The Hudson River: NYC's Wettest Earth Science Teaching Tool

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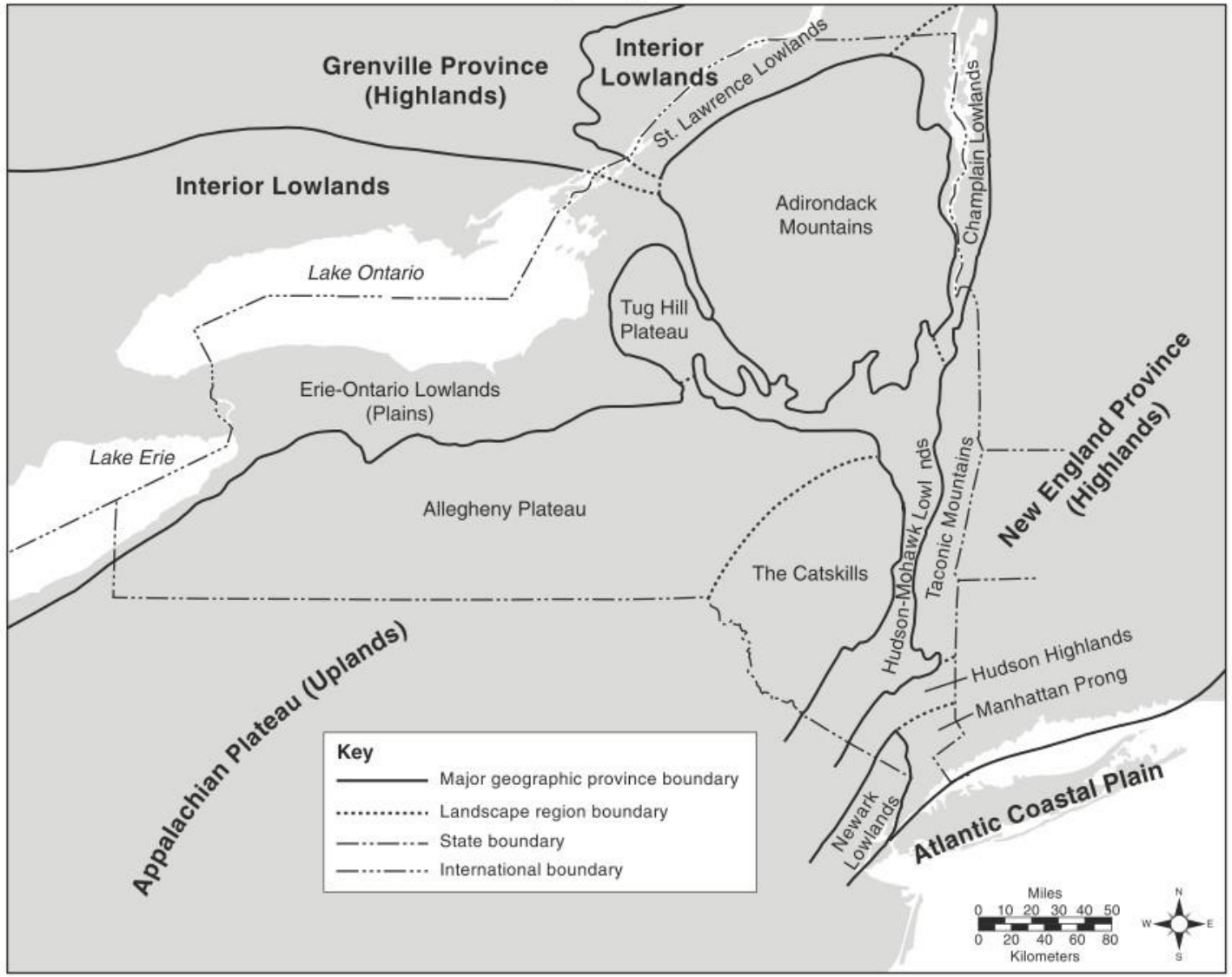
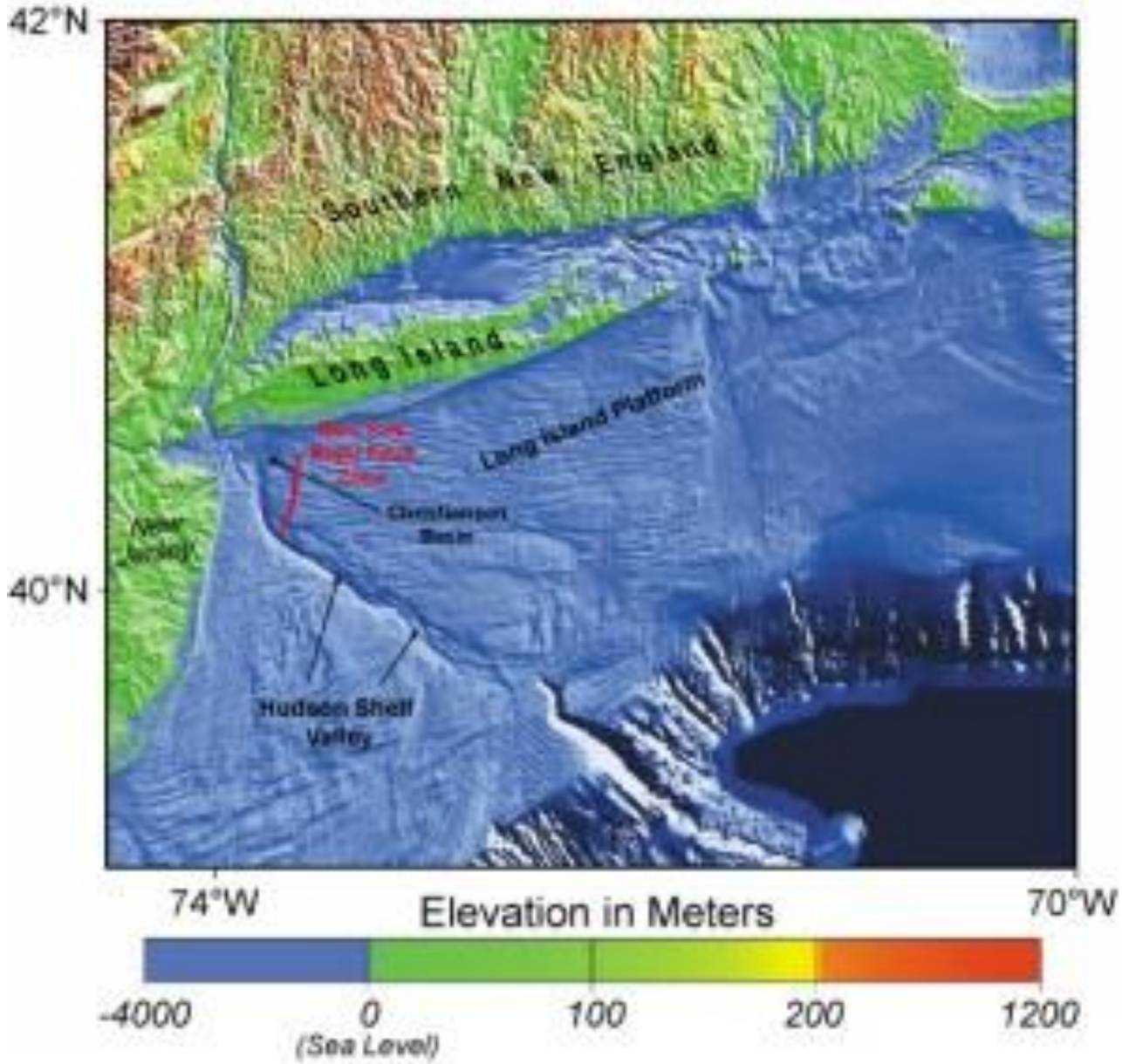
Part 1: Physical Geography of the Hudson River

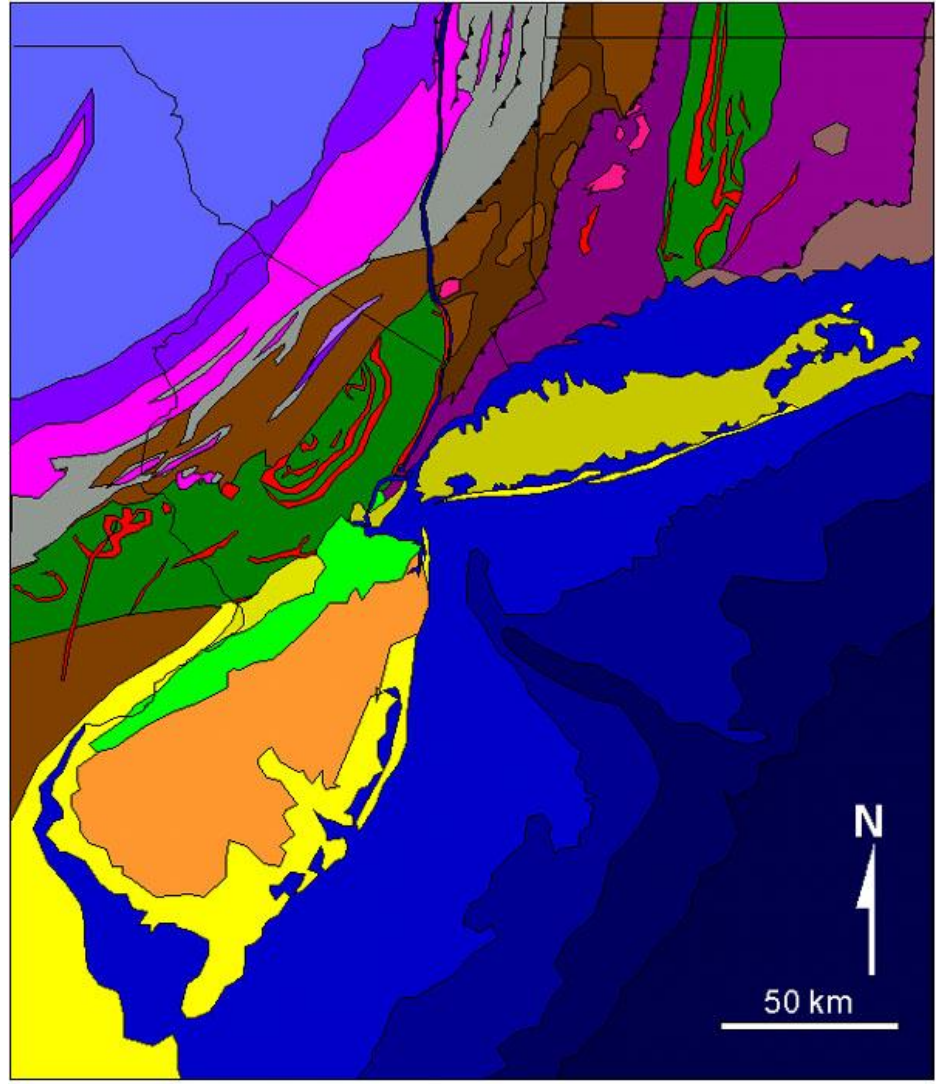
http://newyorkscienceteacher.com/sci/pages/reftables/esrt-mobile.html

Generalized Landscape Regions of New York State

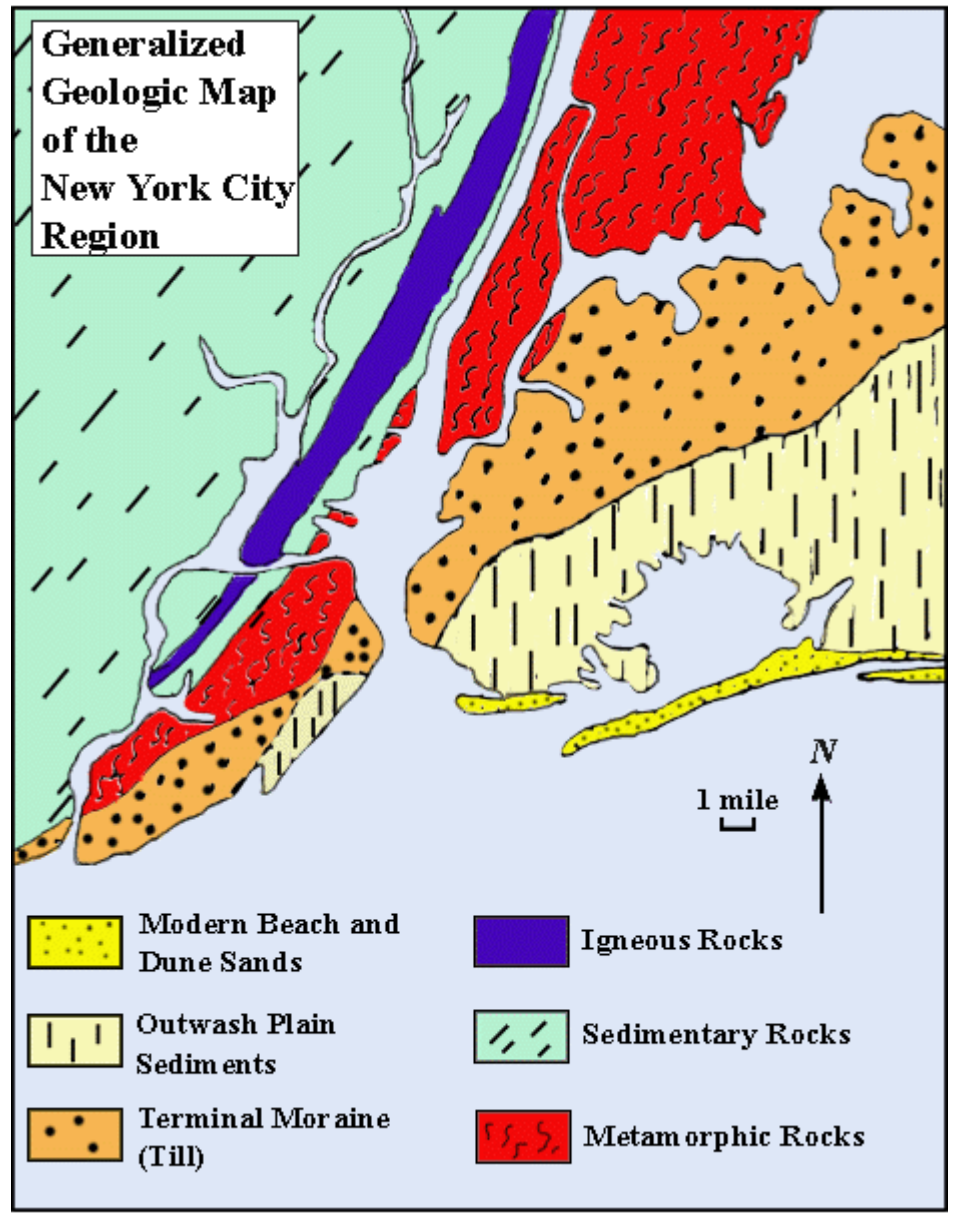




https://woodshole.er.usgs.gov/project-pages/newyork/geologicbkgrnd.html



Quaternary alluvium
Pleistocene glacial/terrace deposits
Tertiary sediments
Cretaceous sediments
Triassic/Jurassic volcanic rocks
Triassic sediments (redbeds)
Devonian Catskill sedimentary rocks
Silurian sedimentary rocks
Late Ordovician sedimentary rocks
Cambrian/Lower Ordovician meta-sedimentary rocks
Cambrian/Ordovician metamorphic rocks (Iapetus Terrane)
Paleozoic granitic intrusive igneous rocks
Precambrian metamorphic rocks (Avalon Terrane)
Precambrian gneisses (Grenvillian)
Precambrian metasedimentary rocks (Grenvillian)
Major thrust faults
Ocean depths represent 20 fathom contour interval



http://academic.brooklyn.cuny.edu/geology/leveson/core/linksa/nyc7b.html

Geologic Map of New York City

Compiled by Pamela Chase Brock & Patrick W.G. Brock, Oct 2001

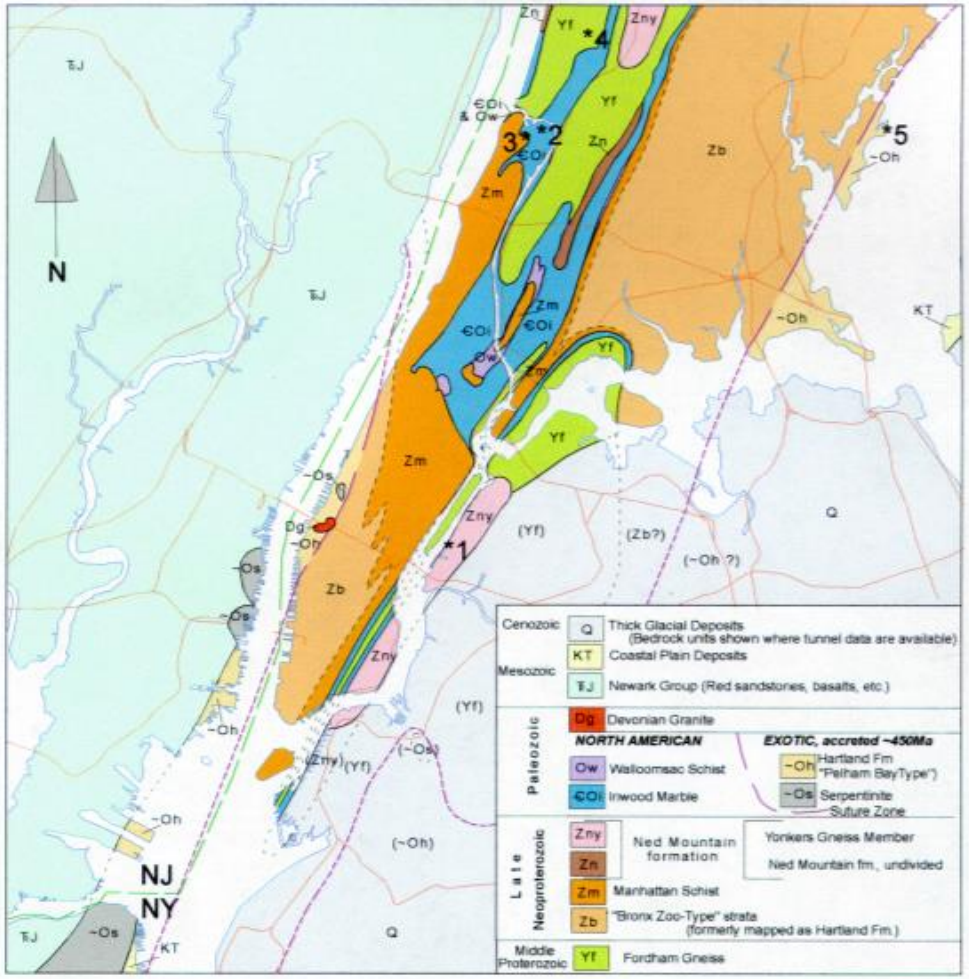
From the Geologic Map of New York State (Fisher et al., 1970)

Engineering Geology Maps of New York City (Baskerville, 1992, 1994)

Field Guides to New York City Geology (Merguerian and Sanders 1990-1993)

Geology of the Brooklyn and Queens water tunnels (Chesman 1997, Schnock 1999, Merguerian personal communication, and Brock et al., 2001)

and mapping by the authors



Miles

1 0 10

Kilometers

5 0 15

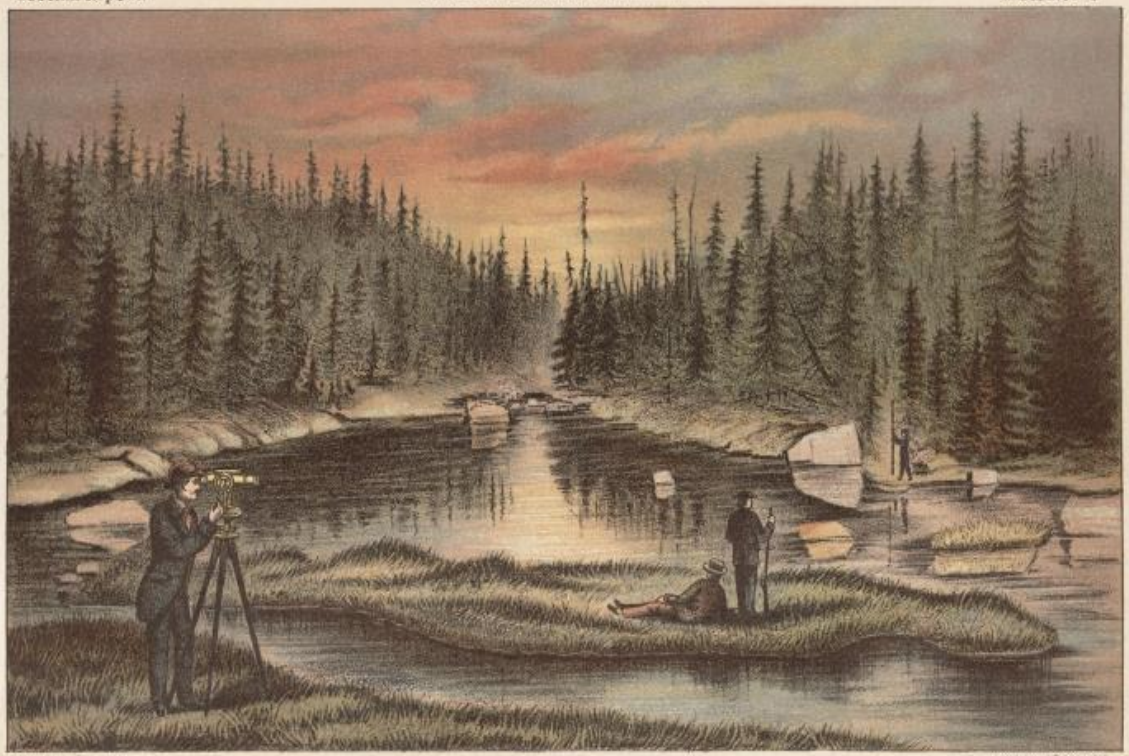
Figure 1

http://www.hudsonwatershed.org/hudson-riverwatershed.html

STATE OF NEW YORK

ADIRONDACK SURVEY

Seventh Report. VERPLANCK COLVIN, Superintendent. Plate Nº 1.

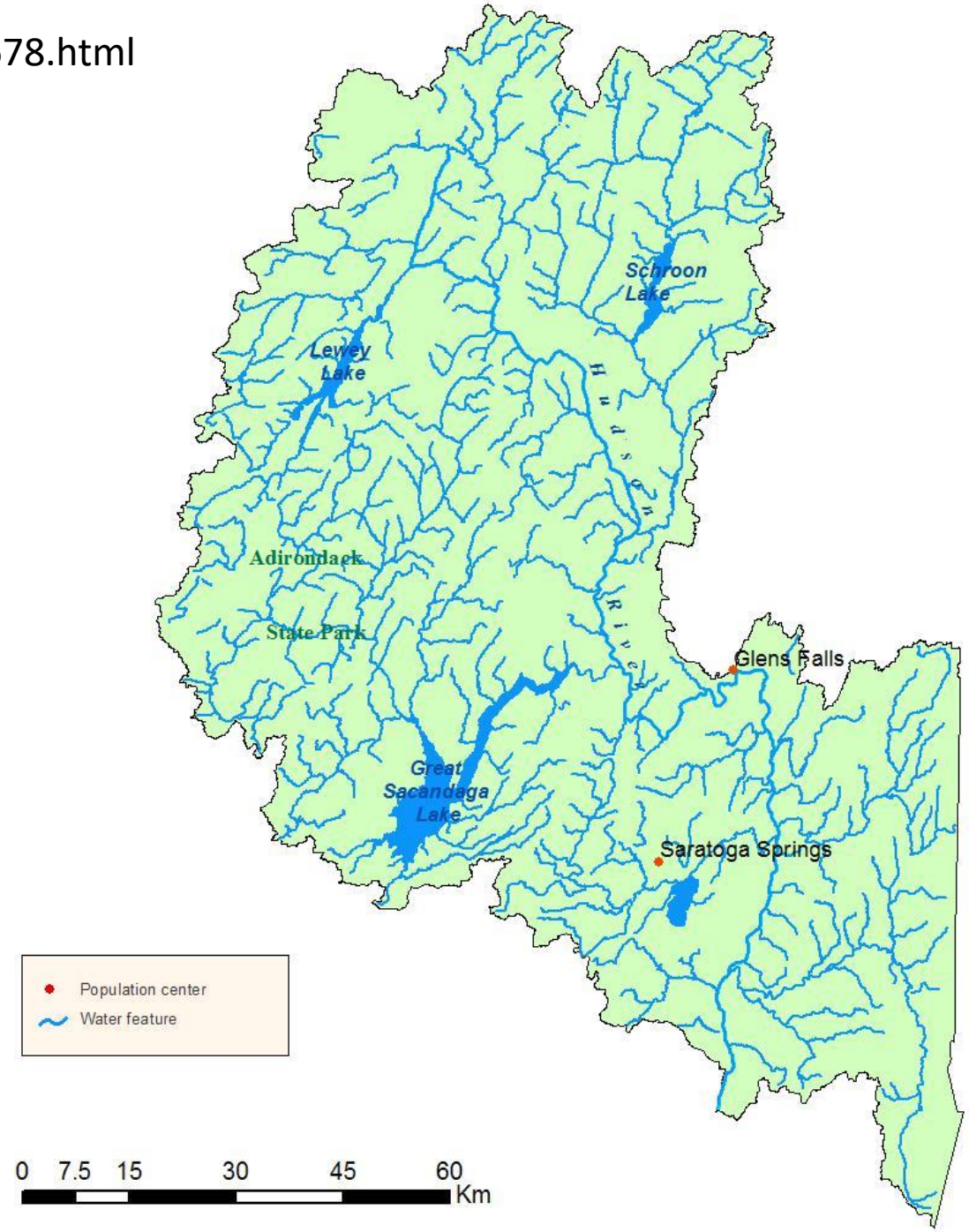


Drawn by Verplanck Colvin Lith by Wood Parsons & Co

LAKE TEAR OF THE CLOUDS.

The Source of the Hudson River.

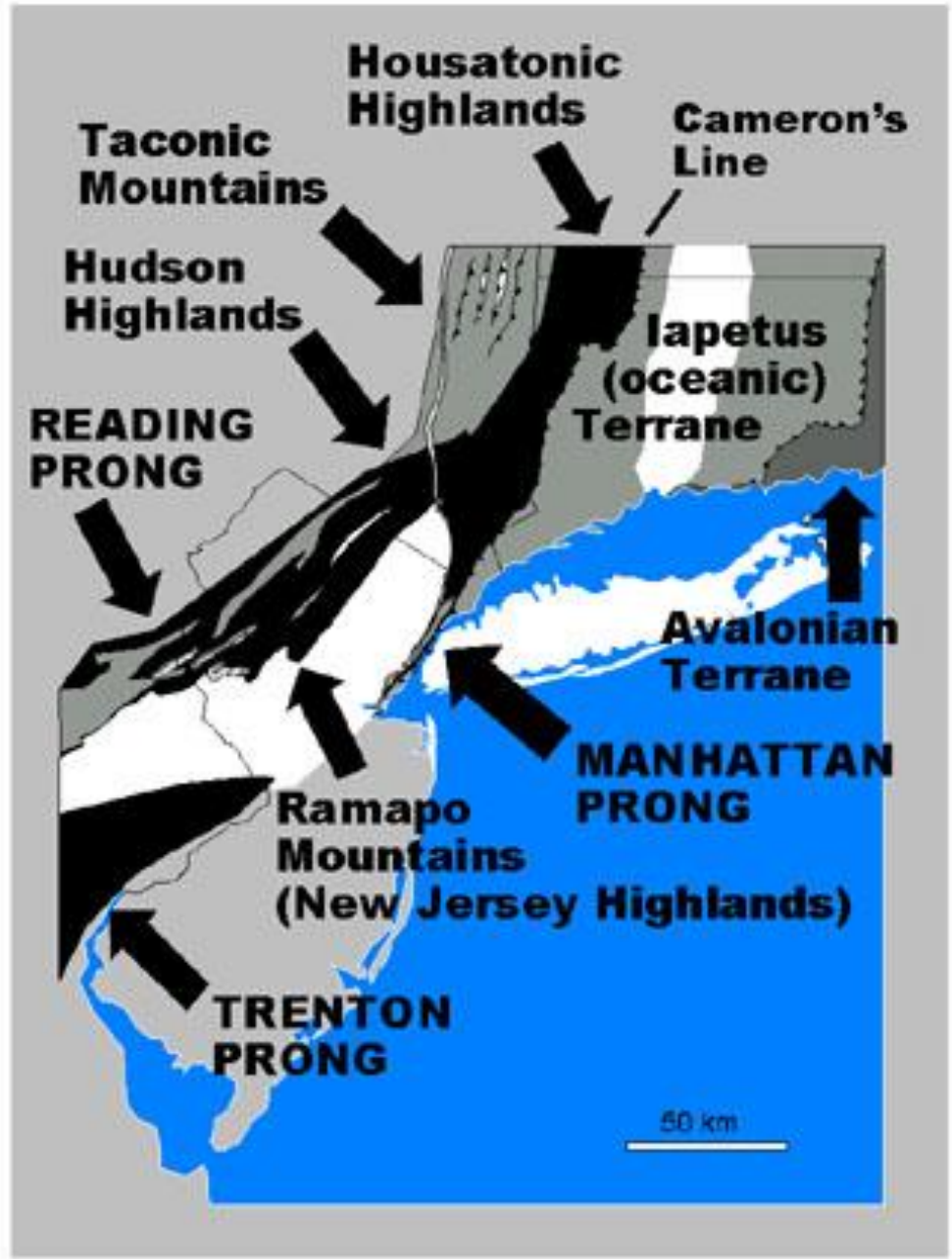
http://www.dec.ny.gov/lands/53678.html



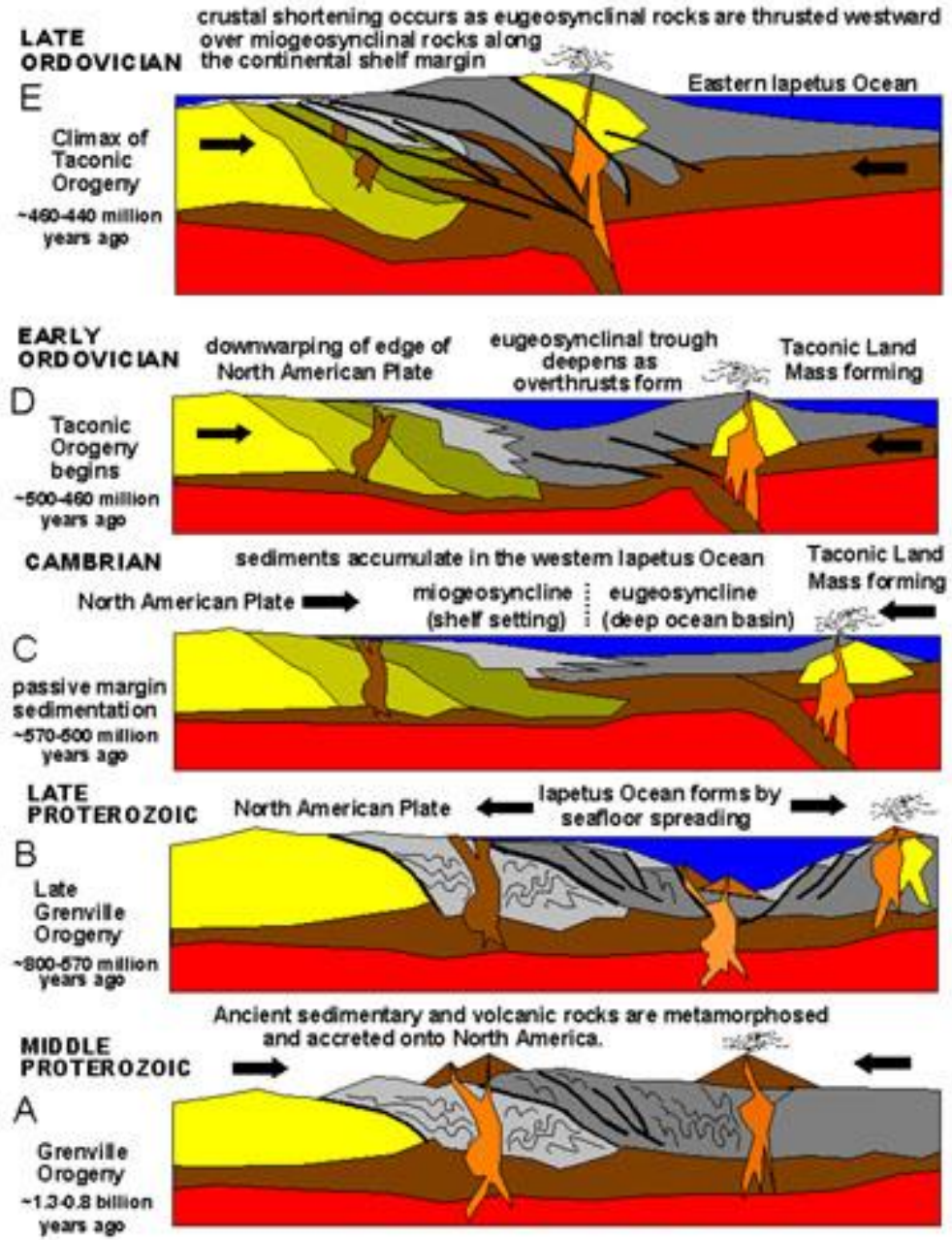
http://www.nyc.gov/html/dep/html/drinking_water/wsmaps_wide.shtml

