How has the Hudson River watershed changed since the arrival of Europeans?

Manhattan Island in 1609 and 2009; Mannahatta Project
Predict what you think happened to each of these land use types between 1936 and 2000

<table>
<thead>
<tr>
<th>Topic</th>
<th>Loss</th>
<th>Gain</th>
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<tbody>
<tr>
<td>Population</td>
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<td>Forests</td>
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<td>Agriculture</td>
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<td>Dams</td>
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<td>Wetlands/river shoreline</td>
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<td>Housing</td>
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<td>Roads</td>
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2004: Poughkeepsie Galleria on right hand side, gravel quarry next to river
1936: Rt 9, site of current Galleria mall, small quarry visible next to river
2004: Rt 44 leaving Poughkeepsie; Stop and Shop plaza is on the left hand side, Adams Fairacre Farms is in the middle of the photo
Changing Hudson Project
Institute of Ecosystem Studies
1936: Rt 44 leaving Poughkeepsie
You live in: The Hudson River Watershed

- The river drains New York, and parts of Connecticut, Vermont, Massachusetts, and New Jersey.
- Over 3,600 stream miles
- 65 tributaries
What is a watershed?

• An area of land where all the water drains to a specific place (a stream, river, bay, estuary, etc)
• No matter where you are, you’re in a watershed

http://www.meted.ucar.edu/broadcastmet/watershed/
• Within the Hudson River Watershed, there are numerous smaller watersheds
• What watershed do you live in?
• What watershed does your water come from?
Swaney et al. 2006
Population density over time


Persons per km²

Source: Swaney et al. 2006
History of the Hudson Valley

- There is evidence of human use of the Hudson Valley area as long as 8000 years ago
- Why is the river called the ‘Hudson’?
- When did Europeans first explore the ‘Hudson’?
- What did the Native Americans call the river?
- What is special about the lower part of the Hudson (below the Troy dam)?
How we’ve changed Henry’s river

- We changed the river’s shape and size
- We changed the species that live in the river
- We changed the river’s watershed
- We polluted the water
Changes made to the Hudson River

• Navigational “improvements”:
  A channel was dredged for boats; depth increased from 12 feet to 27 feet in 1925 and 32 feet in 1954

• Huge loss of wetland habitat: 4300 acres (almost 7 square miles) of shallows in the upper Hudson were destroyed

• About 50% of the shoreline has been changed—bulkheads, railroads, etc

• Almost every major tributary to the river has at least one dam (800 recorded dams)
We changed the river’s shape and size.

Miller, Ladd, Nieder
Shallow water ecosystems have been lost.
Large areas of shallow-water habitats were lost.
Normal Water Flow Has Been Obstructed by Dams
Dams

Source: Swaney et al. 2006
Land Use Change

• 1609: most of the watershed was forested (small amounts of native American agriculture)
• By 1880: 63% had been converted to agriculture
• As soils were depleted through deforestation and overuse, erosion increased
• Dutchess County: more than 90% was in farmland in 1880, less than 30% in the 1990s
• Forest cover has increased: Adirondacks-from 30-40% in 1875 to 90% in the 1990s
• However: forests do not fully recover species diversity for hundreds of years
Source: Swaney et.al 2006

Forest cover

1875
1920
1955
1968
1990s

percent
Recovery takes time…

-species richness and diversity have not always improved in recovering forests

-forest wildflowers and herbs have not returned as quickly as expected
Why did they cut down all those trees?
- ship masts & wood for Europe
- tanning
- paper process

INDUSTRY COLLAPSE:
late 1800s
Development pressures are changing the landscape along the river: from large single-family homes…

Source: www.scenichudson.org
...to condominium development projects in wetland areas...

Source: www.scenichudson.org
...to housing development projects.

Source: www.scenichudson.org
Figure 4 (a).
Figure 4 (b).

Source: K. Limburg
Pollution Changes

- In the early to mid 1900s: rapid development, lots of raw sewage
- Clean Water Act (1977)
- What happens if you release raw sewage into a river?
- Today: problems with combined sewer overflows: in New York City, about 70 times a year (27 billion gallons)- plans are in the works to close 36 pipes by 2010
- Syracuse recently closed 24 of its overflow pipes, reducing sewage outflows by 33%
- There are over 700 CSO source points in the NY/NJ harbor
- PCBs continue to be a big problem
What does the future hold...?

Photo by C. Bowser, HRNRR & DEC
NYC: Today's 100-Year Flood Could Occur Every 10 Years under the Higher-Emissions Scenario

The light blue area in these maps depicts today’s FEMA 100-year flood zone for New York City (i.e., the area of the city that is expected to be flooded once every 100 years). With additional sea-level rise by 2100 under the higher-emissions scenario, this approximate area is projected to have a 10 percent chance of flooding in any given year; under the lower-emissions scenario, a 5 percent chance. As the close-up shows, critical transportation infrastructure located in the Battery could be flooded far more frequently unless protected. The 100-year flood at the end of the century (not mapped here) is projected to inundate a far larger area of New York City, especially under the higher-emissions scenario.
Many Hudson Valley wetlands may be lost due to rising waters

Tivoli Bay marsh, NY at high tide in 2009 (left) and 2080 (right). The marsh cannot “move” because it is constrained by the landscape.
Summary

• We have significantly changed the Hudson River and its watershed
• We can control how much we change the watershed in the future