malabanan Lucchese - "Transform barrier into connections"; "Environmental Justice"; and "Water Quality"

Lance Cheung, United States Department of Agriculture (USDA) - "Food Security"

