

# 02 Dynamic Earth Systems

Content Area: **Science**  
Course(s):  
Time Period: **Full Year**  
Length: **5 weeks**  
Status: **Published**

## **General Overview, Course Description or Course Philosophy**

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Environmental Science covers major environmental topics such as acid rain, global warming, pollution, and renewable and non-renewable energy sources. The interdependence of earth's systems, the human population, the loss of biodiversity and the trade-offs between the environment and society will be studied. The course includes laboratory and field investigations.

## **OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS**

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In this unit of study, planning and carrying out investigations, analyzing and interpreting data, developing and using models, and engaging in arguments from evidence are key practices to explore the dynamic nature of Earth systems. Students apply these practices to illustrate how Earth's interacting systems cause feedback effects on other Earth systems, to investigate the properties of water and its effects on Earth materials and surface processes, and to model the cycling of carbon through all of the Earth's spheres. Students seek evidence to construct arguments about the simultaneous co-evolution of the Earth's systems and life on Earth. The crosscutting concepts of energy and matter, structure and function, and stability and change are called out as organizing concepts for these disciplinary core ideas.

## **CONTENT AREA STANDARDS**

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SCI.HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
SCI.HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
SCI.HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
SCI.HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
TECH.9.4.12.CT	Critical Thinking and Problem-solving
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
TECH.9.4.12.CT.3	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).

## **RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)**

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Reason abstractly and quantitatively. (HS-ESS2-2), (HS-ESS2-6) **MP.2**

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS2-2), (HS-ESS2-6)

### **HSN.Q.A.1**

Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS2-2), (HS-ESS2-5), (HS-ESS2-6) **HSN.Q.A.3**

Model with mathematics. (HS-ESS2-6) **MP.4**

Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS2-6) **HSN.Q.A.2**

LA.RL.11-12.1	Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
LA.RL.11-12.2	Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; provide an objective summary of the text.
LA.RI.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
LA.RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

## **STUDENT LEARNING TARGETS**

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### **Declarative Knowledge**

Students will understand that:

- Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.
- The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.
- Feedback (negative or positive) can stabilize or destabilize a system.
- The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics.
- The properties include water's exceptional capacity to absorb, store, and release large amounts of energy; transmit sunlight; expand upon freezing, dissolve and transport materials; and lower the viscosities and melting points of rocks.
- Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen.
- Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.
- The total amount of energy and matter in closed systems is conserved.
- The total amount of carbon cycling among and between the hydrosphere, atmosphere, geosphere, and

biosphere is conserved.

- The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.

## **Procedural Knowledge**

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Students will be able to:

- Analyze geoscience data using tools, technologies, and/or models (e.g., computational, mathematical) to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
- Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- Develop a model based on evidence to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
- Develop a model based on evidence to illustrate the biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere, providing the foundation for living organisms.
- Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth

## **EVIDENCE OF LEARNING**

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### **Formative Assessments**

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Homework

Notes

Demos

Do-Now

Labs/Experiments/Projects

Activities

Video clips/animations

## **Summative Assessments**

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- Benchmarks – departmental benchmark given at the end of MP1, MP2, and MP3
- Alternative Assessments
  - Lab inquiries and investigations
  - Lab Practicals
  - Exploratory activities based on phenomenon
  - Gallery walks of student work
  - Creative Extension Projects
  - Build a model of a proposed solution
  - Let students design their own flashcards to test each other
  - Keynote presentations made by students on a topic
  - Portfolio

## **RESOURCES (Instructional, Supplemental, Intervention Materials)**

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Talk to CP Environmental Science teacher about shared resources.

Global Science by Christensen and Christensen

Biozone - Earth and Space Science NGSS

## **INTERDISCIPLINARY CONNECTIONS**

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Life Sciences

Physical Science

Chemistry

Mathematics

## **ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS**

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See link to Accommodations & Modifications document in course folder.