Unit 3: Biogeochemical Cycles
Environmental Science

13 Class Meetings

Rev. June 2019

Essential Questions

- How can human activities impact the nitrogen and carbon cycles?

Enduring Understandings with Unit Goals

EU 1: Water is an essential compound for life and is cycled through Earth's systems.
- Describe the process and importance of the hydrologic cycle.

EU 2: Nitrogen is an essential nutrient for life that is cycled through Earth's systems
- Describe how nitrogen cycles through the Earth's system and where it is used and stored.

EU 3: Carbon cycles through Earth systems and is impacted by human activities.
- Describe how carbon cycles through the Earth's systems.
- Analyze how human activities have impacted the carbon cycle.

Standards

Next Generation Science Standards
- **HS-ESS3-6**: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
- **HS-ESS2-6.** Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

Common Core State Standards
- **CCSS.ELA.CONTENT.WHST.9-12.9** Draw evidence from informational texts to support analysis, reflection, and research.
- **CCSS.ELA.CONTENT.RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account
- **CCSS.MATH.CONTENT.MP.2** Reason abstractly and quantitatively.
- **CCSS.MATH.CONTENT.MP.4** Model with mathematics.
- **CCSS.MATH.CONTENT.HSS.IC.B.6** Evaluate reports based on data.

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MSMHS Academic, Civic and Social Competencies

Competency 1. Read and write effectively for a variety of purposes.
Competency 2. Speak effectively with a variety of audiences in an accountable manner.
Competency 3. Make decisions and solve problems independently and collaboratively.
Competency 4. Apply scientific knowledge and concepts to a variety of investigative tasks.
Competency 5. Contribute to a positive learning environment with respect and responsibility.

Unit Content Overview

- Unit Phenomena (such as Earth's climate)
- Hydrologic cycle
- Runoff
- Nitrogen cycle
- Algal blooms
- Dead zones (hypoxia)
- Properties of nitrogen
- Nitrogen sinks
- Human impacts on the nitrogen cycle
- Carbon cycle
- Carbon sinks
- Properties of carbon
- Human impacts on the carbon cycle
- Greenhouse effect and global climate change

Interdisciplinary Connections

- Marine Studies I- nitrogen cycle
- Biology- biosphere

Learning Objectives with *TWPS Activities*

Students will be able to…

- Design a model that predicts the climate of the Earth in the future.
    - *Explain how does evidence about Earth's past help scientists predict future changes.*
- Identify and describe the processes involved in the hydrologic cycle.
    - *Describe the process or processes associated with the water cycle that is responsible for helping to clean or filter the water?*
- Describe the importance of nitrogen in the biosphere

- *In your opinion, explain which is more important for the survival of the planet, the nitrogen cycle or hydrologic cycle?*

- Identify sinks and sources of nitrogen on Earth, and describe the steps of the nitrogen cycle.
  - *Read and annotate the articles "Hypoxia in Long Island Sound" and "Nutrient Reduction: New Solutions to Old Problems". Explain how did the one region of Long Island Sound improve its water quality on the report card?*
- Explain the causes of fish die-offs, toxic water crises, and algal blooms.
  - *Refer back to the unit phenomena. Analyze the diagram about the "Red Tide" algae bloom in the Gulf of Mexico. Explain how this algae bloom can impact Earth's future climate.*
- Investigate and analyze changes to human activities that reduce humanity's impact on the nitrogen cycle.
  - *Describe the various changes that humans can make to prevent the forming of harmful algae blooms.*
- Identify sinks and sources of carbon on Earth, and describe the steps of the carbon cycle.
  - *Analyze the before and after pictures of coral in the Great Barrier Reef in Australia. Referring back to the unit phenomena, explain how the coral has changed over time.*
- Describe the role of carbon in the greenhouse effect.
  - *Based off the information that has been covered this unit, explain what evidence scientist have collected to support that Earth's climate has changed.*
- Analyze changes in human activity that have impacted carbon in Earth's atmosphere over the last 200 years.
  - *Scientist have measured the growth in tree rings every year. Suppose a tree ring was 2 mm in 1961 and 20 mm in 2000. Explain why the growth of the tree in 2000 was 10 times more than in 1961.*
- Identify how changes in the carbon cycle have impacted the global climate.
  - *Based off the precipitation rates and temperature rates collected from 1960 and today, describe how those rates will change 50 years from now.*
- Analyze the pros and cons of possible changes that could be made to human activities to reduce the impact of carbon on the global climate.
  - *In your opinion, describe the most important change that humans need to make to reduce carbon emissions, in order to help climate change.*

Instructional Strategies/Differentiated Instruction

- **HLP:** Academically Productive Talk
- **HLP:** Writing to Learn (TWPS)
- **HLP:** Effective Feedback

- Power Point Lecture with note-taking
- Guided note-taking
- Warm up activities
- Flexible grouping
- Independent reading
- Foldables
- Exit slips
- Graphic Organizers
- Creating authentic connections for students
- Vocabulary word bank
- Rephrasing and restatement of information and concepts
- Tiered instruction
- Alternative test settings
- Student use of headphones
- Student-led instruction
- Homework assignments

Assessments

FORMATIVE ASSESSMENTS:

- Is The Climate Changing Where We Live? Scientific Poster
  - MSMHS Rubric 4: Scientific Research
- Warm Up activities
- Homework
- Accountable Talk Discussion
- Daily Think-Write-Pair Share (TWPS)
- Exit slips
- Warm up activities
- Oral questioning
- Guided notes

SUMMATIVE ASSESSMENTS:

- Quiz on EU 1 and EU 2
- Quiz on EU 3
- Is the Climate Changing Where We Live? Scientific Poster
- Biogeochemical Cycles Booklet
- Unit Test

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Unit Task

Unit Task Name: Is the Climate Changing Where We Live? Scientific Poster

Description: Students will use information from this unit about the cycling of matter through Earth's system, including the Hydrologic Cycle (EU 1), Nitrogen Cycle (EU 2) and the Carbon Cycle (EU 3), as well as human impacts to these cycles (EU 1) to investigate if the climate is changing in Connecticut. Students will then create a scientific poster according to the MSMHS school-wide rubric.

Evaluation: MSMHS Rubric 4: Scientific Research

Unit Resources

- Textbook (Environment Science. Jay Withgott, Pearson Education, Inc. 2011.)
- MSMHS School-wide Rubrics
- Internet databases
- BrainPop: Carbon Cycle, Nitrogen Cycle
- POGIL: Nutrient cycles
- POGIL: Global Climate Change
- Data Nuggets
- Microsoft Power Point or Prezi, Microsoft Publisher
- Laptops