



CENTER FOR THE URBAN RIVER AT BECZAK

Estuary model video: <https://www.youtube.com/watch?v=jCKYg1NtBnI>

Link to student version of worksheets:

<https://www.centerfortheurbanriver.org/education/teachers/worksheets.pdf>

Link to student vocabulary list (all ages):

<https://www.centerfortheurbanriver.org/education/teachers/vocablist.pdf>

Hudson River Estuary Model Activity - Answer Key

Lower Elementary Level

1) What is the color of the Hudson River on the map?

RED

GREEN

BLUE

ORANGE

2) What animals do you think live inside of the Hudson River?

BIRDS

FISH

LIZARDS

LIONS

3) Draw some of your favorite Hudson River animals.

4) List some pollution you see in your neighborhood.

Plastic, litter, etc.

5) Draw a picture of YOU helping save the Hudson River from pollution!

Supportive Thinking Prompts:

Have you ever visited a river? Have you ever visited an ocean? What do these 2 waters look like? How are they similar? How are they different?

Standards:

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live

K-ESS3-3. Communicate solutions that will reduce the impact of humans on living organisms and non-living things in the local environment.

1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

Hudson River Estuary Model Activity Worksheet Answer Key

Upper Elementary Level

- 1) What states are found on the model of the lower Hudson River?
New York, New Jersey, Connecticut
- 2) The end of the Hudson River empties into another big body of water you may visit - the ocean! Which ocean does the Hudson River empty into?
Atlantic Ocean
- 3) What does it look like when Eli pours the first bucket of water into the model? Is it clear or cloudy?
Cloudy
- 4) What happens when Eli pours in the second bucket of water into the model?
The clear water mixes with the cloudy water.
- 5) What are some different kinds of water pollution you know about?
Plastic pollution, oil spills, litter, etc.
- 6) Can you think of any solutions that might reduce pollution in the Hudson River?
Recycling, reducing plastic use, oyster reefs, beach clean-ups
- 7) Do you know of any animals that live in the Hudson River? Draw them here.

Supportive Thinking Prompts:

What is freshwater and what is saltwater? What does the water from your home taste like? Have you ever accidentally gotten water in your mouth when visiting the beach?

How are these 2 waters different? How are these 2 waters similar?

Do you know of any animals that only live in saltwater? What about freshwater?

Standards:

5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Hudson River Estuary Model Activity Worksheet Answer Key

Middle School Level

- 1) What are some of the geographic features that are highlighted on the model?
Any of the following could be responses: The Hudson River; Atlantic Ocean; Palisade cliffs; state lines (New York, New Jersey, Connecticut); the Rockaways (peninsula); islands: Manhattan, Staten Island; the Hudson River watershed
- 2) Where do additional sources of water to the river come from?
Snow, rain, snowmelt, tributaries
- 3) What is the difference between the 2 buckets of water that are added to the model? What do these 2 types of waters represent?
One is clear and one is cloudy. The clear water is freshwater and the cloudy water is saltwater.
- 4) What is the definition of an estuary?
A place where a river meets the ocean. Where fresh and saltwater mix together.
- 5) How do tides impact the movement of water within the Hudson River?
High tide brings saltwater in from the ocean, and low tide brings fresh water back to the ocean
- 6) What happens during storm surges?
Water gets pushed from the river or ocean onto the land, by wind or tide or both.
- 7) What are some different ways litter and pollution move throughout our waterways?
Tides, waves
- 8) What can humans do to slow and stop pollution from getting into the waterways?
Recycle, reduce, reuse, beach clean-ups, don't litter, etc.

Supportive Thinking Prompts:

What happens to different animals that live in the estuary?

How can a marsh affect the different animals that live in an estuary?

Standards:

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms in a variety of ecosystems

MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the Sun and the force of gravity

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century

Hudson River Estuary Model Activity Worksheet Answer Key

High School Level

- 1) What are some of the different waterways that are shown in the model and how do they interact with one another?

Hudson River, empties into and mixes with the Atlantic Ocean. Sawmill River as a tributary of the Hudson. Bronx River as a tributary to the Long Island Sound/East River.

- 2) How does the watershed play a part in the movement of water from our freshwater system to the ocean system?

If water falls on the land as rain or snow, it enters tributaries which empty out into the Hudson, which eventually mixes with water from the Atlantic Ocean, forming brackish water for our estuary.

- 3) What is the influence of tidal change on the watershed? How is this tied to flooding?

The tide changes about every 6 hours in the lower Hudson watershed. That means that high tide brings more saltwater from the ocean, and low tide brings fresh water back towards the ocean twice a day. There is a 4-foot difference between high and low tide in Yonkers.

At high tide, some low-lying areas can be flooded at very high tide if they are at sea level. We see this in the video at the top of the model around Croton and also near the Atlantic Ocean in the Rockaways.

- 4) What are some ways pollution moves through the estuary system?

Pollution moves very easily throughout the water. Pollution that floats in the water moves especially quickly around the waterways, especially with tidal changes that bring the water around the Hudson River and back to the Atlantic Ocean. Pollution that's just on the ground, like litter, can also be brought into the estuary system by rain, wind, and runoff. Some pollution can even be flushed down toilets, like antibiotics or other medicines, which eventually ends up in the water as well.

- 5) What are some engineering measures we can use to prevent waterway pollution other than green infrastructure such as marshlands?

Answers can include: planting more plants on land, using bioswales, greenroofs, greenwalls, water catchment, pervious pavement all help to collect water from rain and runoff before it gets into the Hudson River. Other answers could include changing our infrastructure to get away from combined sewer overflows, coming up with ideas to trap microplastics in the water without harming animals, etc.

Supportive Thinking & Research Prompts:

How far up north does the tide bring the saltwater? What are some human made barriers that impact the natural flow of tide?

What is a salt wedge and what does it look like for the Hudson River? How can we calculate this?

How does animal anatomy and evolution help them to adjust to fluctuating salt levels throughout the estuary?

How have recent large storm systems impacted water throughout the river systems?

Standards:

HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in ecosystems.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity

HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features

HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems