Secaucus Board of Education

Environmental Studies

Course Code: 4331

Science Department

Born on August 2016

Aligned to the NJSLS – Science (2014), Technology (2014), 21st Century Life and Careers (2014), ELA (2016) and Mathematics (2016)

Adopted by the Secaucus Board of Education on August 25, 2016

District Equity Statement

The Board of Education directs that all students enrolled in the schools of this district shall be afforded equal educational opportunities in strict accordance with the law. No students shall be denied access to or benefit from any educational program or activity or from a co-curricular or athletic activity on the basis of the student's race, color, creed, religion, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, gender identity or expression, socioeconomic status, or disability. The Board directs the Superintendent to allocate faculty, administrators, support staff members, curriculum materials, and instructional equipment supplies among and between the schools and classes of this district in a manner that ensures equivalency of educational opportunity throughout this district. The school district's curricula in the following areas will eliminate discrimination, promote mutual acceptance and respect among students, and enable students to interact effectively with others, regardless of race, color, creed, religion, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, gender identity or expression, socioeconomic status, or disability:

1. School climate/learning environment
2. Courses of study, including Physical Education
3. Instructional materials and strategies
4. Library materials
5. Software and audio-visual materials
6. Guidance and counseling
7. Extra-curricular programs and activities
8. Testing and other assessments.

Excerpt from Secaucus Board of Education, Policy 5750, Edited September 2016

Course Description

Environmental Studies is based on the basic principles of ecology: field work, case studies, and an in-depth coverage of complex environmental issues. The environmental science program is designed to explore issues facing our own environments through surveys of the following units: ecosystems, pollution, climate change, biodiversity, and population studies. Laboratory procedures will contextualize these specific topics. A prerequisite of Biology (or equivalent) is required to take this course.

Course Modifications (ELLs, Special Education, Gifted and Talented)

The course instructor will determine, with the assistance of guidance counselors, teacher assistant/aides, and/or special education teachers, what modifications will be made for his/her students. Such examples of modifications can include, but not be limited to:

- Extended time as needed
- Modification of tests and quizzes
- Preferential seating
- Alternative/Formative assessment (projects)
- Effective teacher questioning (ranging from simple recall to higher order critical thinking questions)
- Supplemental materials
- Cooperative learning
- Teacher tutoring
- Peer tutoring
- Differentiated Instruction

Interdisciplinary Connections

The following NJSLS for ELA, Mathematics, College and Career Readiness and Technology depict what standards align to the science standards taught in this Environmental Studies Course.

NJSLS - ELA/Literacy:

- 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. (HS-LS1-1),(HS-LS1-6)
- WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS1- 1),(HS-LS1-6)
- WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS1-6)
- WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HSLS1-3)
- WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-LS1-3)
- WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS-1-1),(HS-LS1-6)
- SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-2),(HS-LS1-4),(HS-LS1-5),(HS-LS1-7)
- RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)
- 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. (HS-LS2-1),(HS-LS2-2),(HS-LS2-3),(HS-LS2-6),(HS-LS2-8)

- RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)
- RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)
- WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS2-1),(HSLS2-2),(HS-LS2-3)
- WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS2-3)
- WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7)
- 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. (HS-LS3-1),(HS-LS3-2)
- RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-LS3-1)
- WHST.9-12.1 Write arguments focused on discipline-specific content. (HS-LS3-2)
- 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. (HS-LS4-1),(HS-LS4-2),(HS-LS4-3),(HS-LS4-4)
- RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS4-5)
- WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS4-1),(HS-LS4- 2),(HS-LS4-3),(HS-LS4-4)
- WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS4-6)
- WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS4-6)
- WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS4-1),(HS-LS4-2),(HS-LS4-3),(HS-LS4-4),(HS-LS4-5)

- SL.11-12.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (HS-LS4-1),(HS-LS4-2)

NJSLS - Mathematics:

- MP.4 Model with mathematics. (HS-LS1-4)
- HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (HS-LS1-4)
- HSF-BF.A.1 Write a function that describes a relationship between two quantities. (HS-LS1-4)
- MP.2 Reason abstractly and quantitatively. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-6),(HS-LS2-7)
- MP.4 Model with mathematics. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4)
- HSN-Q.A.1 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-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-7)
- HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-7)
- HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-7)
- HSS-ID.A.1 Represent data with plots on the real number line. (HS-LS2-6)
- HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (HS-LS2-6)
- HSS-IC.B.6 Evaluate reports based on data. (HS-LS2-6)
- MP.2 Reason abstractly and quantitatively. (HS-LS3-2),(HS-LS3-3)
- MP.2 Reason abstractly and quantitatively. (HS-LS4-1),(HS-LS4-2),(HS-LS4-3),(HS-LS4-4),(HS-LS4-5)
- MP.4 Model with mathematics. (HS-LS4-2)
- MP.2 Reason abstractly and quantitatively. (HS-ESS2-1),(HS-ESS2-2),(HS-ESS2-3),(HS-ESS2-4),(HS-ESS2-6)
- MP.4 Model with mathematics. (HS-ESS2-1),(HS-ESS2-3),(HS-ESS2-4),(HS-ESS2-6)

- HSN-Q.A.1 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-ESS2-1),(HS-ESS2-2),(HS-ESS2-3),(HS-ESS2-4),(HS-ESS2-6)
- HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS2-1),(HS-ESS2-3),(HS-ESS2-4),(HS-ESS2-6)
- HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS2-1),(HS-ESS2-2),(HS-ESS2-3),(HS-ESS2-4),(HSESS2-5),(HS-ESS2-6)

NJSLS – Technology:

- 8.1.12.A.1 Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
- 8.1.12.A.2 Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
- 8.1.12.A.3 Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
- 8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
- 8.1.12.A.5 Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.

NJSLS – 21st Century Life and Careers:

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

Environmental Studies Curriculum

HS-LS2-3:
Construct and review an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. [Clarification statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.]
HS-LS2-4:
Use mathematical representation to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one tropic level to another and that matter and energy are conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.]
HS-LS2-5:
Develop a model of illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. [Clarification Statement: Examples of models could include simulations and mathematical models.] [Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.]

Essential Questions	**Enduring Understandings**	**Labs, Investigation, and Student Experiences**
How is matter transferred and energy transferred/ transformed in living systems?	All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism.	**Textbook:** Holt Environmental Science, Student Edition 2008 ISBN: 978-0-03-078136-0 **(5.3.12.B.1)** 1. **Nutrient cycles**: Activity on carbon cycle. See www.practicalbiology.org/area/intermediate/environment/carbon-cycle
Content Statements	**Cumulative Progress Indicators**	

As matter cycles and energy flows through different levels of organization within living systems (cells, organs, organisms, communities), and between living systems and the physical environment, chemical elements are recombined into different products.	Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting.	2. **Nitrates lab:** Students will be able to observe the interaction of the Nitrogen cycle and the behavior of gold fish in their environment. http://peer.tamu.edu/curriculum_modules/water_quality/module_5/student_procedure.htm 3. **Food chains:** Students must research different organisms and construct a single food chain which includes a producer, primary consumer, secondary consumer, tertiary consumer. 4. **Memo to the Zoo Director**: You are a zookeeper at a nationally recognized zoo. You care for the largest mixed-species exhibit at the zoo, which features a wide variety of organisms from the Amazonian rainforest. When cleaning the exhibit, you have noticed that the soil contains far fewer worms and termites than earlier in the year. Express your concern for the lack of "soil engineers" in terms of the energy flow and matter cycling in the exhibit. Prepare a memo to the zoo director highlighting your concerns in order to request emergency funds, explaining why all of the species living in the exhibit are at risk. To bolster your argument, use evidence and data from appropriate peer-reviewed journal articles. (Correlations: 5.1.12.A.2, 5.1.12.B.4 and 5.3.12.B.1) **Resources:** National Science Digital Library, Science Digital Literacy Maps The Living Environment, Flow of Matter in Ecosystems http://strandmaps.nsdl.org/?id=SMS-MAP-9001
Desired Results		
Students will be able to: 1. Life's organization requires continuous inputs of energy to replace lost energy, much of it in the form of heat. Organisms store energy in bonds between atoms. 2. Cells carry out a variety of chemical transformations which allow conversion of energy from one form to another, the breakdown of molecules into smaller units, and the building of larger molecules from smaller ones. Most of these transformations are made possible by protein catalysts called enzymes. 3. Enzymes work best within limited ranges of temperature, pH, and salt concentration. Ranges of tolerance differ from one type of enzyme to the next.		

4. Cofactors are atoms or molecules other than proteins that associate with enzymes and are necessary for their function. 5. Cells build carbohydrates, lipids, proteins, and nucleic acids. The main molecular building blocks used are simple sugars, fatty acids, amino acids and nucleotides. 6. Plant cells contain chloroplasts, which convert light energy into chemical energy through the process of photosynthesis. This chemical energy is used by the plants to convert carbon dioxide and water into glucose molecules, that may be used for energy or to form plant structures. 7. Photosynthesis adds oxygen to the atmosphere and removes carbon dioxide.	

HS-LS2-4:
Use mathematical representation to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one tropic level to another and that matter and energy are conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.

Essential Questions	**Enduring Understandings**	**Labs, Investigation, and Student Experiences**
How is matter transferred and energy transferred/ transformed in living systems?	All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism.	**Textbook:** Holt Environmental Science, Student Edition 2008 ISBN: 978-0-03-078136-0 1. **Effects of the Biosphere on Coral Reefs** Students will research on effects of Biosphere on destruction of Coral reefs and how to save them. The students will present their findings in the form of a power point presentation. (See reference material) http://www.cotf.edu/ete/modules/coralreef/CRsituation.html 2. http://www.woodstown.org/ACS/resources/ab/ch9/act3.pdf 3. http://www.need.org/needpdf/Energy%20Flows.pdf **4. Research proposal to the International Union for the Conservation of Nature** You are a conservation biologist interested in studying the
Content Statements	**Cumulative Progress Indicators**	
Continual input of energy from sunlight keeps matter and energy flowing through ecosystems.	Predict what would happen to an ecosystem if an energy source was removed.	

Desired Results	impact of tourism on the coral reef ecosystems. You are concerned primarily with importance of symbioses to energy flow in reefs. Write a research proposal to the International Union for the Conservation of Nature to request funds to study a reef of your choice. In the proposal, explain why the reef is essential to its marine ecosystem from an energy perspective. Evaluate and critically select data and evidence from published journal studies to support your proposal. (Correlations: 5.1.12.A.3, 5.1.12.B.3 and 5.3.12.B.3) **Resources:** National Science Digital Library, Science Digital Literacy Maps The Living Environment, Flow of Energy in Ecosystems http://strandmaps.nsdl.org/?id=SMS-MAP-1422
Students will be able to: 8. Life's organization requires continuous inputs of energy to replace lost energy, much of it in the form of heat. Organisms store energy in bonds between atoms. 9. Cells carry out a variety of chemical transformations which allow conversion of energy from one form to another, the breakdown of molecules into smaller units, and the building of larger molecules from smaller ones. Most of these transformations are made possible by protein catalysts called enzymes. 10. Enzymes work best within limited ranges of temperature, pH, and salt concentration. Ranges of tolerance differ from one type of enzyme to the next. 11. Cofactors are atoms or molecules other than proteins that associate with enzymes and are necessary for their function. 12. Cells build carbohydrates, lipids, proteins, and nucleic acids. The main molecular building blocks used are simple sugars, fatty acids, amino acids and nucleotides. 13. Plant cells contain chloroplasts, which convert light energy into chemical energy through the process of photosynthesis. This chemical energy is used by the plants to convert carbon dioxide and water into glucose molecules, that may be used for energy or to form plant structures. 14. Photosynthesis adds oxygen to the atmosphere and removes carbon dioxide.	

<table>
<tr><td colspan="3">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. [Clarification Statement: Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperature and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.]</td></tr>
<tr><td>Essential Questions</td><td>Enduring Understandings</td><td rowspan="3">Labs, Investigation, and Student Experiences

Textbook:
Holt Environmental Science, Student Edition 2008
ISBN: 978-0-03-078136-0

