

# Global Watershed Spring Unit Overview

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**Unit Title:** Groundwater and Biogeochemical Connections

**Target Grade Level:** 8<sup>th</sup> grade Earth Science

**Content Standards Addressed** (in order):

E1.2A	Critique whether or not specific questions can be answered through scientific investigations.
E1.2B	Identify and critique arguments about personal or societal issues based on scientific evidence.
E1.2D	Evaluate scientific explanations in a peer review process or discussion format.
E4.p1D	Explain the types, process, and beneficial functions of wetlands.
E4.1A	Compare and contrast surface water systems (lakes, rivers, streams, wetlands) and groundwater in regards to their relative sizes as Earth's freshwater reservoirs and the dynamics of water movement (inputs and outputs, residence times, sustainability).
E4.1C	Explain how water quality in both groundwater and surface systems is impacted by land use decisions.
E2.2F	Explain how elements exist in different compounds and states as they move from one reservoir to another.
E2.3A	Explain how carbon exists in different forms such as limestone (rock), carbon dioxide (gas), carbonic acid (water), and animals (life) within Earth systems and how those forms can be beneficial or harmful to humans.
E2.3D	Explain how carbon moves through the Earth system (including the geosphere) and how it may benefit (e.g., improve soils for agriculture) or harm (e.g., act as a pollutant) society.

## **Learning Objectives for the Unit:**

Students will be able to:

- I. Describe where groundwater is located in their watershed.
- II. Describe the impact of land use decisions on groundwater quality.
- III. Develop an independent scientific investigation to identify the source of a pesticide contamination in a fictional town's groundwater reservoir.
- IV. Describe the benefits of wetlands in a watershed and identify the major wetland types in Michigan.
- V. Develop a scientific research poster explaining the major features of one type of wetland in Michigan.
- VI. Present results of a scientific investigation in a short (3 minute) poster presentation.
- VII. Describe the characteristics and functions of at least three different wetland types in their local watershed.
- VIII. Describe the different processes involved in the global carbon cycle.
- IX. Diagram the flow of carbon through the biosphere, atmosphere and lithosphere using props.

**Table of Lessons:**

Lesson Number	Lesson Title and Brief Description	Learning Objectives	Content Expectations	Materials Needed	Duration (periods)
1	Groundwater and Contaminants	I	E4.1 C	Powerpoint, Handouts	2
2	Fruitvale Investigation	II, III	E1.2 A,B,D	Powerpoint Handouts Fruitvale Activity Materials	3
3	Michigan's Wetlands	IV, V	E4.p1 D	Powerpoint, Handouts	1
4	Wetlands Poster Presentations	VI, VII	E4.p1 D	Posterboard, Internet, Printer, Construction Paper, Markers	6
5	Carbon Cycle Video	VIII, IX	E2.2 F E2.3 A,D	Handouts, Internet, Projector, MS Office, Video Cameras	5

### **Brief Summary of Unit:**

This unit will cover the groundwater and biogeochemical aspects of the Earth Science curriculum through a mixture of inquiry based teaching methods, small group activities, independent scientific investigations, and novel presentation styles. We will integrate a small group or independent thinking activity into each lesson. In addition, students will be tasked with producing a product for each lesson, which demonstrates their knowledge.

Lesson 1- First, students will review what constitutes groundwater and where they can find groundwater in their local watershed. Students have previously discussed groundwater and how land use decisions may affect groundwater quality. Here students will go into more detail about the location and source of groundwater in the local watershed. Students will focus on learning about potential contaminants in their groundwater and how these contaminants may spread in the groundwater. This will set the students up with the background knowledge they will need to complete the Fruitvale activity in upcoming lessons.

Lessons 2- In this lesson, students will complete an investigation into a contaminated aquifer using a fictional activity from a company called SEPUP. In the activity students are given the background information on a pesticide spill in a fictional town. Students are offered samples of groundwater from a series of wells spread out through the town. The students develop a hypothesis about the source of the spill (i.e., a factory, gas station, housing development, etc). Students choose wells to test and use those results to model the pesticide plume in the town. Students will work in pairs on this activity.