“A Day in the Life of the Hudson River”

https://www.ldeo.columbia.edu/edu/k12/snapshotday/index.html

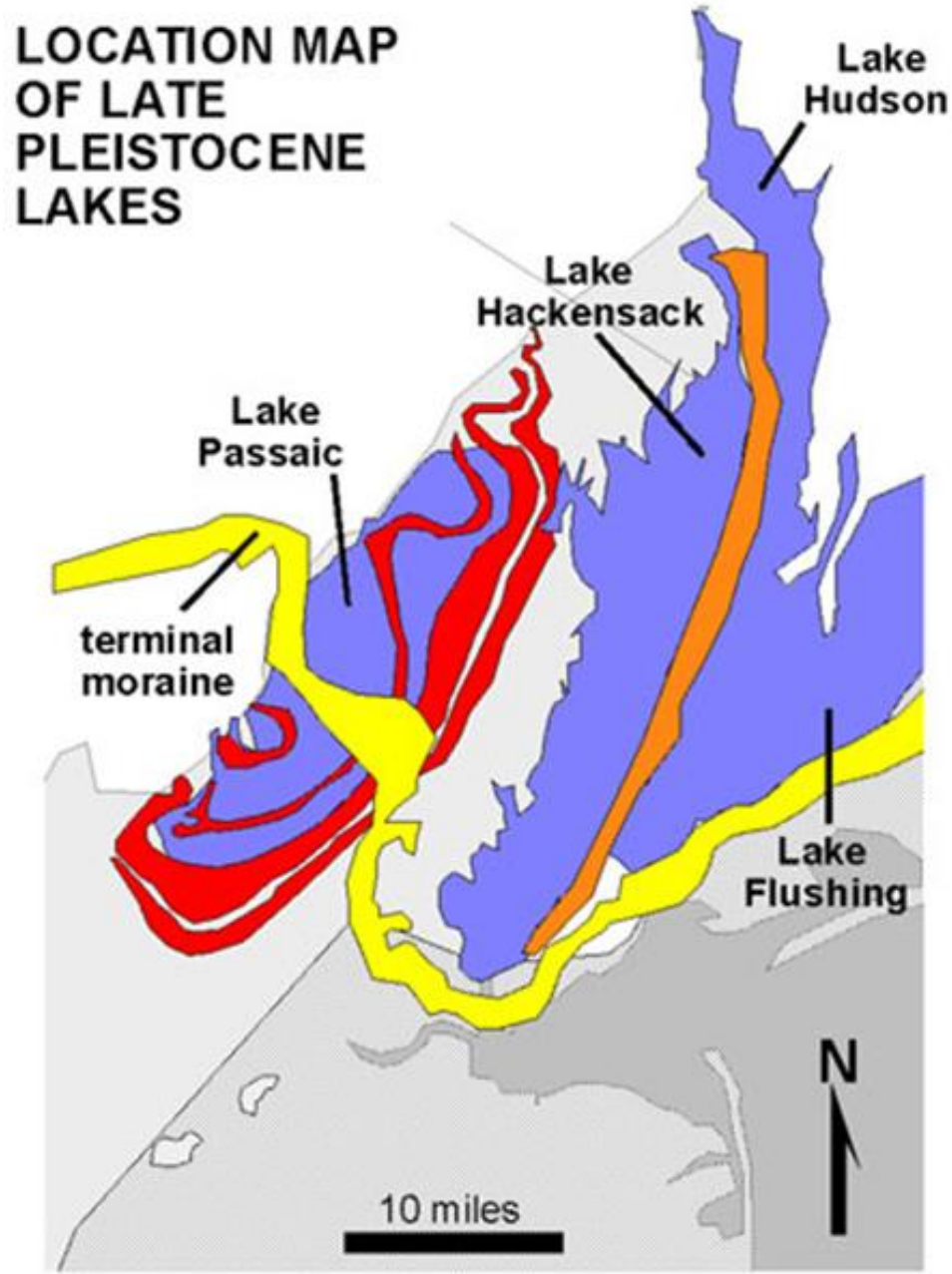


https://3dparks.wr.usgs.gov/nyc/highlands/highlands.html



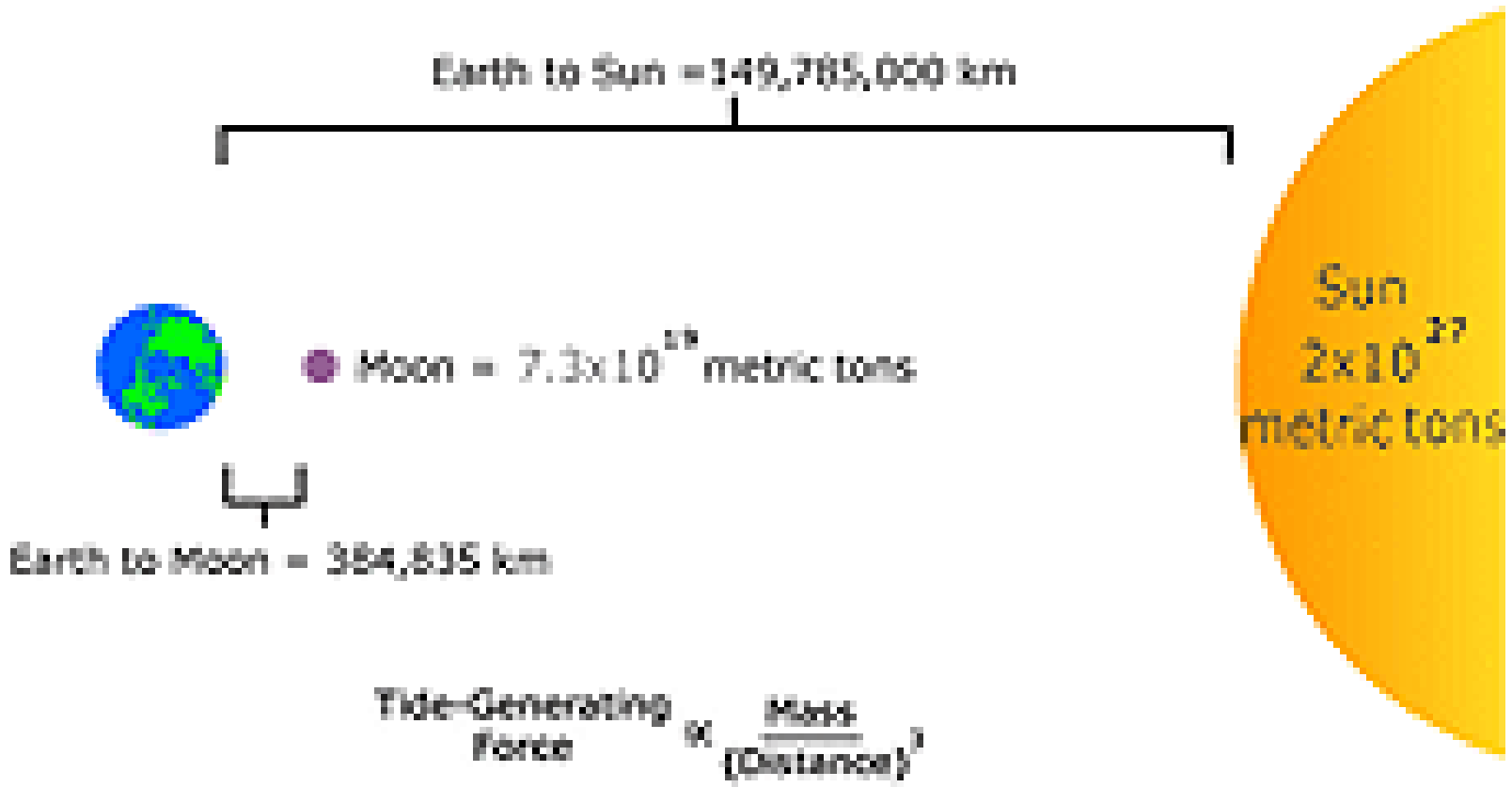
https://3dparks.wr.usgs.gov/nyc/highlands/highlands.html

http://www.durangobill.com/AncestralRivers/AncestralRiversUSEast.html



https://3dparks.wr.usgs.gov/nyc/moraines/rivers.htm

Part 2: The Dynamic Hudson



$$\text{Tide-Generating Force} \propto \frac{\text{Mass}}{(\text{Distance})^3}$$

Secure | https://tidesandcurrents.noaa.gov/waterlevels.html?id=8518750

Apps | United | Wells Fargo | Earth2Class | MG Turismo | AMS EDU | LDEO | VIII GeoSciEd Confere | IODP-CAPES-BRASIL | State_of_Geography_ | NAEP Geography Sub | RES_reference-tab;es

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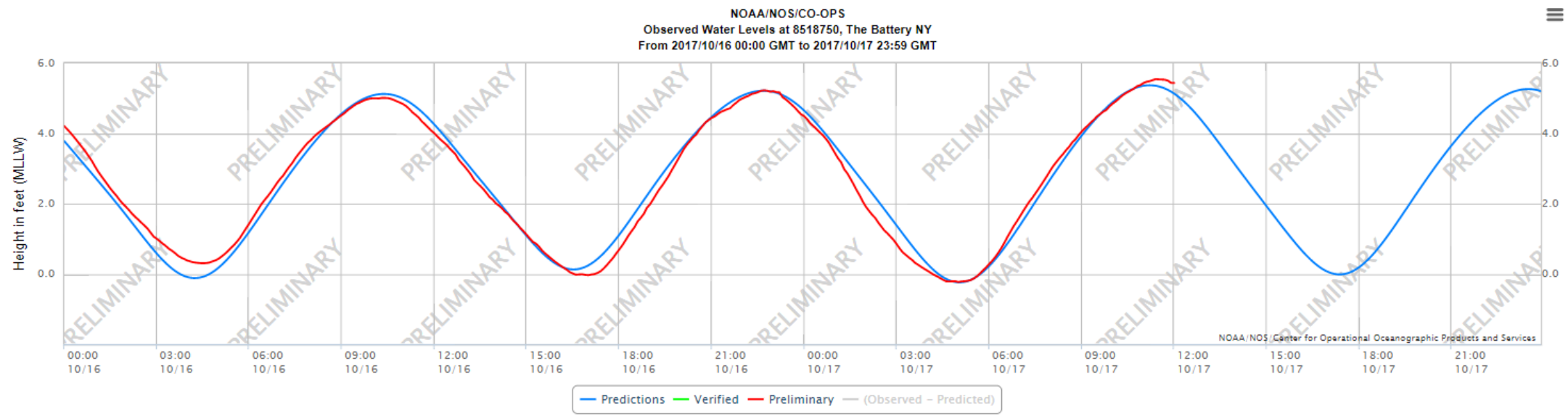
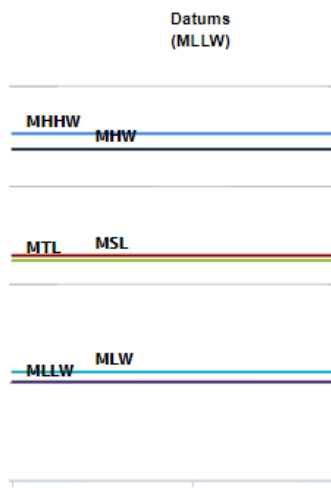
Home / Products / Water Levels / 8518750 The Battery, NY

Notice: Scheduled website maintenance on Thursday, October 19th at 5:30 AM EDT.

Station Info | Tides/Water Levels | Meteorological Obs. | Phys. Oceanography | PORTS® | OFS





Options for
8518750 The Battery, NY

From:
Oct 16 2017

To:
Oct 17 2017

Units
Feet

Timezone
GMT

Datum
MLLW

Shift dates
Back 1 Day | Forward 1 Day

Interval
6 min | 1 hr | H/L | Day | Month

Update
Plot | Data Only

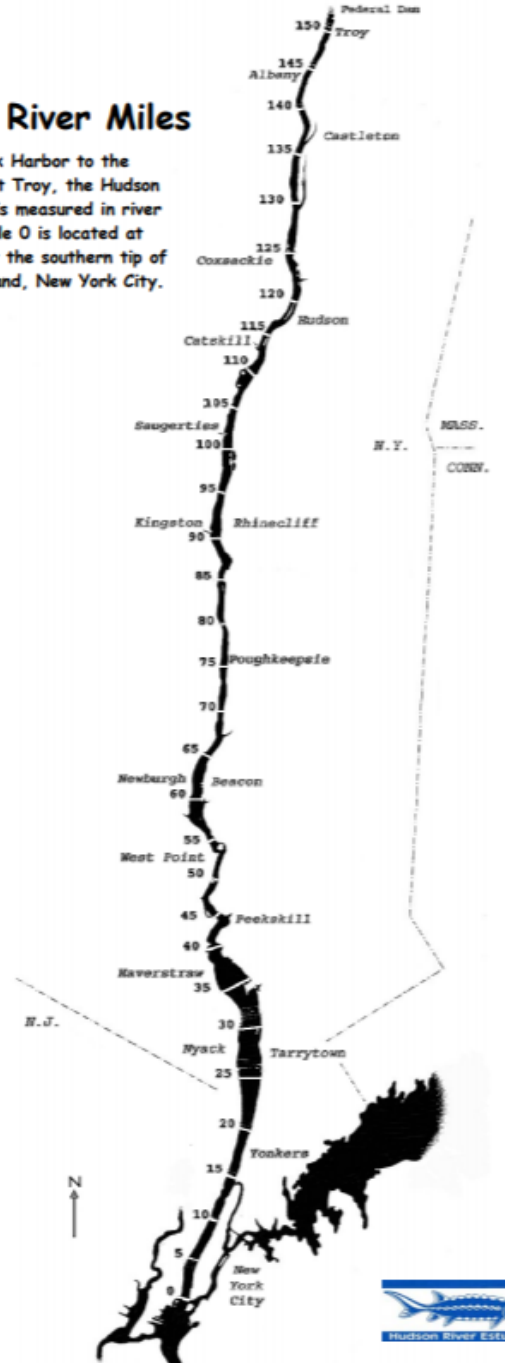
Phases of the Moon

U.S. Naval Observatory
Astronomical Applications Department

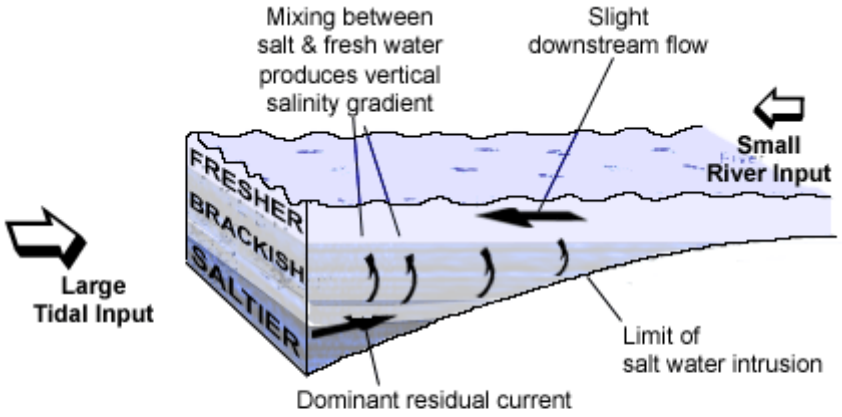
Date and Time (Universal Time)			
New Moon	First Quarter	Full Moon	Last Quarter
2017 Oct 19 19:12	2017 Oct 27 22:22	2017 Nov 04 05:23	2017 Nov 10 20:36
2017 Nov 18 11:42	2017 Nov 26 17:03	2017 Dec 03 15:47	2017 Dec 10 07:51
2017 Dec 18 06:30	2017 Dec 26 09:20	2018 Jan 02 02:24	2018 Jan 08 22:25
2018 Jan 17 02:17	2018 Jan 24 22:20	2018 Jan 31 13:27	2018 Feb 07 15:54
2018 Feb 15 21:05	2018 Feb 23 08:09	2018 Mar 02 00:51	2018 Mar 09 11:20
2018 Mar 17 13:12	2018 Mar 24 15:35	2018 Mar 31 12:37	2018 Apr 08 07:17
2018 Apr 16 01:57	2018 Apr 22 21:46	2018 Apr 30 00:58	2018 May 08 02:09
2018 May 15 11:48	2018 May 22 03:49	2018 May 29 14:19	2018 Jun 06 18:32
2018 Jun 13 19:43	2018 Jun 20 10:51	2018 Jun 28 04:53	2018 Jul 06 07:51
2018 Jul 13 02:48	2018 Jul 19 19:52	2018 Jul 27 20:20	2018 Aug 04 18:18
2018 Aug 11 09:58	2018 Aug 18 07:48	2018 Aug 26 11:56	2018 Sep 03 02:37
2018 Sep 09 18:01	2018 Sep 16 23:15	2018 Sep 25 02:52	2018 Oct 02 09:45
2018 Oct 09 03:47	2018 Oct 16 18:02	--	--

Hudson River Miles

From New York Harbor to the Federal Dam at Troy, the Hudson River Estuary is measured in river miles. River mile 0 is located at the Battery at the southern tip of Manhattan Island, New York City.