Websites/Labs

● National Science Digital Library, Science Digital Literacy Maps
o The Physical Setting: Weather and Climate: http://strandmaps.nsdl.org/?id=SMS-MAP-1698
o The Physical Setting: Changes in the Earth's Surface http://strandmaps.nsdl.org/?id=SMS-MAP-0048
o Common Themes: Systems: http://strandmaps.nsdl.org/?id=SMS-MAP-1594
● Earth Science Literacy Principles. Published May 2009 http://www.earthscienceliteracy.org/
● Essential Principles and Fundamental Concepts for Atmospheric Science Literacy. Published October 2008bhttp://eo.ucar.edu/asl/index.html</td></tr>
<tr><td>1. How does scientific understanding build over time?
2. Why has the Earth changed over time?
3. How do changes in one part of an Earth system affect other parts of the system?</td><td>1. Science builds upon itself over time.
2. As new evidence arises and we acquire new understandings, old theories are revised or replaced by new ones.
3. Earth is a complex system of interacting rock, water, air, and life that has evolved over time.
4. Composition of the soils and the atmosphere provide the interfaces for changes in the composition of the Earth's systems.</td></tr>
<tr><td>Content Statements</td><td>Cumulative Progress Indicators</td></tr>
<tr><td>Soils are at the interface of the Earth systems, linking</td><td>Model the interrelationships among the spheres in the Earth</td></tr>
</table>

together the biosphere, geosphere, atmosphere, and hydrosphere.	systems by creating a flow chart.	● American Geologic Institute, Sustaining our Soils and Society(1999 http://www.agiweb.org/environment/publications/soils.pdf
The chemical and physical properties of the vertical structure of the atmosphere support life on Earth.	Analyze the vertical structure of Earth's atmosphere, and account for the global, regional, and local variations of these characteristics and their impact on life.	
Desired Results		
Open Ended/ EOC Response Items: 1. Recent studies indicate that ozone in the upper layers of Earth's atmosphere is being depleted. What effect does the depletion of ozone have, and how is this effect harmful to humans? 2. You are a (*pick one*: scientists, civil engineers, government officials, relief workers, insurance industry representatives, news media, or homeowners). Based on real scientific data and geography model a city's decision to either rebuild or relocate homes that have been destroyed in a natural disaster. The class develops criteria for scientific use of data, analysis processes, and accountability of the impact for different roles on project outcomes.		

<table>
<tr><td colspan="3">HS-ESS2-4: Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. [Clarification Statement: Examples of the causes of climate change differ by timescale, over1-10 years: large volcanic eruption, ocean circulation; 10-10's of years: changes in human activity, ocean circulation, solar output; 10-10s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-10s of millions of years: long-term changes in atomospheric composition.] [Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.]</td></tr>
<tr><td>Essential Questions</td><td>Enduring Understandings</td><td rowspan="2">Labs, Investigation, and Student Experiences

Textbook:
Holt Environmental Science, Student Edition 2008
ISBN: 978-0-03-078136-0

Resources:

● National Science Digital Library, Science Digital Literacy Maps
o The Physical Setting: Weather and Climate: http://strandmaps.nsdl.org/?id=SMS-MAP-1698
o The Physical Setting: Plate Tectonics: http://strandmaps.nsdl.org/?id=SMS-MAP-0049
o The Physical Setting: States of Matter: http://strandmaps.nsdl.org/?id=SMS-MAP-1341
● American Association for the Advancement of Science, National Oceanic and Atmospheric Administration, (2009).
● The Essential Principles of Climate Sciences. Published March 2009</td></tr>
<tr><td>4. How does scientific understanding build over time?
5. Why has the Earth changed over time?
6. How do changes in one part of an Earth system affect other parts of the system?
7. Are the roles of Earth's materials and the sun in the transfer of energy within the Earth system connected?</td><td>5. Science builds upon itself over time.
6. As new evidence arises and we acquire new understandings, old theories are revised or replaced by new ones.
7. Earth is a complex system of interacting rock, water, air, and life that has evolved over time.
8. Both internal and external sources of energy determine the global energy budget.</td></tr>
<tr><td>Content Statements</td><td>Cumulative Progress Indicators</td></tr>
</table>

<table>
<tr><td>Earth systems have internal and external sources of energy, both of which create heat.</td><td>Predict what the impact on biogeochemical systems would be if there were an increase or decrease in internal and external energy.</td><td rowspan="3">http://www.globalchange.gov/resources/educators/climate-literacy
● Principles and Fundamental Concepts for Atmospheric Science Literacy. Published October 2008 http://eo.ucar.edu/asl/index.html
● Earth Science Literacy Principles. Published May 2009 http://www.earthscienceliteracy.org/</td></tr>
<tr><td colspan="2">Desired Results</td></tr>
<tr><td colspan="2">Open Ended/ EOC Response Items:

1. Predict what the impact on biogeochemical systems would be if there were an increase or decrease in internal and external energy.
2. Summarize the effect of latitude, elevation, and geography on global temperature patterns.
3. Explain how local and regional seasonal variations are the result of variation in solar heating.</td></tr>
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HS-ESS2-6: Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. [Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.]
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. [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reacting impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine population.] [Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]
HS-LS2-6: Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]
HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

Essential Questions	Enduring Understandings	Labs, Investigation, and Student Experiences
8. How does scientific understanding build over time? 9. Why has the Earth changed over time? 10. How do changes in one part of an Earth system affect other parts of the system? 11. Is the Earth's climate and weather controlled?	1. Science builds upon itself over time. 2. As new evidence arises and we acquire new understandings, old theories are revised or replaced by new ones. 3. Earth is a complex system of interacting rock, water, air, and life that has evolved over time.	**Textbook:** Holt Environmental Science, Student Edition 2008 ISBN: 978-0-03-078136-0 **Websites/Labs** ● National Science Digital Library, Science Digital Literacy Maps o The Physical Setting: Use of Earth's Resources: http://strandmaps.nsdl.org/?id=SMS-MAP-1699

12. How do natural and human-made changes in one part of the Earth system affect other parts of the system?	4. Earth's energy and climate are controlled by many interacting factors. 5. Earth's components form systems that have cycles and patterns that allow us to make predictions and informed decisions.	• Ocean Literacy: The Essential Principles of Ocean Sciences. Published July 2005. http://oceanliteracy.wp.coexploration.org/ • Earth Science Literacy Principles. Published May 2009 http://www.earthscienceliteracy.org/ • United States Geological Survey, Water Resources of the United States (2010) http://water.usgs.gov/ • United States Geological Survey, Groundwater Availability in the United States (2008), published July 2008, http://pubs.usgs.gov/circ/1323/ • American Geologic Institute, Water and the Environment (2002) http://www.agiweb.org/environment/publications/soils.pdf **Websites/Labs** • National Science Digital Library, Science Digital Literacy Maps o The Physical Setting: States of Matter: http://strandmaps.nsdl.org/?id=SMS-MAP-1341 o Common Themes: Systems: http://strandmaps.nsdl.org/?id=SMS-MAP-1594 o Common Themes: Models: http://strandmaps.nsdl.org/?id=SMS-MAP-2408 • Earth Science Literacy Principles. Published May 2009, http://www.earthscienceliteracy.org/ • Climate Literacy: The Essential Principles of Climate Sciences. Published March 2009
Content Statements	**Cumulative Progress Indicators**	
Natural and human-made chemicals circulate with water in the hydrologic cycle.	Analyze and explain the sources and impact of a specific industry on a large body of water (e.g., Delaware or Chesapeake Bay). 5.4.12.G.1	
Natural ecosystems provide an array of basic functions that affect humans. These functions include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients.	Explain the unintended consequences of harvesting natural resources from an ecosystem. 5.4.12.G.2	

Movement of matter through Earth's system is driven by Earth's internal and external sources of energy and results in changes in the physical and chemical properties of the matter.	Demonstrate, using models, how internal and external sources of energy drive the hydrologic, carbon, nitrogen, phosphorus, sulfur, and oxygen cycles. 5.4.12.G.3	http://www.globalchange.gov/resources/educators/climate-literacy ● Stanford Solar Center: Global Warming (2008) http://solar-center.stanford.edu/sun-on-earth/glob-warm.html
Desired Results		
Open Ended/ EOC Response Items: 1. Demonstrate, using models, how internal and external sources of energy drive the hydrologic, carbon, nitrogen, phosphorus, sulfur, and oxygen cycles. 2. There is legislation pending that will limit the kinds and amounts of fertilizers used by farmers in the Chesapeake Bay watershed. Analyze the legislation and predict its impacts on farmers and the health of the Chesapeake Bay. 3. Create a conceptual model, that illustrates how internal and external sources of energy drive the (choose two: hydrologic, carbon, nitrogen, phosphorus, sulfur, oxygen) cycles.		