The Chicago River:
Biodiversity, Urban Ecology, and
the Sustainability of Water Resources

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Key Issues

- History and geography of the Chicago River
- Urban rivers as greenways and repositories of biodiversity
- Ecological connections: Lake Michigan, the Chicago River, groundwater
- Water supply and wastewater management
- Impacts of pollution and channelization
- Water as a cultural and economic resource
A Journey in Three Parts

Into the past
History and geography of the Chicago River

Into the canoe
Paddling the infamous Bubbly Creek

Into the future
Asian Carp and the 21st century challenge of sustainability
The Chicago River was reversed by the opening of the Sanitary and Ship Canal in 1900. The canal, built by the Sanitary District of Chicago (today called the Metropolitan Water Reclamation District), cut through a natural drainage divide separating the Chicago River and Des Plaines River basins, shown by a dotted line on the map. It was seen as an engineering marvel, and the technology was used to later dig the Panama Canal. The North Shore Channel was completed in 1909, flushing additional wastewater from the north suburbs away from Lake Michigan. The Cal-Sag Channel was completed in 1922, reversing the Calumet River. Present day city limits are shown by the shaded area.
The Chicago River is 28 miles long within City limits.

The three primary branches of the river are known as the Main Branch, the North Branch, and the South Branch. The South Fork of the South Branch is commonly known as Bubbly Creek.

Several man-made canals and slips are also part of the river system. The largest of these are the Sanitary and Ship Canal, the North Shore Channel, and the North Branch Canal.
North Branch of Chicago River
Bubbly Creek,
South Branch of Chicago River
Bubbly Creek, South Branch of Chicago River
Impacts on Rivers and Streams

- Dams
- Channelization
- Current control
- Development
- Pollution
- Wastewater
- Invasive species
Impacts on Bubbly Creek

- Dams
- Channelization
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Historic photo of Bubbly Creek under the 35th bridge: A worker inspects stockyard waste entering the creek.
Problems Facing the Chicago River

- Loss of biodiversity / habitat
- Toxins in water and sediment
  - biomagnification
- Excess nutrients
  - eutrophication
- Excess fecal coliform bacteria
- Excess erosion
- Presence of dams
- Lack of public access / awareness / action

(Source: Friends of the Chicago River)
Studying Bubbly Creek’s Water Chemistry

- Oxygen
- pH
- Temperature
- Phosphates
- Nitrates
- Turbidity
- Fecal Coliform
Biodiversity

- Phytoplankton (algae, diatoms)
- Macrophytes (floating and benthic)
- Riparian plants
- Zooplankton
- Macroinvertebrates (worms, insects, crayfish, clams, mussels, snails, leeches)
- Vertebrates (fish, amphibians, birds, mammals)

A common Illinois freshwater mussel – *Cyclonaias tuberculata*, purple wartyback
North Branch Restoration Project

• N branch of Chicago River from Foster Ave up through N suburbs
• Diverse ecosystems along river: woodland, savanna, prairie, wetland
• Inception in late 1970s
• Model for citizen science and volunteer labor
• Multiple restoration strategies
North Branch Restoration Project

- Re-establishment of ecosystem structure (e.g. open woodlands)
- Invasive species control
- Native species planting
- Fire as management tool
- Herbicide applications
- Monitoring progress (Floristic Quality Index studies)
- Recreation and education
Into the Future – Asian Carp and the 21st Century Challenge of Sustainability

• Species
  – Silver Carp
  – Bighead Carp
• History in US
• Biology
• Environmental Impacts

Photo: Great Lakes Fisheries Commission
Bow-hunter on Illinois River being hit by silver carp

Photo: Daily Mail
Current Distribution of Asian Carp in US

Map: NPR
A river reversed, a problem created

The Chicago and Calumet rivers were once tiny waterways that trickled into Lake Michigan. Beginning in 1900 the city dug a series of canals that reversed their flows so they could carry the city’s waste into the Mississippi River basin, and away from the lake—the city’s drinking water source. A push is now under way to engineer a system to re-establish the natural hydrological divide between Lake Michigan and the Mississippi.

Sources: Great Lakes Fishery Commission
Other Great Lakes Invasive Species

Sea Lamprey
*Petromyzon marinus*

**Origin**: Atlantic ocean  
**Introduced**: 1835 (Lake Ontario)  
**Impacts**: Parasite on fish; devastation of whitefish, lake trout, chub in ‘40s and ‘50s; in all the Great Lakes, esp. Huron  
**Costs**: $13 million / year for control

Zebra Mussel
*Dreissena polymorpha*

**Origin**: Caspian Sea  
**Introduced**: 1988  
**Impacts**: Displacement of native clams and mussels; clogging of water intake pipes; has spread to all GLs, Mississippi River, and inland lakes  
**Costs**: Several hundred million $ / year
How the Debate Is Usually Framed

State vs. State

Environment vs. Industry

Industry vs. Industry

Sustainability
  • Environment
  • Economy
  • Equity
Other Asian Carp Narratives
RE: Science and Sustainability

Fear and loathing
Environmental Apocalypse
National emergency
Denial
Self-interest

Conflict
Cooperation
Technology

Scientific uncertainty
Opportunity

Photo: Absolute Michigan
Science and Uncertainty

• Validity of eDNA detection techniques
• Experimental nature of electric barrier
• Potential efficacy of lock closure
• Timing of carp entry into Lake Michigan
• Impact upon Great Lakes ecosystem
Electric fish barrier tested for safety

Although a $9 million electric barrier to protect the Great Lakes from giant Asian carp was constructed in early 2006, the Coast Guard and Army Corps of Engineers are still conducting safety tests for barge operators and haven’t put it into permanent operation. The carp, which could transform the Great Lakes’ fishery and make the lakes far less appealing to boaters, are only a two-day swim from Lake Michigan.

How electric barriers could turn back Asian carp

1. Migrating Asian carp are repelled by an electrical current shot through an array of steel bands lining the canal bottom.
2. The intensity of the electrical field increases as the fish swim toward the center of each array.
3. Two arrays are needed to provide redundancy and to allow for maintenance. The original barrier is also being rebuilt.

Historically, the Chicago River flowed into Lake Michigan. Chicagoans reversed the flow of the river over a century ago to flush their sewage into the Mississippi River basin. The project meant creating an artificial connection between the Mississippi and the Great Lakes, and that has opened the door to biological chaos.
Opportunity

• Rare chance to prevent invasive species takeover before it happens
• Asian Carp as profitable commodity for export or local consumption
• Reconsideration of Chicago’s hydrology:
  – Wastewater treatment upgrades
  – Hydrological separation of Lake Mich. and Miss. River watersheds
  – Long-term water supply sustainability
Chicago River sewage runoff

Federal officials want to use the Clean Water Act to force water quality improvements in the Chicago River, which can be saturated with millions of gallons of sewage runoff during storms.

KEY: ● Runoff locations ■ Treatment plants ➟ Direction of river flow

Potential steps for improvement

DISINFECTION
To reduce bacteria, treated wastewater from Chicago’s three major plants could be disinfected prior to its release.

OXYGEN
The city could inject more oxygen into the waterways to help break down bacteria and help fish survive.

The future: Are barriers the answer to undo damage?

A potential scenario would re-establish the hydrological divide between Lake Michigan and the Mississippi River basin that the Chicago canals destroyed more than 100 years ago.

The red blocks represent general areas where the canals might be plugged. Water to the west of the blocks would flow toward the Mississippi; water to the east would flow to Lake Michigan. This would have big implications for commercial navigation, as well as sewage and floodwater management issues that will be addressed in a forthcoming federal study.

Sources: Great Lakes Fishery Commission, Journal Sentinel research

NOTE: Some dots represent more than one runoff location
SOURCES: U.S. EPA Water Division, Tribune reporting
Proposed rules may require river cleanup

The Illinois Pollution Control Board has proposed designating stretches of the Chicago-area waterway system as suitable for some forms of recreation. Current bacteria levels are high enough that hundreds of signs along the channels warn against “any human body contact.”

Bacteria in the water

**WASTEWATER COMPARISON**

<table>
<thead>
<tr>
<th>Location</th>
<th>CFU per 100 milliliters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little Calumet River, Calumet-Sag Channel</td>
<td>8,231</td>
</tr>
<tr>
<td>North Shore, North Branch of Chicago River</td>
<td>19,338</td>
</tr>
<tr>
<td>Fox River (Elgin)</td>
<td>23</td>
</tr>
<tr>
<td>Mississippi River (Minneapolis/St. Paul)</td>
<td>59</td>
</tr>
<tr>
<td>Delaware River (Philadelphia)</td>
<td>48</td>
</tr>
</tbody>
</table>

**NORTH SHORE CHANNEL AND NORTH BRANCH OF CHICAGO RIVER**

Samples taken directly from river

**Proposed designations**

No bacteria standards have been set for these designations.

**KEY**

- **Limited contact recreation:** Contact with the water is incidental or accidental and the probability of ingesting water is minimal. Includes fishing, commercial and recreational boating, and other shoreline activities.
- **Recreational navigation:** Boating only

**Flow of water**

- Upper North Shore Channel
- Lower North Shore Channel
- Chicago River North Branch
- Chicago River South Branch
- South Fork
- Chicago Sanitary and Ship Canal and Lower Des Plaines River
- Calumet River
- Lake Calumet
- Grand Calumet River
- Little Calumet River (East)
- Little Calumet River (West)
- Calumet-Sag Channel

**Sources:** U.S. Environmental Protection Agency, Illinois Pollution Control Board
Toward a Sustainable Future?

Proposed ecological separation of Great Lakes and Mississippi River watersheds

- Blockage of carp from Lake Michigan
- Return of water to Great Lakes basin
- Improved water quality of Chicago’s wastewater treatment
- Investment in transportation infrastructure