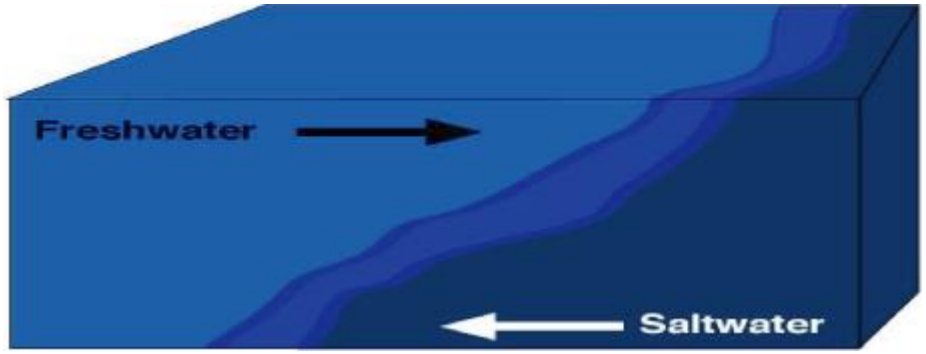


Hudson River Estuary

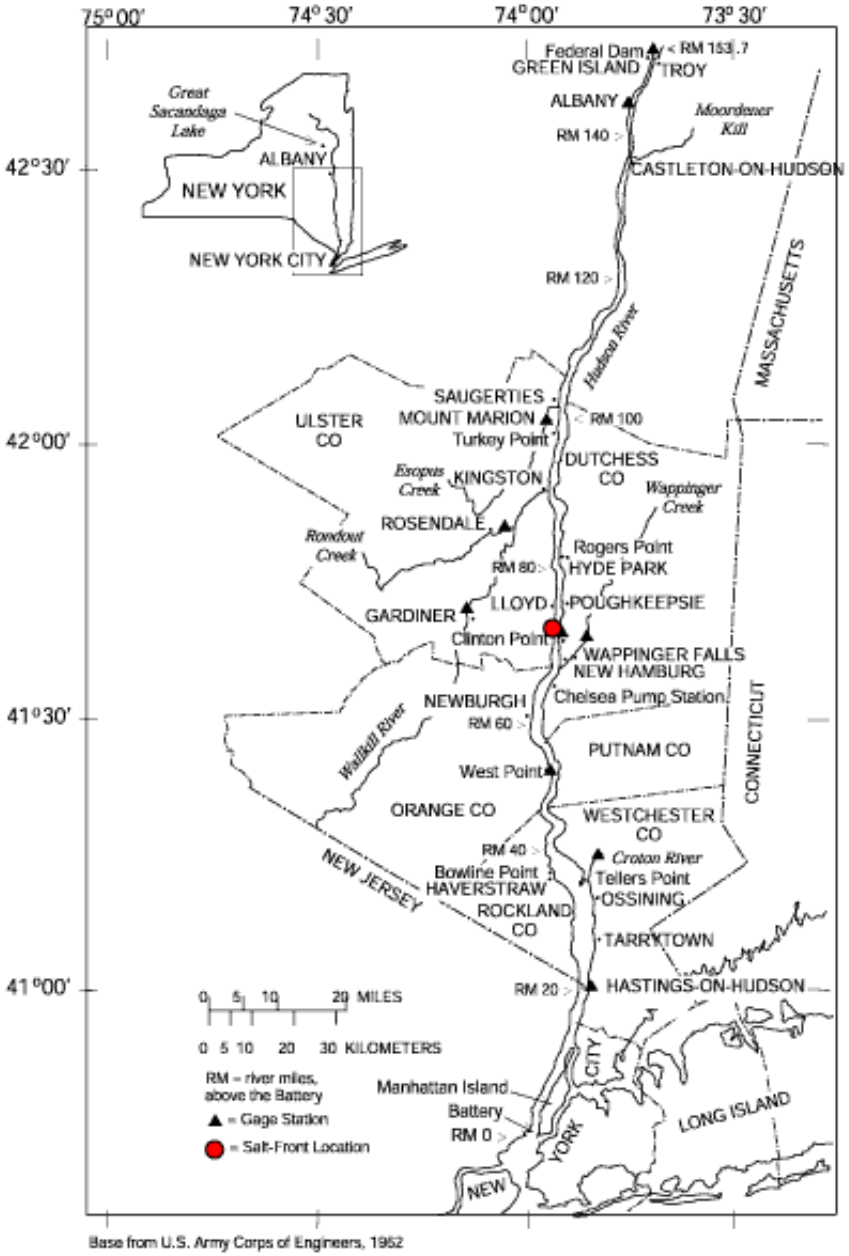


A Partially Mixed Estuary

http://steinhardtapps.es.its.nyu.edu/nyuhudson/?page_id=169



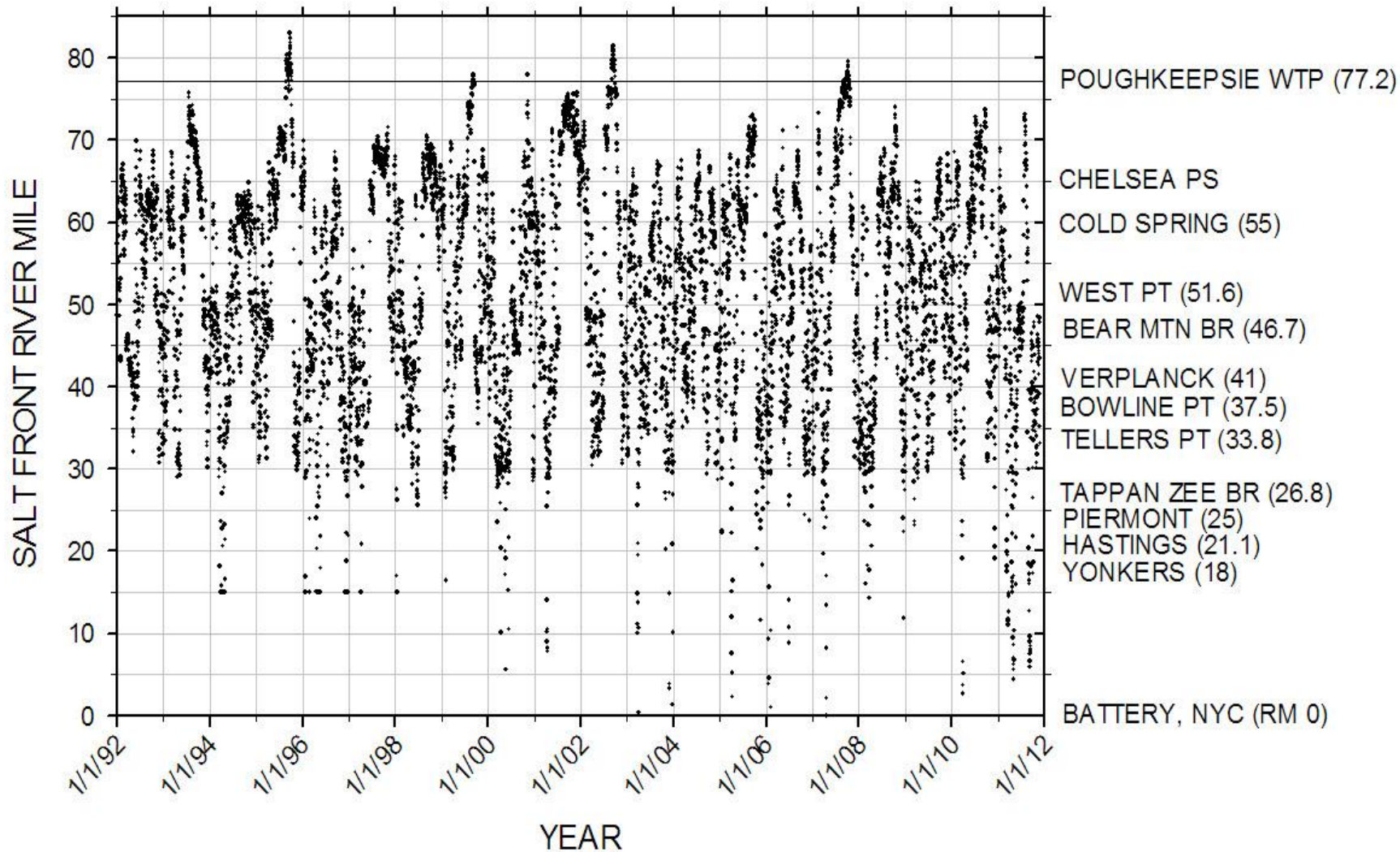
https://www.ldeo.columbia.edu/edu/k12/snapshotday/Parameters.html



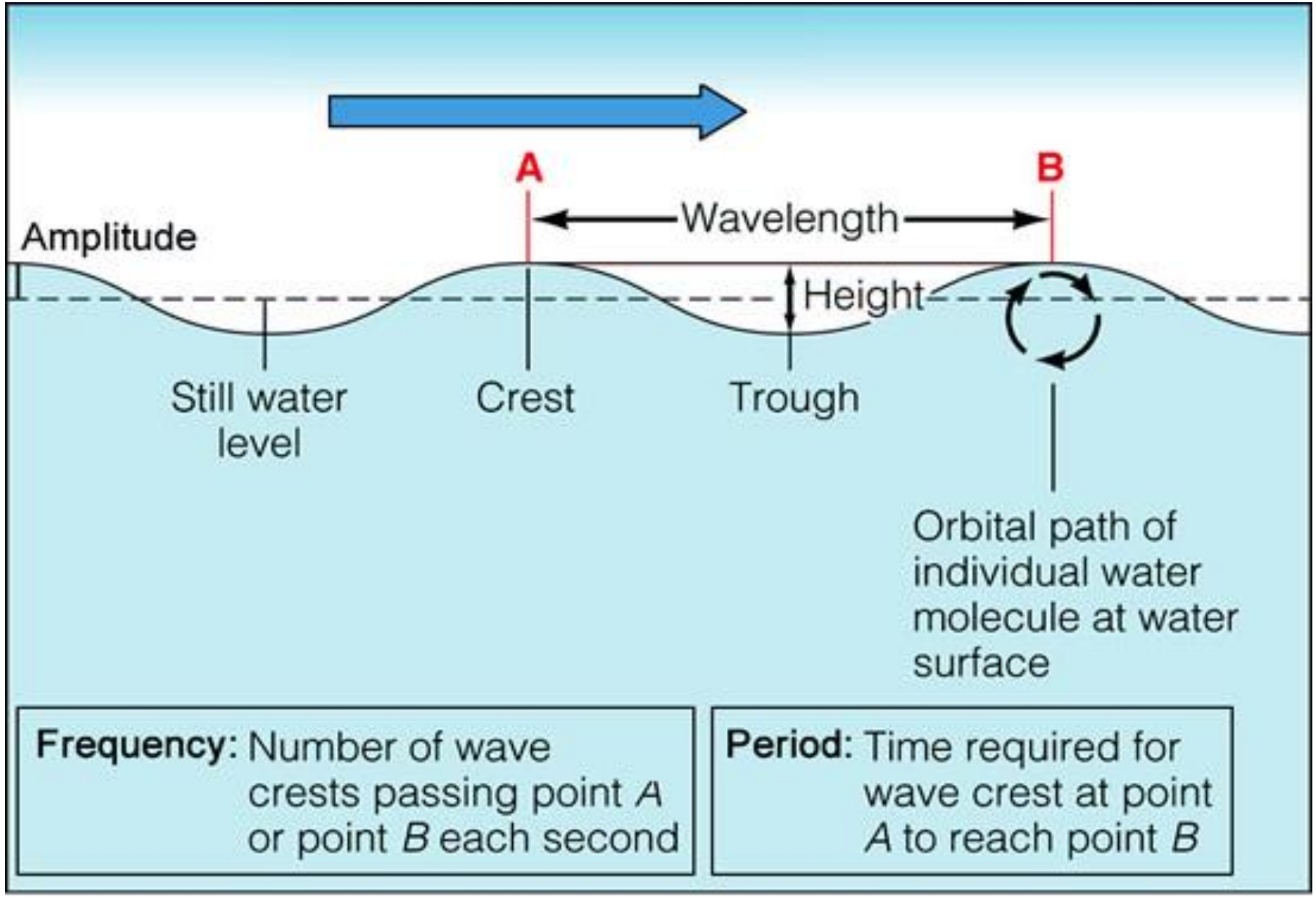
U.S. Geological Survey Hudson River salt-front data--
Yesterdays salt-front location at high-slack tide was
73 river miles above the Battery at New York City.

River Mile: 73 on 09/30/2015

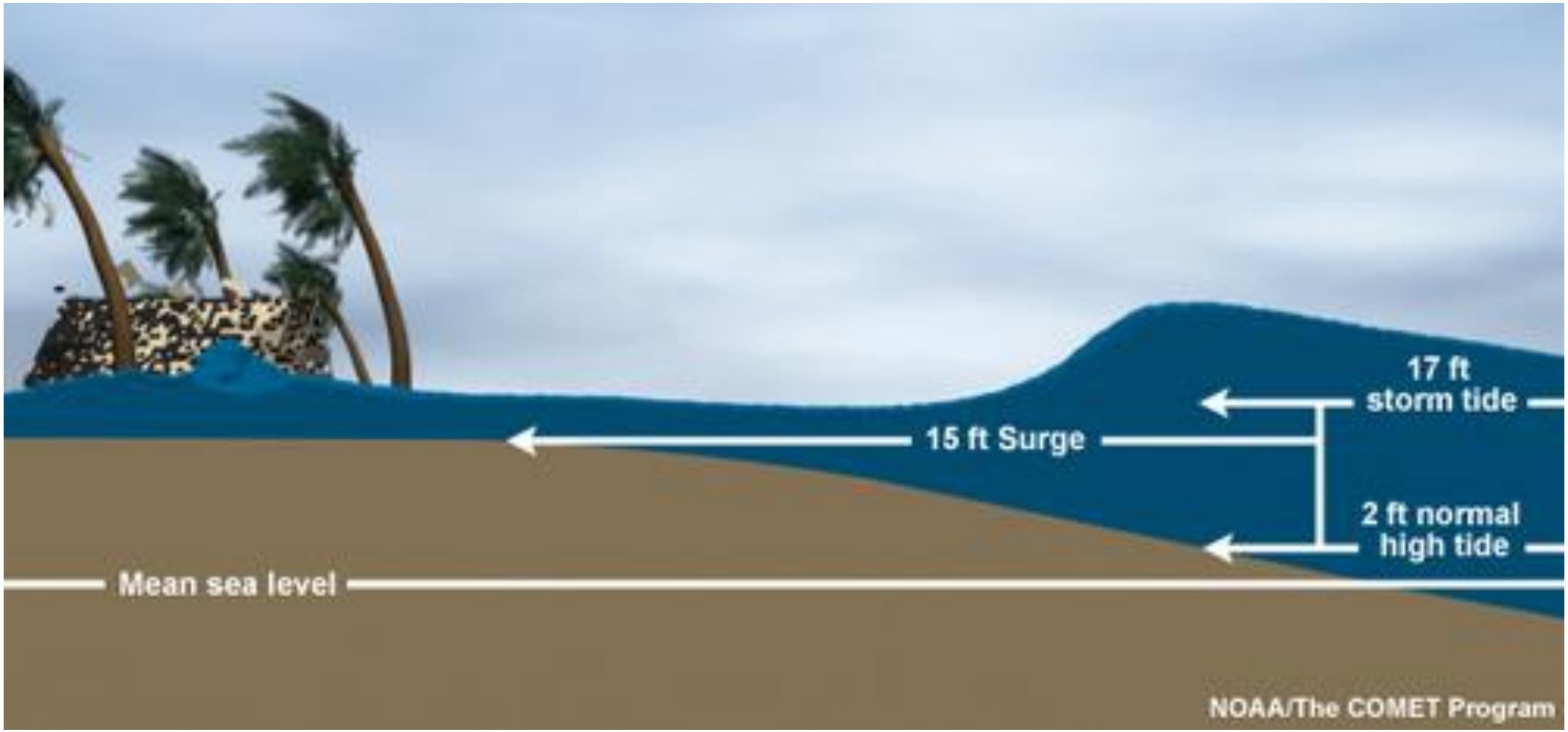
Maximum Daily Location of Salt Front in Hudson River 1992 - 2012



https://ny.water.usgs.gov/projects/dialer_plots/salt_front_1992-2012.jpg



http://science.kennesaw.edu



http://www.nhc.noaa.gov/surge/

day in the life hudson - | Parameters.htm | Storm Surge Overview | National Storm Surge Ha

noaa.maps.arcgis.com/apps/MapSeries/index.html?appid=d9ed7904dbec441a9c4dd7b277935fad&entry=1