Lesson 3- Students will be introduced to the different types of wetlands in their local watershed. They will also learn the vital functions these wetlands perform in their watershed.

Lesson 4- Students will be assigned into groups of two to investigate a specific wetland type in the United States (i.e., salt marsh, vernal pool, fen, bog, marsh, etc.). Students will perform research on their wetland and prepare a scientific poster educating other members of the class on their wetland type. Students will learn about how scientists use posters at conferences to communicate their research and to gain feedback on their ideas. Students will present their poster in a short (3 minute) oral presentation summarizing their main results. Students may also be asked to present their posters to other grades in the school.

Lesson 5- Students will learn about the importance of carbon in the lithosphere, hydrosphere, biosphere, and atmosphere. They will review the global carbon cycle and the various forms of carbon in the cycle. To ensure complete understanding of this cycle, students will be tasked with developing a short (5 minute) presentation explaining the carbon cycle. This presentation must be creative and can be in any form the students choose (i.e., rap, skit, song, interpretive dance, stop-motion video, or other).

**Unit Assessment:** The objectives of the unit will be assessed through a number of products completed throughout the semester. As a whole, the unit will be assessed through exam questions at the end of 2 marking periods.

Lesson 1: Verbal assessment through questions outlined in the lesson.

Lessons 2: Scientific report explaining the methodology and results of the Fruitvale investigation in the form of a formal scientific report.

Lesson 3: Verbal assessment through questions outlined in the lesson.

Lesson 4: Scientific poster preparation and presentation.

Lesson 5: Carbon cycle video presentation.

### **How this unit relates to my graduate research:**

As an ecologist, I am interested in the relationship between organisms and their environment. My work focuses on studying how organisms respond to changes or alterations in their immediate environment. I am also passionate about the conservation of reptiles and amphibians. Freshwater resources are of utmost importance to the conservation and sustainability of herpetofauna, particularly to amphibians. Considering that freshwater resources represent a small percentage of the water available on Earth, it is vital that we conserve and educate others about water conservation. My dissertation research is focused on the intersection between these two interests. I study the impact that chemical road deicers (e.g., road salt and others) have on both larval and adult amphibian species in the local area. Sodium chloride is applied heavily in cold climates of North America and the negative environmental impact from this application is only now being realized. Numerous alternative chemicals are being pushed as 'environmentally friendly' alternatives to sodium chloride without proper testing to warrant this label.

My research is well suited for integration into a classroom setting. My research organisms are those that most students are likely to be familiar with. In addition, all students are familiar with road salt as we live in an area of heavy snowfall. Through the lessons outlined above I hope to raise awareness as to the value of our local freshwater sources. Conservation of these is important for humans as well as a number of wildlife species. The school district I am assigned to is also in a rural area where most students get their household water from a well. Thus, the understanding of groundwater and the impacts of land use activities on its quality is of vital importance to these citizens.

In the classroom I hope to serve as both a mentor as well as an educator. I would like students to observe what a scientist actually does and help them realize that they too can pursue a career in the STEM fields. Students often think of scientists as characters they have seen in movies or on television. They are surprised to learn that there are many different kinds of scientists doing unique types of research. I hope to show them the more applied side of science. For example, when we perform the investigation into a fictional pesticide spill, students are excited to be in charge of this study knowing that their decisions will help to protect the townspeople. I will integrate this aspect of science into any lesson in which it is appropriate. Lessons will focus on real world application of water conservation. In addition, wherever possible I will bring this into the explanation of the justification for each lesson.

Scientific communication is also a major lesson at the middle school level. Through the completion of scientific reports, students will learn how to present their data using graphs as well as how to draw conclusions from that data. Students will also present independent research projects in the form of MS Powerpoint presentations and as a scientific poster. These methods of communication will help students to understand the various aspects of scientific communication. They will gain experience in using written,

oral, and graphical forms of data presentation that many different kinds of scientists use in their own research.

**Additional Resources:** (See table above)

MEEC Water Quality Lessons

MEEC Land Use Lessons

MEEC Ecosystems and Biodiversity Lessons

MEEC online 'Tech Alive' presentations and animated presentations  
([techalive.mtu.edu/meec\\_index.htm](http://techalive.mtu.edu/meec_index.htm))