

Lesson 3: The Changing Life of a Water Droplet

Objectives:

- Students understand the water cycle
- Students learn about water communities on Mannahatta
- Students understand the environmental importance of surfaces that can absorb water

Vocabulary: evaporation, transpiration,
perspiration, runoff

Materials:

- Modern Manhattan orthophotos*
- 1609 Mannahatta images*
- 1609 water images** and water cycle game cards**
- Chart of 1609 water cycle**
- Modern water images** and water cycle game cards**
- Chart of modern water cycle**
- 20 business-length envelopes
- Houseplant
- Brick + tray
- Paper cups + water pitcher



Students playing the water cycle game

New York State Elementary Learning Standards *Key Ideas* and *Performance Indicators*:¹

- Science *Key Idea MST4.PS2*: Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.
- Science *Performance Indicator MST4.E.PS2A*: Students describe the relationships among air, water, and land on Earth.
- Science *Key Idea MST4.LE7*: Human decisions and activities have had a profound impact on the physical and living environment.
- Interconnectedness: Common Themes *Key Idea MST6.ST1*: Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

[Classroom/materials prep: This lesson requires about 20 minutes of materials prep. Tape the ten 1609 water images to ten of the envelopes; then cut the ten sets of 1609 game cards into strips, and place each set of strips into the corresponding envelopes; finally, tape all ten envelopes up around the classroom. Next, tape the ten modern water images to the other ten envelopes; cut the ten sets of modern game cards into strips, and place each set of strips into the corresponding envelopes; save these to tape up in between the two games. Finally, fill up the pitcher of water.]

Introduction: Mannahatta map review

(5 minutes)

Pass out orthophotos of modern Manhattan and images of Mannahatta 1609. Review the differences students discovered between the images in the introductory lesson. Review the fact that Manhattan is an island situated in an estuary. Review the habitats students identified on Mannahatta, using the legend, asking students to pay

¹ From www.nylearns.org/standards. NY State learning standards encompass standards, key ideas, performance indicators and major understandings.

* These images are the same as the ones used in the introductory lesson.

** All images/materials are available on our website, at www.wcs.org/mannahatta. Images can be printed out in color or black and white.

special attention to watery habitats. Tell students that today we are going to learn about water on Manhattan island – both 400 years ago and today.

Discussion: The water cycle

(10 minutes)

What do you know about the water cycle? What are the three different forms water can take? (Liquid, solid, gas.) Where can you find these forms? (Snow, ice, lakes, clouds, water fountains, etc.) What needs water to live? How do plants take in (absorb) water? (Through their roots.) How does water leave plants? (*Transpiration/evaporation*.) How do people and animals take in water? (We drink it!) How does water leave people and animals? (Peeing, *perspiration/evaporation*.) Is there a certain set amount of water on earth, or can we make new water? (There is only a certain set amount on earth that constantly gets cycled around).

Activity: Mannahatta 1609 water cycle game

(10 minutes)

Remind students of the different water habitats they found on the Mannahatta 1609 image. Now explain to students that they are going to pretend they are water drops, and we are going to see how they traveled through the water cycle of Mannahatta. Ask students to look around at the different envelopes representing different water sources on Mannahatta. Model for students how to play game. Tell them to move to a water source (2-3 students at each one), and begin playing! After 5-8 minutes, ask them to sit down. Ask them for their experiences as a water drop, and draw a diagram on the board that tracks some of their movements. Show them the chart of the Mannahatta water cycle so they get a sense of the whole cycle.

Activity: Modern Manhattan water cycle game

(10 minutes)

Ask students to look again at the orthophoto of modern Manhattan. 400 years ago there were not very many people living on Mannahatta. Do a lot of people live here today? What do we use water for besides drinking? (Flush down the toilets and carry sewage away, watering gardens, putting out fires, cooling our houses and factories, etc.). Where did the Lenape people get their water? (Sources on Mannahatta, including the Collect Pond, springs and streams.) Where does our water come from? (The watersheds in New York State including the Delaware/Catskill and Croton watersheds.) Do you think the way water has moved around the island has changed a lot in the past 400 years? (As you discuss, replace the 1609 set of envelopes/game cards with the modern set of envelopes/game cards.) Ask students to look around at the water sources on Manhattan today. Which are the same? Which have changed? Tell students to play the game a second time. After 5-8 minutes, ask them to sit down. What were their experiences this time? How were they different than before? Show them the chart of the Manhattan water cycle so they get a sense of the whole cycle.

Discussion: Runoff

(5 minutes)

Take another look at the two images: one of Manhattan today, and one of Mannahatta, 400 years ago. Where were some of the places the water went when it rained on Mannahatta? When it rains on Manhattan today, where do you think the water goes? (All the grey on the modern map is buildings and streets.) Are there still streams and ponds and wetlands where the water can collect and flow? Not really – so where does all that water go? (Into storm drains, through water treatment plants, and out into the harbor.) Demonstrate this by placing a brick in a tray and asking a student to pour water over the brick. Does the brick absorb the water, or does it run off? Next, ask another student to pour water into a houseplant. Does the dirt absorb the water, or does it run off?

What problems might this *runoff* cause for the environment? (One: it causes flooding because the water can't be absorbed and moves so much faster; two: when the water mixes with pollutants on the street, those pollutants are

carried into the harbor if the amount of water overwhelms the water treatment plant.) So what could we do to reduce water runoff? (Create more places in the city that can absorb water – like restored wetlands, green roofs, etc.)

Wrap-up: a toast!

(5 minutes)

Pour a small amount of water in each paper cup, and give one to each student. Ask students to think about how far this water traveled to get to them today, and all the different experiences it might have had along the way. Ask for a volunteer to make a toast, and drink your water! Thank students and collect materials.

Extension activities:

- Measure what percentage of your school/schoolgrounds is permeable.
- Turn an impermeable surface at your school into a permeable surface!
- Write a story describing your journey as a water droplet. Since we have essentially the same water on earth now as when the earth began, the story could follow the water droplet through both space and time, from 400 years ago to the present.
- Map the places water flows in your neighborhood, including storm drains, sewers, and pipes that feed your school, in order to figure out how the water cycle works locally.