Apps | United | Wells Fargo | Earth2Class | MG Turismo | AMS EDU | LDEO | VIII GeoSciEd Confere | IODP-CAPES-BRASIL | State_of_Geography_ | NAEP Geography Sut | RES_reference-tab;es

National Storm Surge Hazard Maps

NOAA/NWS/NHC Storm Surge Unit

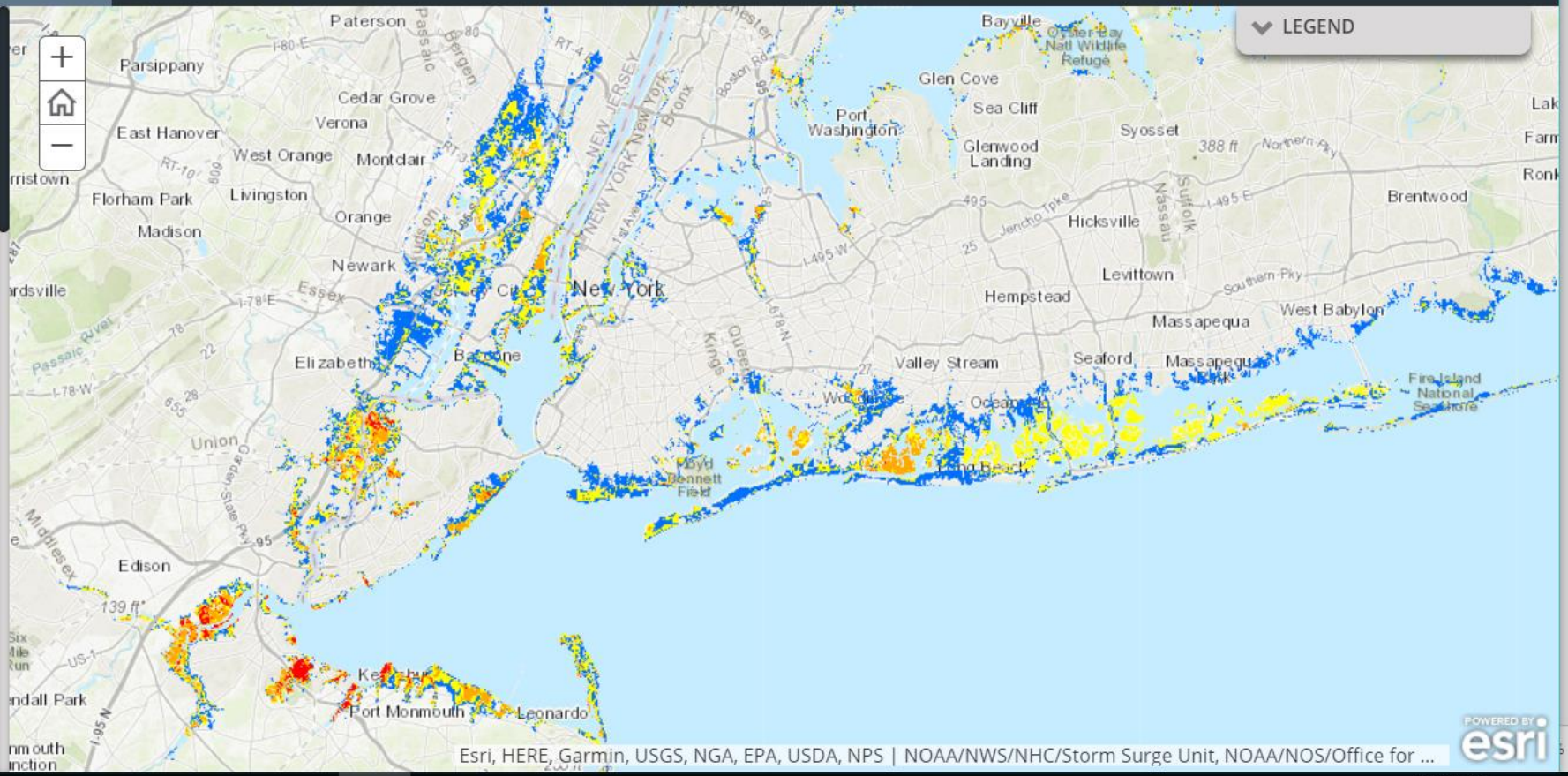
This is not a real-time product. For active tropical cyclones, please see hurricanes.gov and consult local products issued by the National Weather Service

Texas to Maine | Puerto Rico

Category 1 | Category 2 | Category 3 | Category 4 | Category 5

This national depiction of storm surge flooding vulnerability helps people living in hurricane-prone coastal areas along the U.S. East and Gulf Coasts and Puerto Rico to evaluate their risk to the storm surge hazard. These maps make it clear that storm surge is not just a beachfront problem, with the risk of storm surge extending many miles inland from the immediate coastline in some areas. If you discover via these maps that you live in an area vulnerable to storm surge, find out today if you live in a hurricane storm surge evacuation zone as prescribed by your local emergency management agency. If you do live in such an evacuation zone, decide today where you will go and how you will get there, if and when you're instructed by your emergency manager to evacuate. If you don't live in one of those evacuation zones, then perhaps you can identify someone you care about who does live in an evacuation zone, and you could plan in advance to be their inland evacuation destination - if you live in a structure that is safe from the wind and outside of flood-prone areas.

- Less than 3 feet above ground
- Greater than 3 feet above ground
- Greater than 6 feet above ground
- Greater than 9 feet above ground
- Leveed area
  Consult local officials for flood risk



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10/17/2017

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noaa.maps.arcgis.com/apps/MapSeries/index.html?appid=d9ed7904dbec441a9c4dd7b277935fad&entry=1

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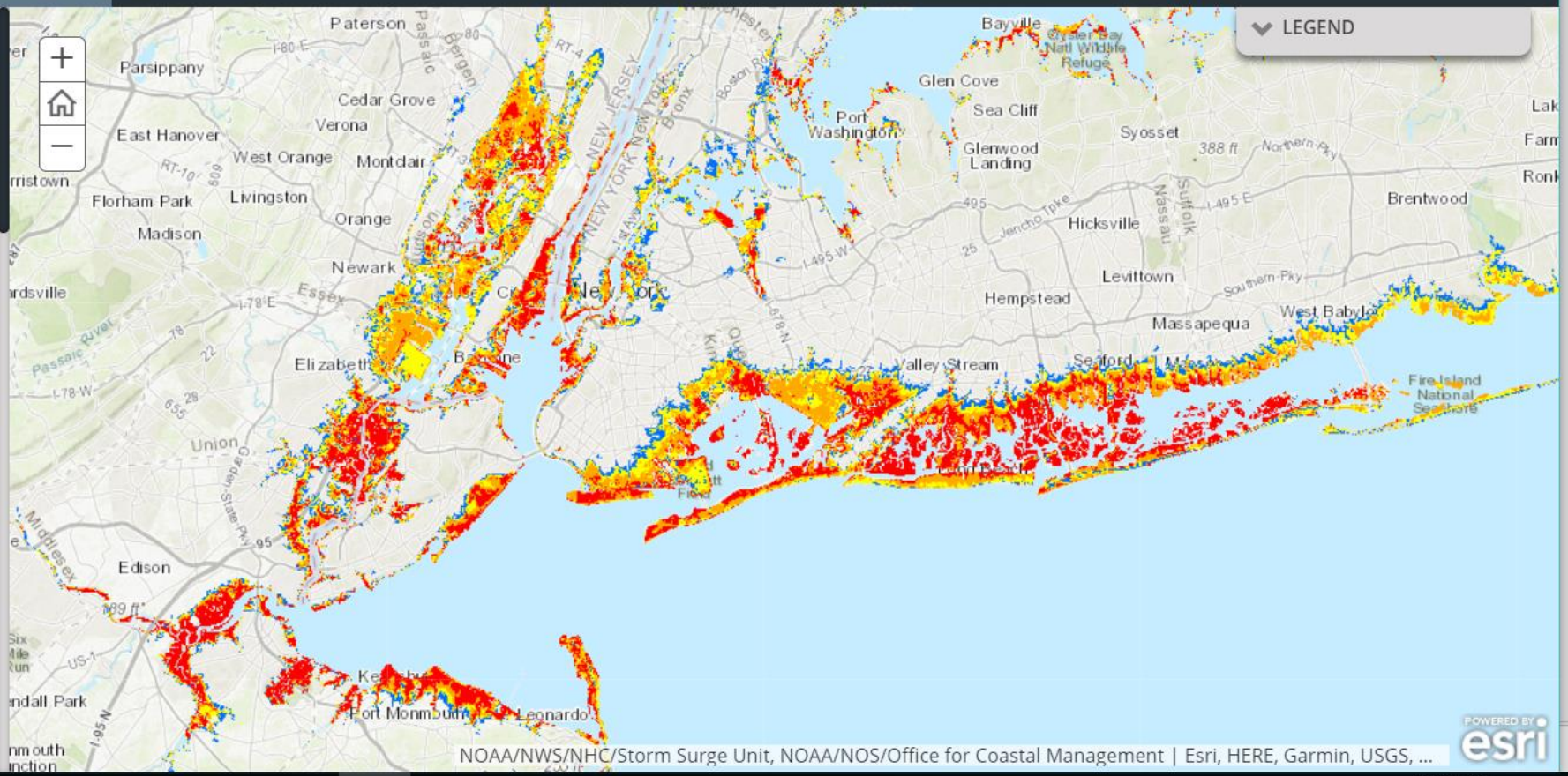

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noaa.maps.arcgis.com/apps/MapSeries/index.html?appid=d9ed7904dbec441a9c4dd7b277935fad&entry=1

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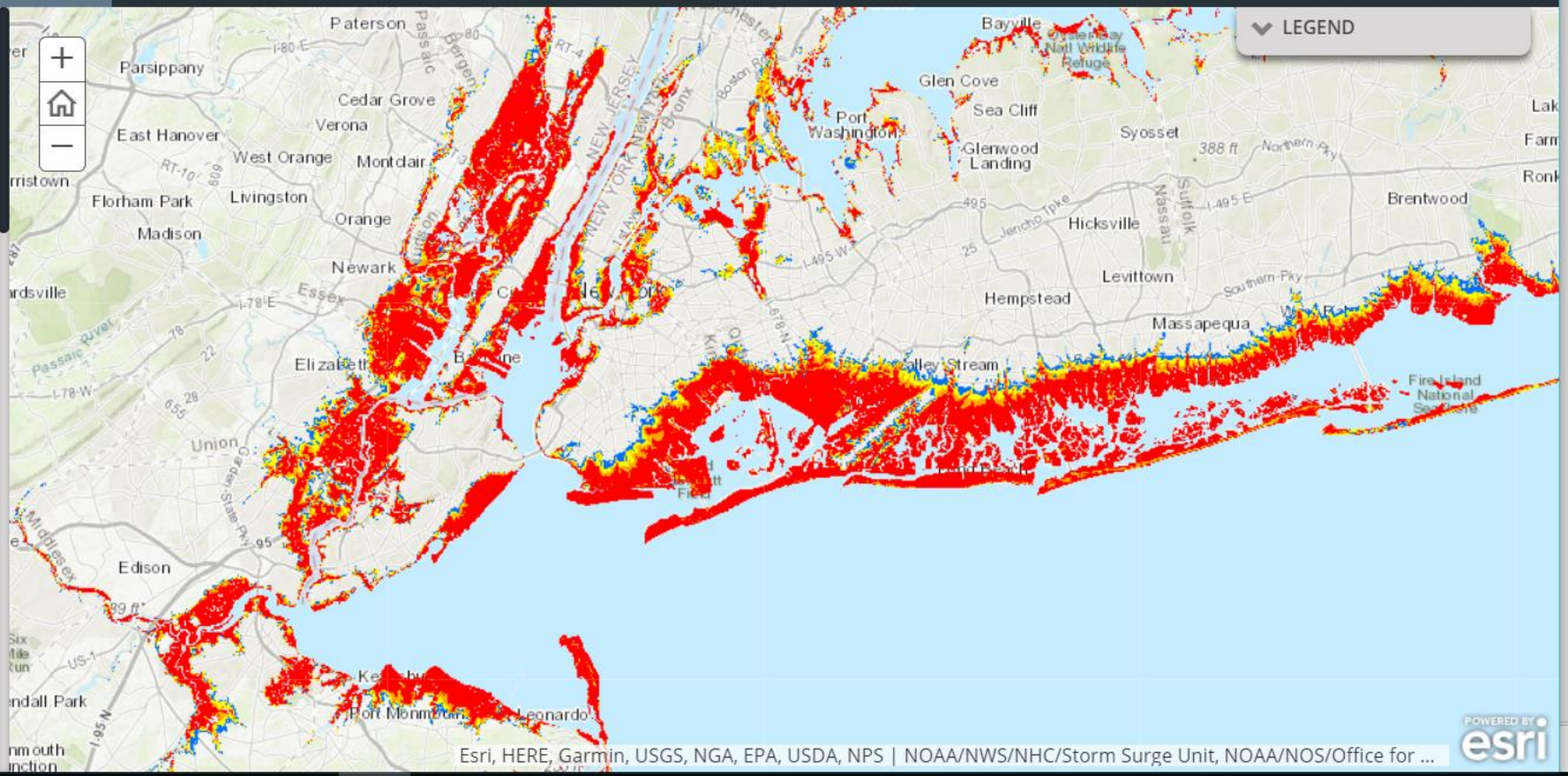

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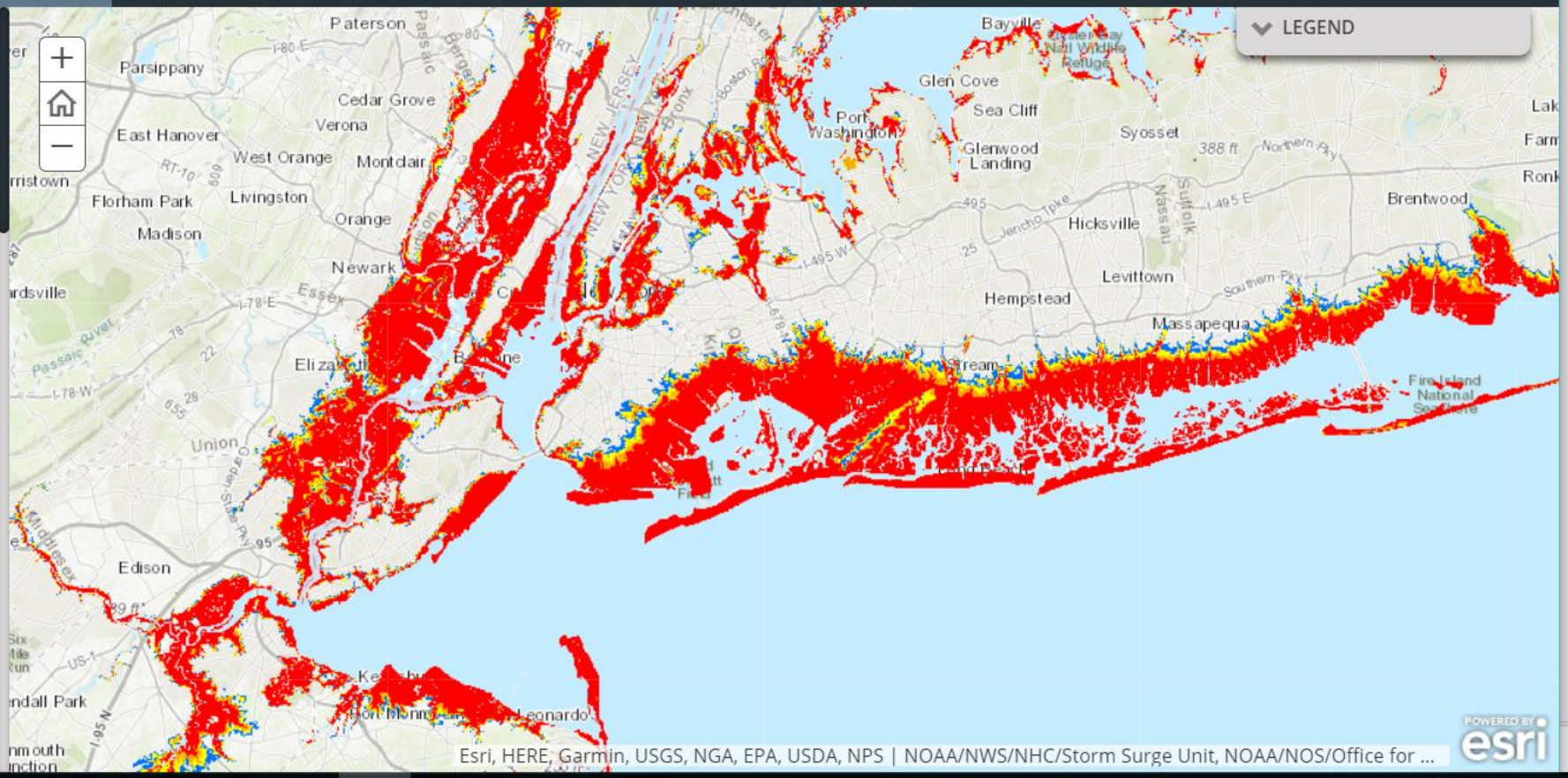
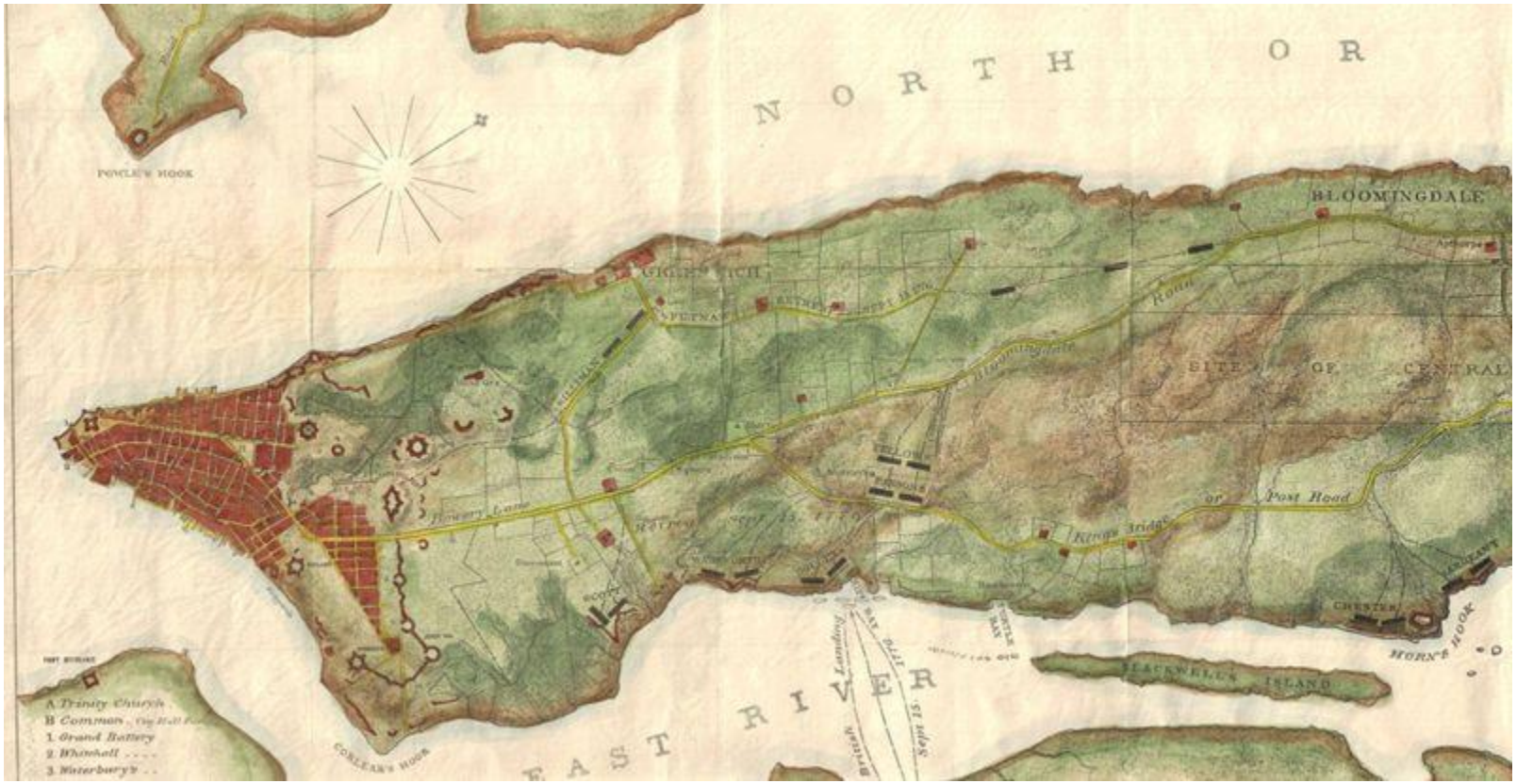
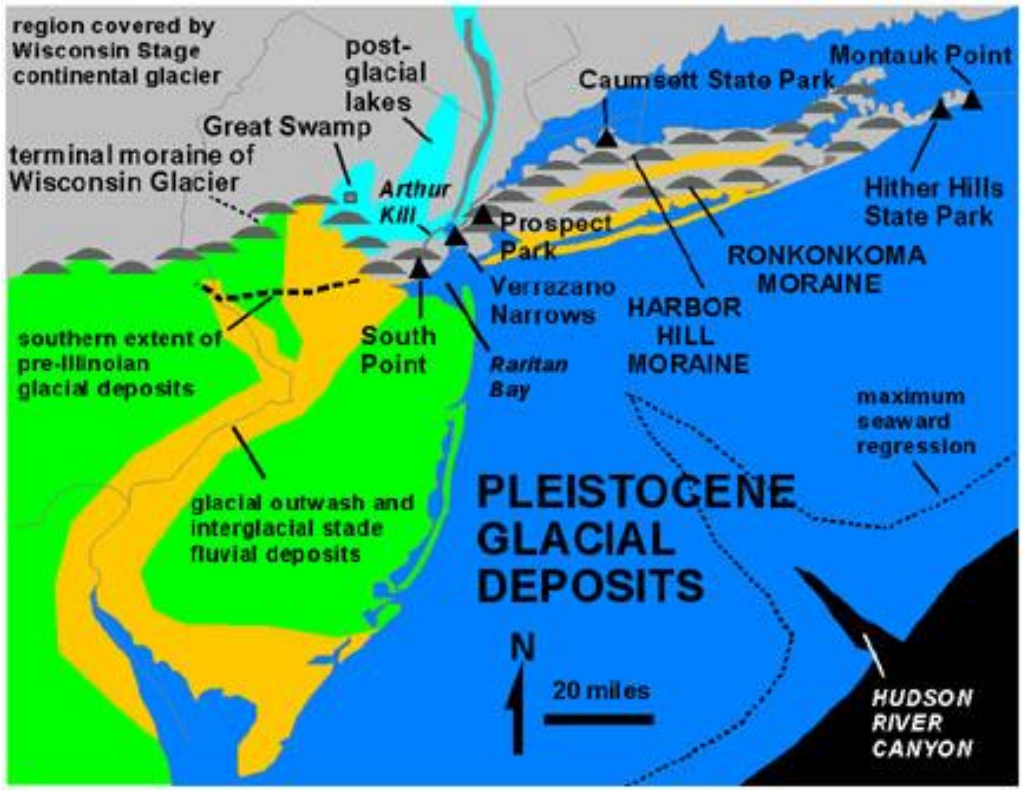


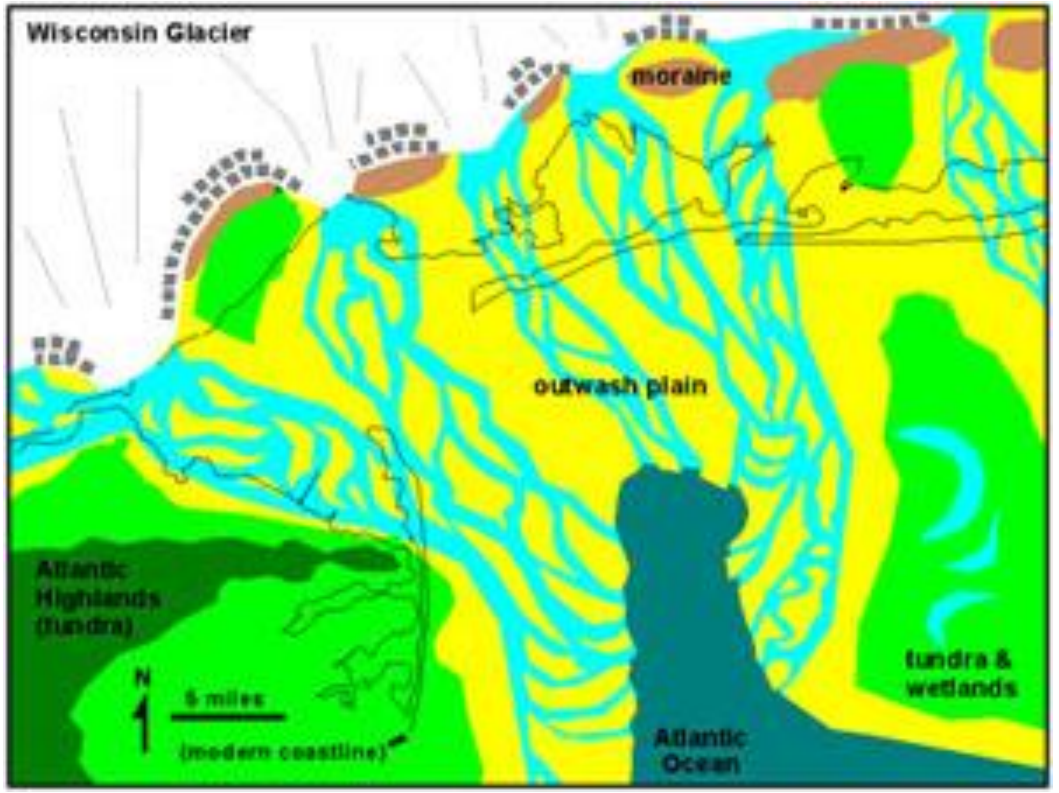
Part 3: Uncovering the Hudson's Environmental Past and Predicting Its Future



https://gizmodo.com/watch-new-york-city-s-boundaries-expand-over-250-years-496440467

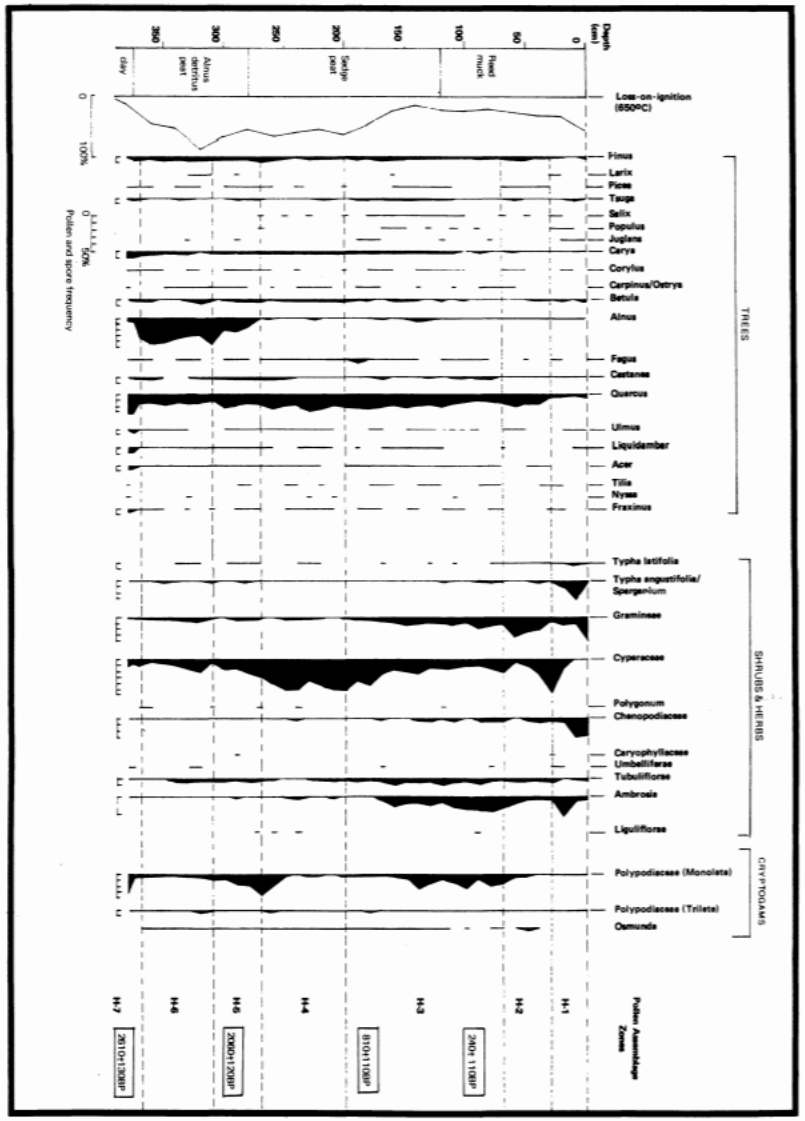
1) Emerging from the Ice Ages





https://3dparks.wr.usgs.gov/nyc/moraines/quaternary.htm

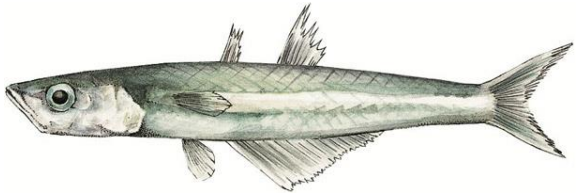
http://www.newyorknature.net/IceAge.html

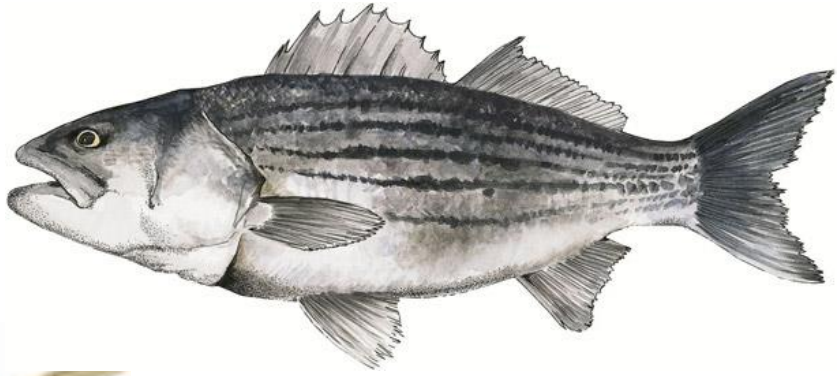


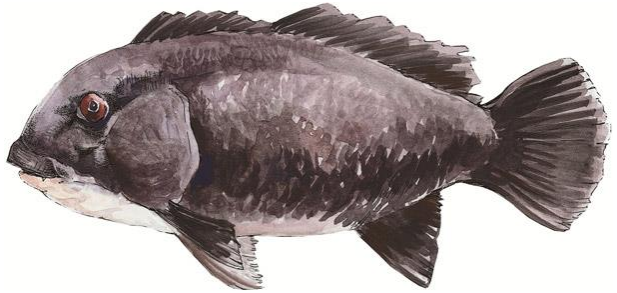
2) Native American Oyster Feasts

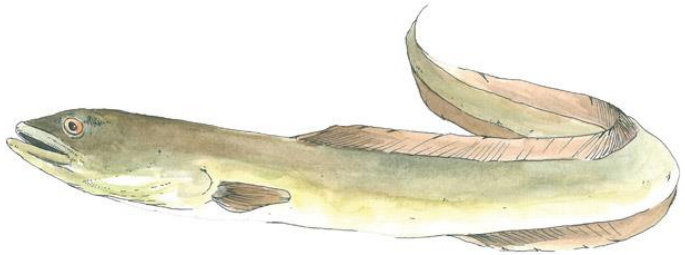
https://www.villagevoice.com/2015/06/01/a-billion-oysters-tell-the-history-of-new-york/

