

**LESSON****Setting the Stage**

Introduce students to the case study goals and Sujay Kaushal, the scientist who conducted the research.

**What We Are Hoping For: Learning Goals**

- Human Impact
  - A, B, C
- Runoff
- Nature of Science
  - A, B, C, D

**Learning Goals:**

- Engage students in the Baltimore case study
- Science begins with questions
- Science is a human endeavor

**CHECKLIST****Setting the Stage**

In this lesson, students will:

- Be introduced to the case study goals and Dr. Sujay Kaushal, the scientist who conducted the research. (5 min)
- Access prior knowledge about the relationship between winter and the use of road salt. Discuss previous snowy winters and the relationship with road salt. (5 min)
- Watch the Science Bulletin: *Winter Roads Make Salty Streams*. (5 min)
- Hear and see more information about snowy and icy roads in Baltimore from the slideshow. (7 min)
- Watch the video profile of Dr. Sujay Kaushal. (5 min)
- Discuss the motivation for Dr. Sujay Kaushal's research. (5 min)
- Discuss how to test Dr. Kaushal's research question. (8 min)
- Complete the *Setting the Stage* section in the Investigation Booklet. (5 min)

(Times indicated are approximate.)

**LESSON PLAN****Setting the Stage – Introduction**

Introduce students to the case study goals and Dr. Sujay Kaushal, the scientist who conducted the research.

In this unit, we are going to discuss a case study of scientific research that has been published in a peer-reviewed journal. The goals of this unit are to:

- Learn about real scientists and their stories—what motivates them, how and why they ask questions, and what type of data or evidence they collect to address their questions.
- Connect your daily life activities to ecological function.
- Connect disruptions in ecological function to environmental issues.

Along the way, we will learn about some concepts that are relevant for understanding the case study. We will begin by looking at the work of Dr. Sujay Kaushal, a young scientist living in Maryland. Dr. Kaushal became interested in learning how snow and ice in the Baltimore area might affect the area's water supply.

Before we discuss his research, let's talk about what you already know about snow to understand why Dr. Kaushal thought this was an interesting question.

## Accessing Prior Knowledge About Snow and Salt

Introduce the unit by accessing student prior knowledge about snow and salt.

### Discussion:

**Key Idea: Snow interferes with daily life, so humans use salt to limit its interference.**

**Question:** What are your experiences with snow in NYC?

**Answer:** The snow piles up, over time becomes dark and dirty, and stays like that until it melts away down storm drains.

**Question:** What does the City look like during a snowstorm? After a snowstorm?

**Answer:** The City is covered with snow. It is very hard to get around. Slowly life gets back to normal.

**Question:** How do people deal with snowy and icy roads or how do people help life get back to “normal”?

**Answer:** The streets are plowed, sidewalks shoveled, and sand and salt is put on roads and sidewalk.

**Question:** Why is salt used on roads?

**Answer:** Salt helps to melt the snow because it lowers the freezing point of water (see the Teacher Tip on colligative properties for more information).

### Teacher Tip

Salt is used to clear roadways of ice and snow because it lowers the melting point of ice. This way even if it is cold outside, the snow/ice will still melt.

For a lab on colligative properties go to: <http://formontana.net/icewater.html>

## **Winter Roads Make Salty Streams**

Show students the *Winter Roads Make Salty Streams* Science Bulletin to introduce students to the case study.

### **Introduction**

“This *Science Bulletin*, *Winter Roads Make Salty Streams* that we are about to watch is based on the scientific research of Sujay Kaushal. He was interested in understanding if the salt we put on roads to melt snow and ice ends up in streams. We will be exploring the work reported in this *Bulletin* over the next week or so.”

### **Questions for Thought**

Ask students to write down any questions they have about the research *Bulletin*. Collect these questions and after class write the questions on a piece of chart paper that can be easily seen during the course of the unit.

**Note:** Refer to these questions throughout the unit and check off any questions that are answered along the way.

## **Baltimore Winters, Snow and Salt**

Use the prepared *Setting the Stage* slideshow to provide more information about Baltimore winters.

### **Discussion**

**Key Idea: Baltimore and the Northeast receive high amounts of snowfall. These areas use road salt to help melt the snow and ice.**

Use the prepared slideshow to provide background on snow in Baltimore.

Some key background Information:

- The Northeast uses the largest amounts of salt during winter months due to high incidence of snow and ice and high population density.
- A little more than 18 inches of snow falls annually in the Baltimore area. The area also gets freezing rain or sleet a few times a year. All of that snow makes it hard for people to get around and can lead to car accidents.
- In the winter of 2009-2010, 80.4 inches of snow fell on Baltimore.
- Salt is used to melt snow and ice to make winter safer in Baltimore and other areas.

**Scientist Profile: Dr. Sujay Kaushal**

Watch the video profile now that the students know a little more about Baltimore and Dr. Kaushal's research. Ask students to write any questions that they have while watching the video.

**Discussion**

Use the video profile of Dr. Kaushal's story to connect the unit with the motivation for the research and to remind students that this case study is based on REAL scientific data.

**Key Idea: Science is a human endeavor.**

**Question:** As you watch the video of Dr. Kaushal, think about his research and what characteristics make him a scientist?

**Answer:** Analytical, ability to do research, observant, open-minded, aware, smart/intellectual, curious

**Question:** What motivated Dr. Kaushal to do this type of research? Why was he interested in the water in the streams? What does the river mean to him?

**Answer:** Dr. Kaushal felt connected to streams and water since his early childhood in rural Tennessee when he hiked his local stream to discover its headwaters. As an adult, he began to look more closely at the power of stream water. He saw how even small streams can move large items such as motorcycles, which caused him to begin to think about how water moves other smaller materials like salt into streams and rivers.

**Question:** What questions did you have while watching the video?

**Answer:** Answers will vary.

## How Can We Test Whether Road Salt is Entering the Water Supply?

Engage students in a discussion on how to test the relationship between roads and the amount of salt found in area streams.

### Discussion

#### Key Idea: Salt enters water systems through runoff.

**Question:** Now with a better understanding of Dr. Kaushal and his work, how might you test to see if salt added to roadways after snowstorms enters the water supply?

**Answer:** Answers will vary, but should include testing water supplies before and after salting of roads.

**Question:** If salt enters water sources, how would you expect stream water in an area with a lot of roads (like New York City) to compare to stream water in an area like a forest without any roads?

**Answer:** Streams in areas with more roads will be saltier than streams in areas without roads. (Shorthand: More roads → More Salt)

**Question:** Why?

**Answer:** Salt is used to melt snow and ice on roadways, so more salt will have to be used in areas with more roadways. This salt will then dissolve into the melt water and runoff into local area streams.