3) Fish of the Hudson River





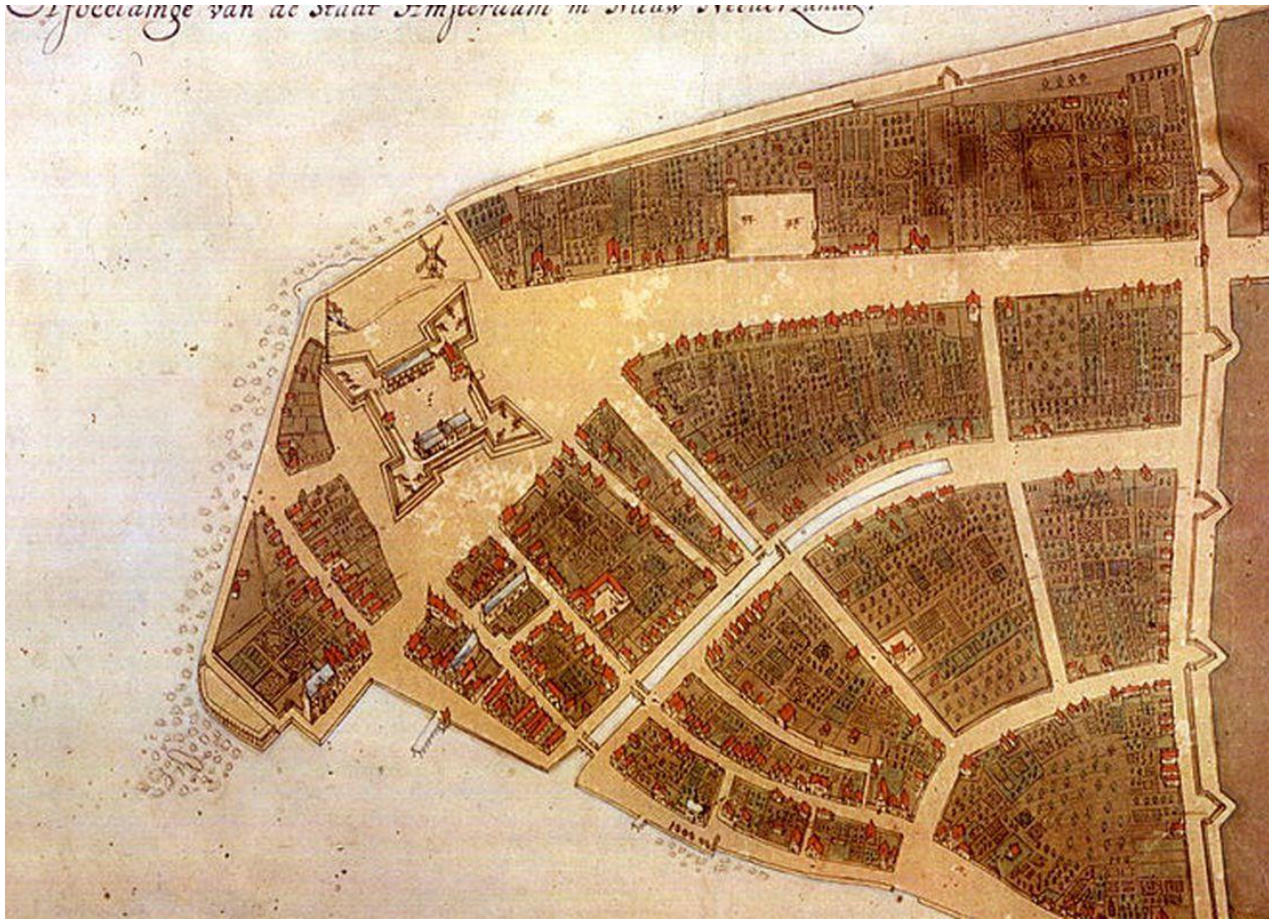




https://www.hudsonriverpark.org/education-and-environment/hudson-river-ecosystem/habitat-water/fish

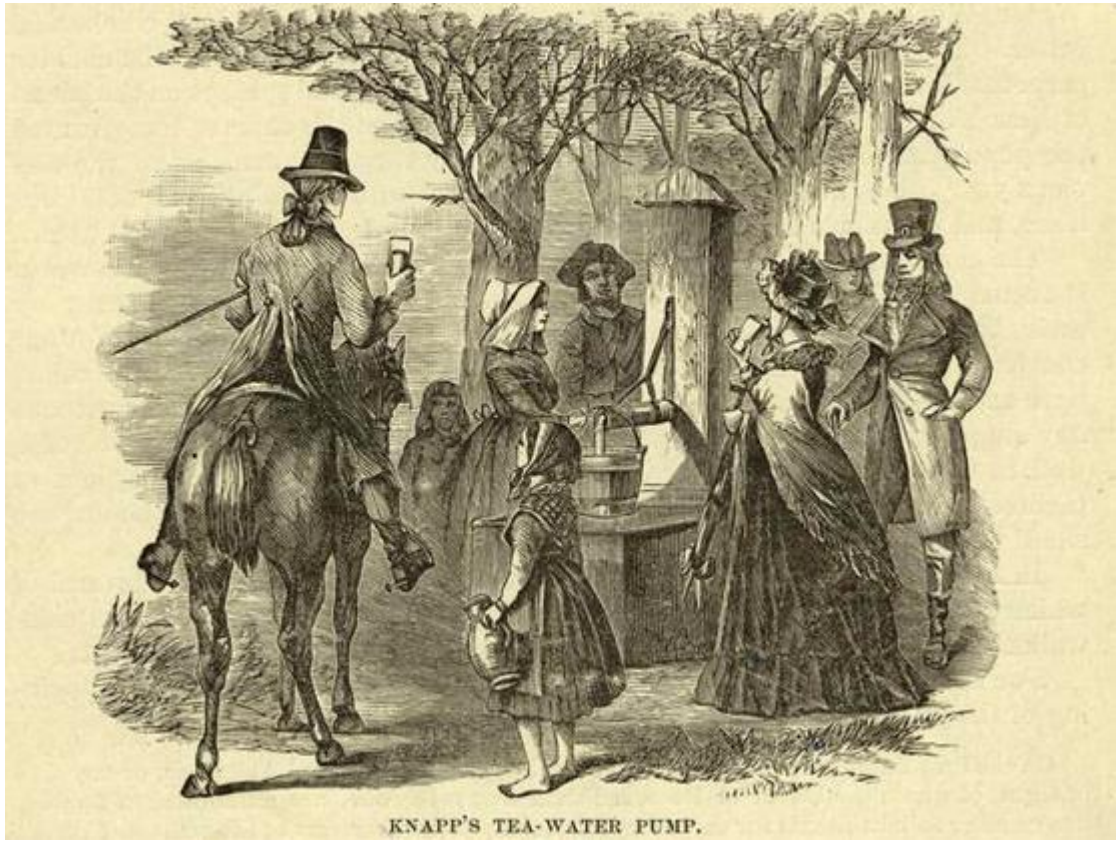
4) Widening Manhattan to Handle the Growing Population

http://newyorkinplainsight.blogspot.com/2010/06/original-shoreline-below-west-23rd.html



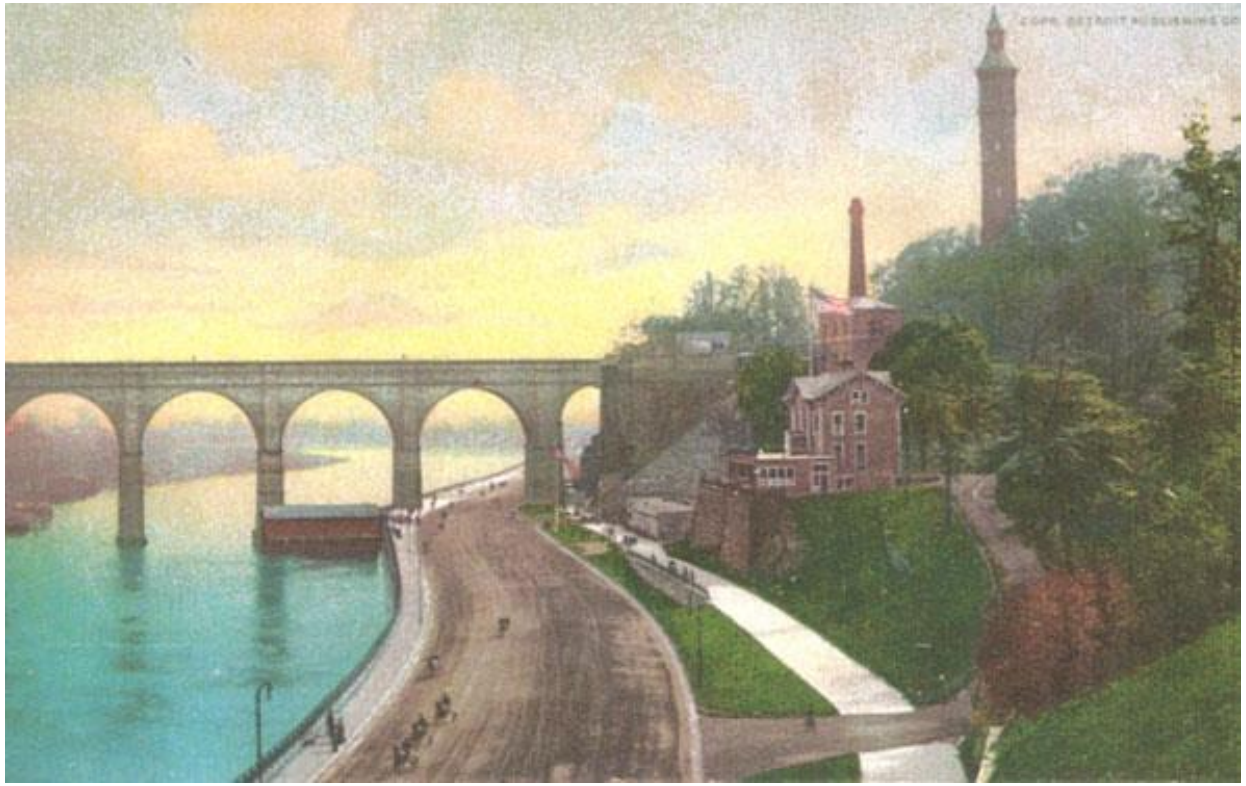
https://ny.curbed.com/2013/5/6/10246784/when-wall-street-was-a-wall-a-1660-map-of-manhattan

5) Impacts of the Growing Population and Industrial Revolution

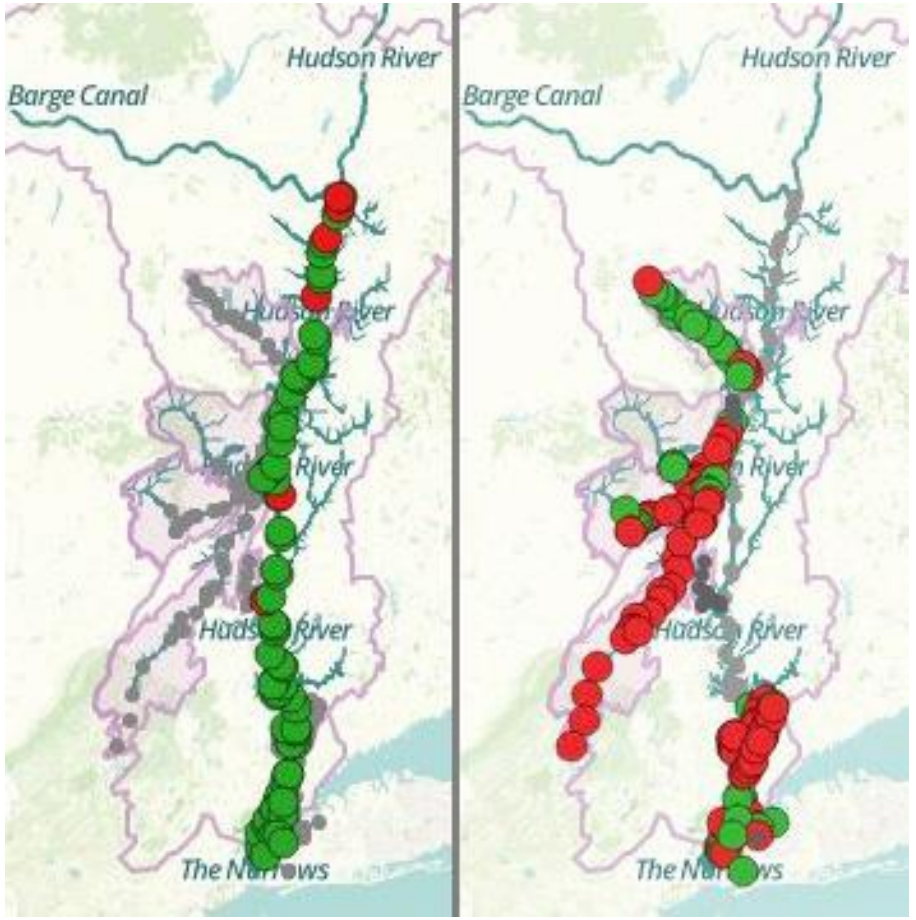


https://www.bostonteapartyship.com/tea-blog/tea-water-wells-new-york

https://www.thoughtco.com/new-yorks-great-fire-of-1835-1773780



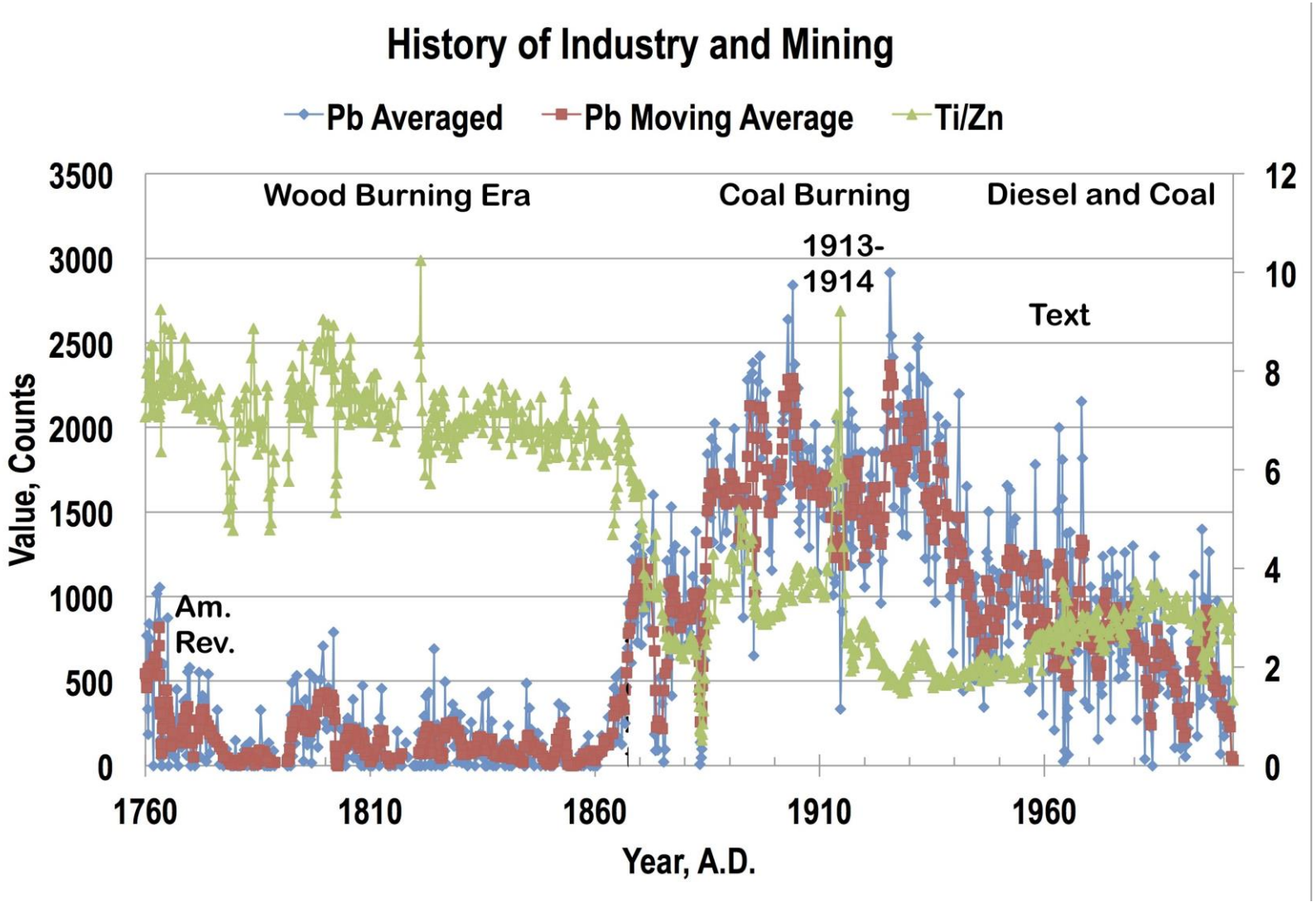
https://www.nycgovparks.org/park-features/highbridge-park/high-bridge-history



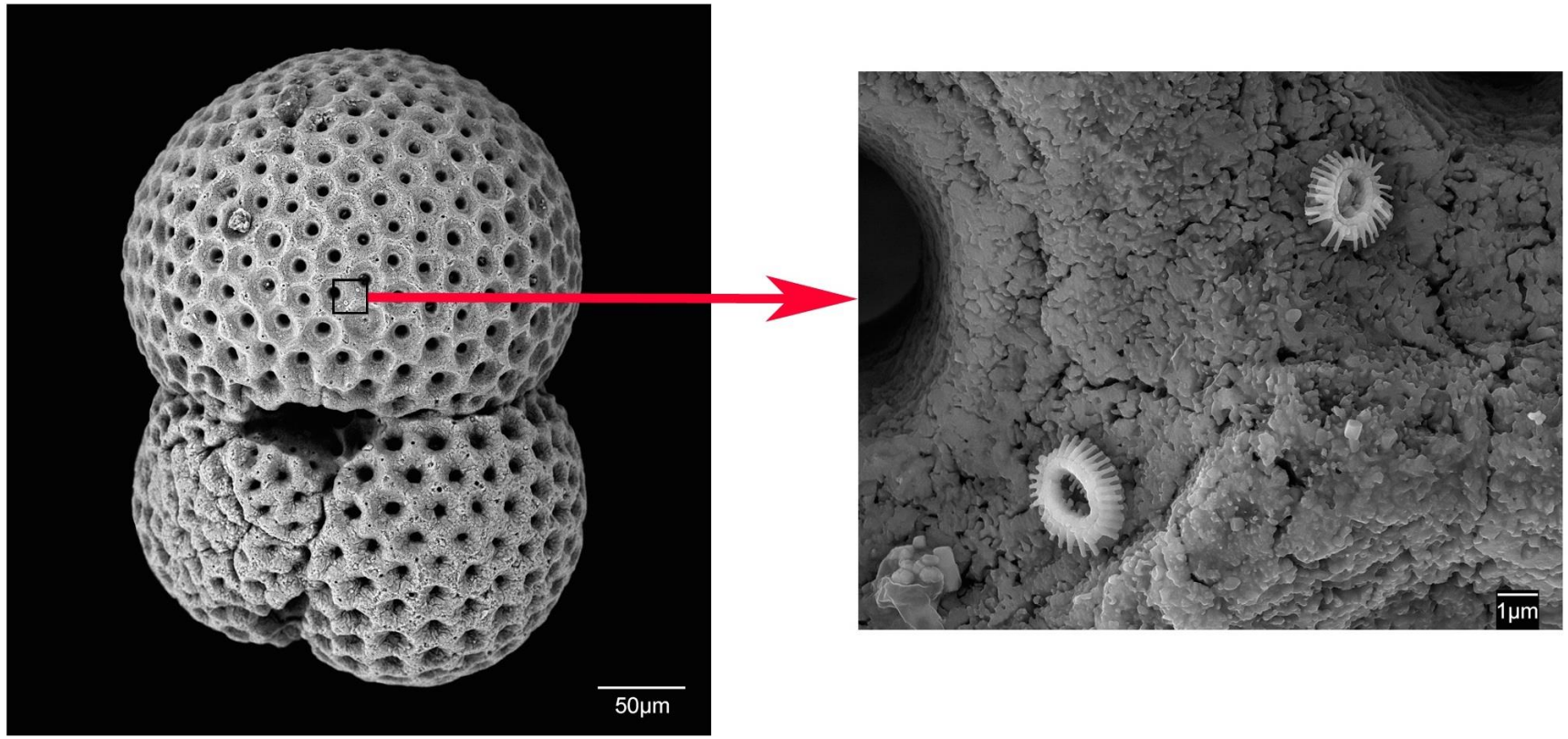
http://www.ldeo.columbia.edu/news-events/how-safe-hudson-scientists-test-river-adirondacks-ocean

Earth2Class: Dallas Abbot Feb 2017

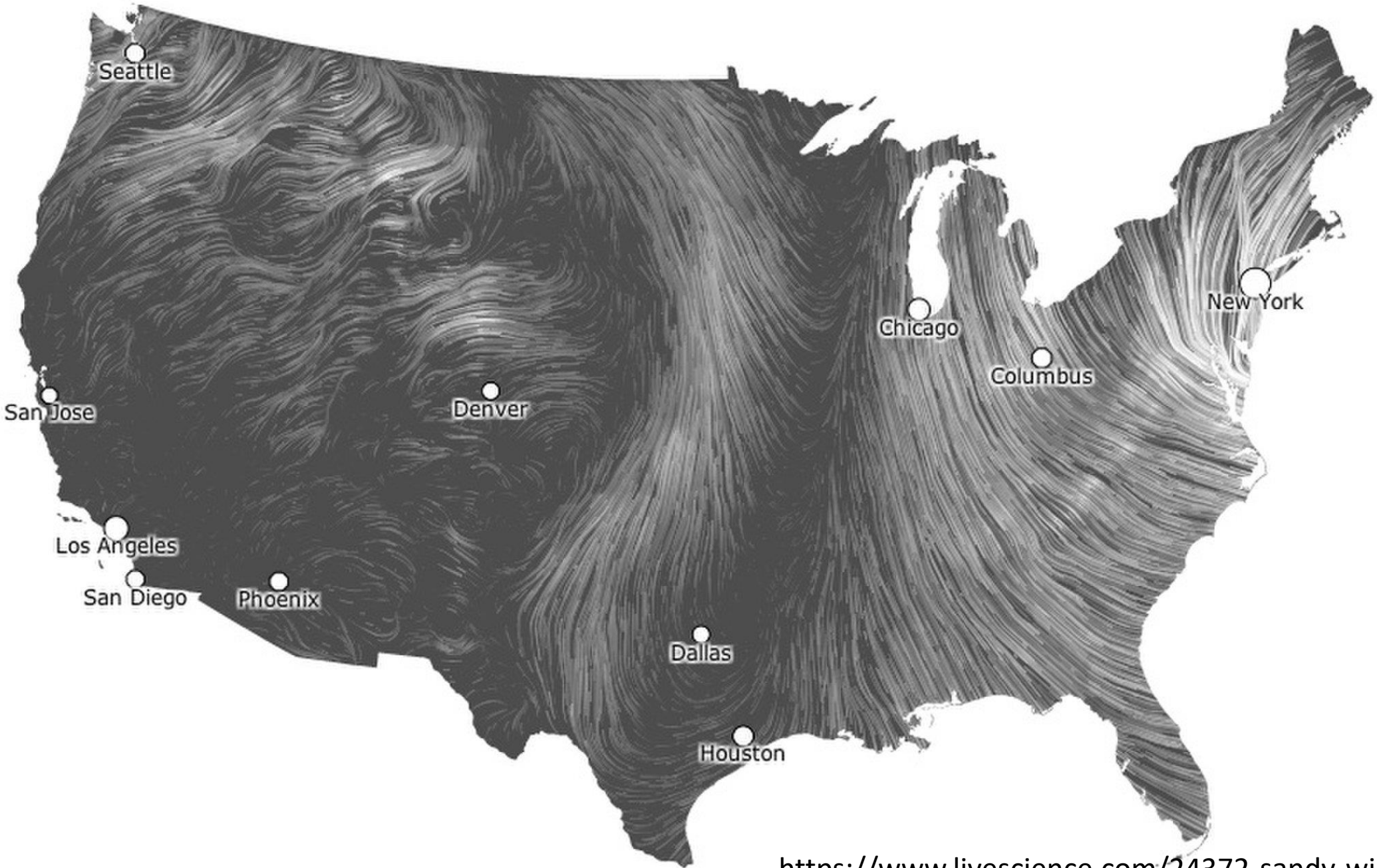
https://earth2class.org/site/?p=11793



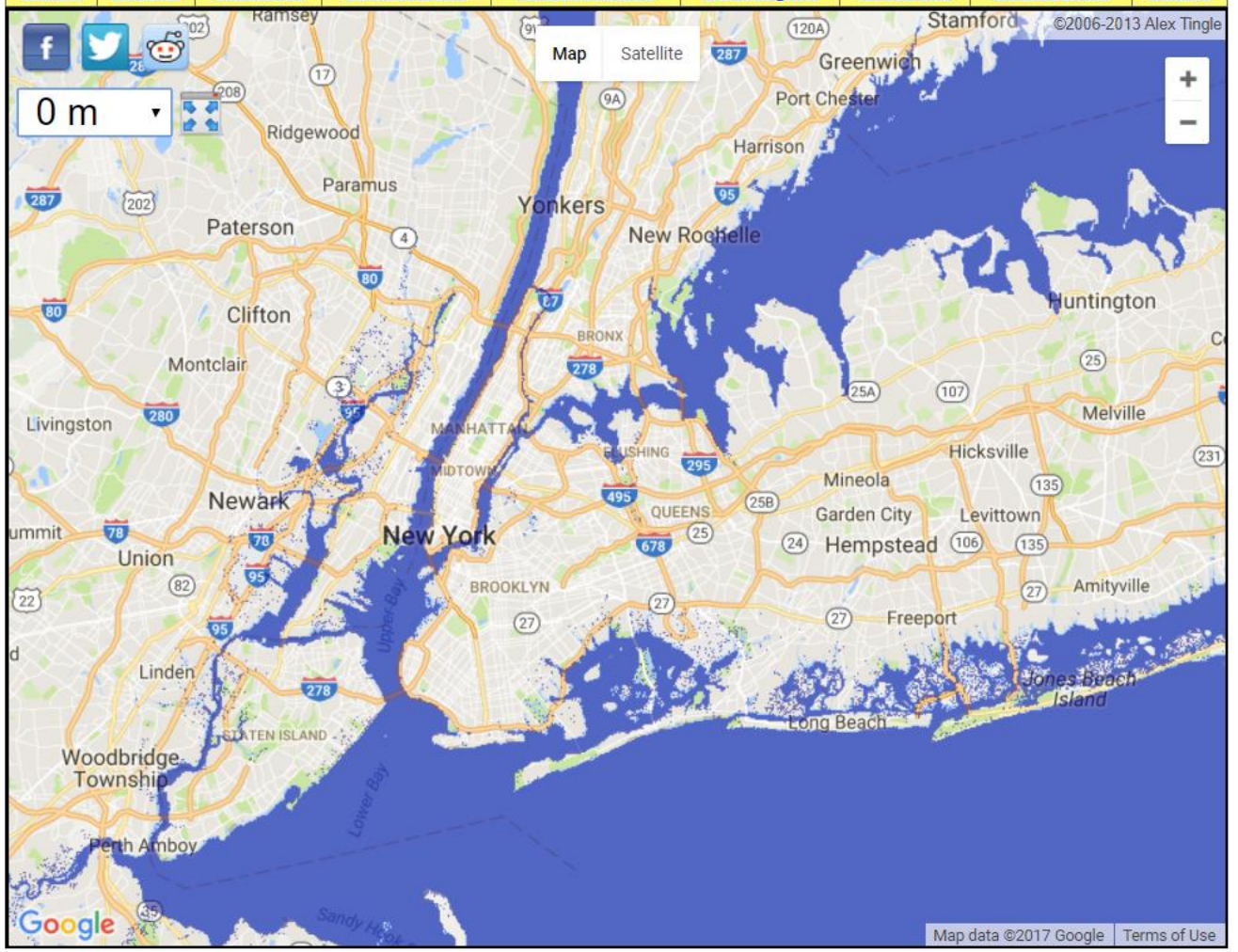
6) Severe Storms and Future Sea Level Rose



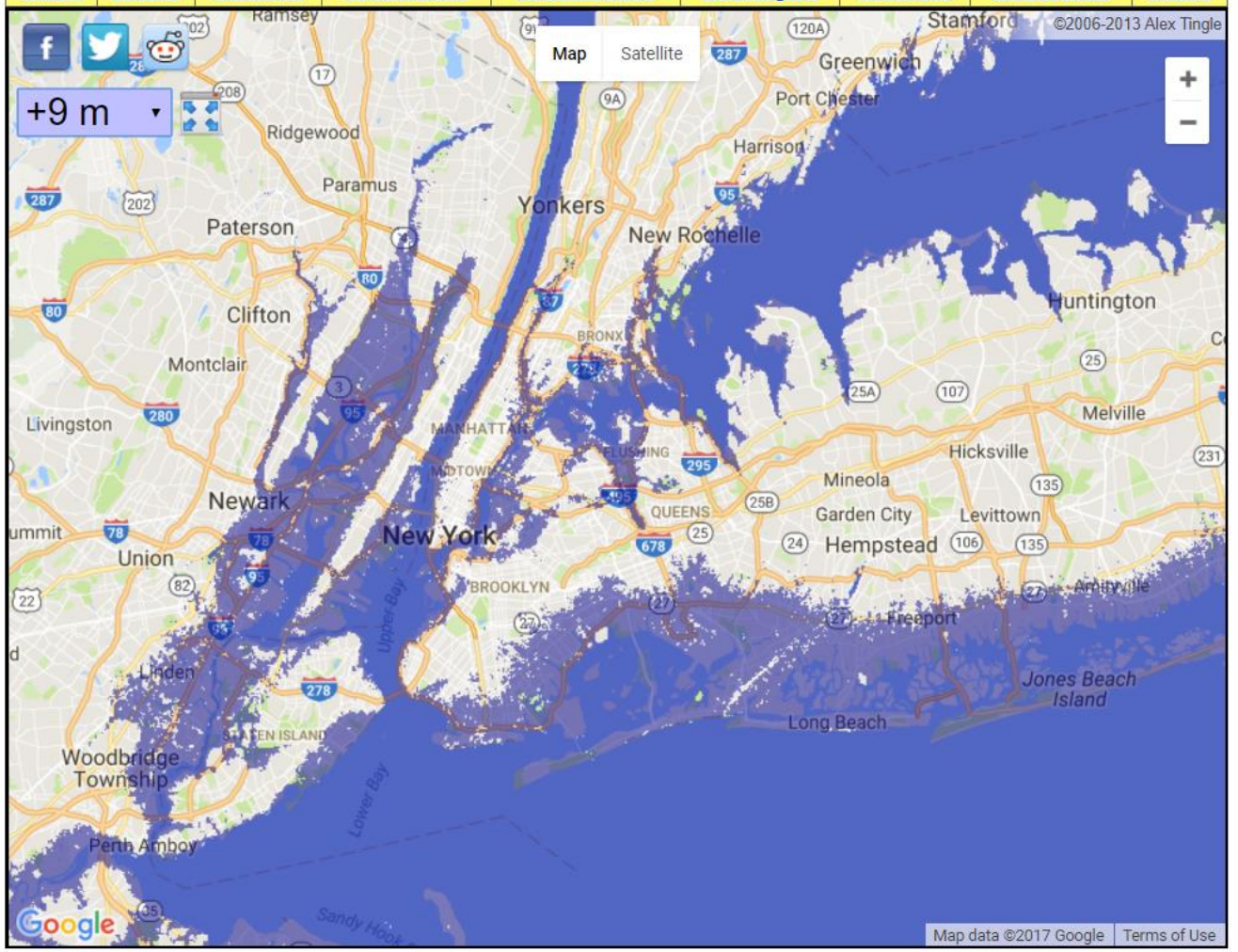
Marine forams and coccoliths found by Dallas Abbott in Hudson River sediments
https://earth2class.org/site/?p=11793



https://www.livescience.com/24372-sandy-wind-map.html



The map above shows areas of New York and New Jersey that would be flooded at various stages of sea level rise. You can select a value of sea level rise using the dropdown box in the



The map above shows areas of New York and New Jersey that would be flooded at various stages of sea level rise. You can select a value of sea level rise using the dropdown box in the

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