ENVIRONMENTAL SCIENCE - Curriculum

Course Title: _ENVIRONMENTAL SCIENCE _____

Content Area_Science_____

Grade Level(s)_11-12_____

Date Revised:___September, 2019_____

Date Adopted_____

Course Description:

Unit 1: Introduction to Environmental Science
In this unit, students will explain the focus of environmental science and conduct a scientific investigation. They will describe, use evidence and model the recent trends in human population and resource consumption. Students will also discuss, compare, conclude and predict humans' relationship to the environment (ethics) and humans' influence on it (environmental footprint)

Unit 2: Economics and the Environment
In this unit, students will analyze and apply the relationship between economics and the environment. They will create a cost/benefit analysis for a real-life situation. Students will apply what they learn about sustainability to analyze and evaluate Walmart's sustainability practices. Then they will recommend additional sustainable practices to Walmart for future stores.

Unit 3: Environmental Policy
In this unit, students will research, discuss and evaluate a piece of environmental policy legislation. They will apply environmental laws to current situations and hypothesize successful and unsuccessful outcomes. Students will play a cap and trade game to experience a car company's dilemma between legal carbon usage and profits.

Unit 4: Dynamic Earth Systems
In this unit, students will plan and carrying out investigations, analyze and interpret data, develop and use models, and engaging in arguments from evidence. 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, phosphorus and nitrogen through the Earth's spheres. Students seek evidence to construct arguments about the simultaneous co-evolution of the Earth's systems and life on Earth.

Unit 5: Human Activity and Climate System
In this unit, students evaluate claims, analyze and interpret data, and develop and use models to explore the core ideas centered on the Earth's climate system. Students evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by the atmosphere and Earth's various surfaces. They apply these core ideas when they use a quantitative model to describe how variations in the flow of energy into an out of the Earth's systems result in changes in climate, and how carbon is cycle through all of the Earth's spheres. They analyze geoscience data to make the claim that one change to Earth's surface can cause changes to other Earth systems, such as the climate system. Finally, students analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

Unit 6: Human Activity and Sustainability
In this unit students construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards are connected to human activity. Additionally, while students are exploring this idea they apply scientific and engineering ideas to design, evaluate, and refine a device that can be used to minimize the impacts of natural hazards. They create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity, and create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. They use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity, and evaluate or refine a technological solution that reduces impacts of human activities on natural systems

Total Number of Units: 6

Pacing Guide

Unit	Days	Standard NJSLS	Skill What we want the students to "DO"
Unit 1: Introduction to Environmental Science	**5 days**	**HS-LS2-1**	**WALT survey the recent trends in human population and resource consumption through analysis of**

			video and text then group presentation.
	5 days	**HS-LS2-2**	**WALT Analyze the focus of environmental science through research with videos, discussions, text readings and a composition**
	5 days	**HS-ESS3-2**	**WALT Analyze the focus of environmental science through research with text reading, vocabulary and group discussion/presentation**
Unit 2: Economics and the Environment	**5 days**	**HS-ESS3-2**	**WALT Analyze and apply the relationship between economics and the environment.**
	5 days	**HS-ESS3-4**	**WBAT Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.**
	5 days	**HS-LS2-7**	**WBAT Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.**
Unit 3: Environmental Policy	**5 days**	**HS-ESS2-4**	**WALT Evaluate the past and future direction of U.S and international environmental policy.**

	5 days	**HS-ETS1-3**	**AWBAT Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs.**
	5 days	**HS-ESS3-3**	**AWBAT Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.**
Unit 4: Dynamic Earth Systems			
Unit 5: Human Activity and Climate System			
Unit 6: Human Activity and Sustainability			

Unit Title: Introduction to Environmental Science
Time Frame: 15 days

Unit 1 Essential Questions

*What is the focus of environmental science?
*How do scientists uncover, research, and solve environmental problems?

*What environmental factors contributed to human population growth?
*What is an ecological footprint and what does it have to do with population growth?
*How do we describe the recent trends in human population and resource consumption?

*How is the tragedy of the commons a lesson for current environmental problems?
*How do we explain the study of environmental ethics?
*How can we best balance our own interests and needs with the health of the environment?

Unit 1 Standards

Standards/CPIs (Cumulative Progress Indicators) taught and assessed:

PERFORMANCE EXPECTATIONS

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.]

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [Assessment Boundary: Assessment is limited to provided data.]

HS-ESS3-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

DISCIPLINARY CORE IDEAS

- **LS2.A: Interdependent Relationships in Ecosystems** ♣ Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HSLS2-2)
- **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** ♣ Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7)
- **LS2.D: Social Interactions and Group Behavior** ♣ Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HSLS2-8)
- **LS4.D: Biodiversity and Humans** ♣ Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat

destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. (Note: This Disciplinary Core Idea is also addressed by HS-LS4-6.)

- **ETS1.B: Developing Possible Solutions** ♣ When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. (secondary to HS-LS2-7)

SCIENCE and ENGINEERING PRACTICES

- **Constructing Explanations and Designing Solutions** ♣ Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS2-3) ♣ Evaluate the evidence behind currently accepted explanations to determine the merits of arguments. (HS-LS2-8)

CROSS CUTTING CONCEPTS

- **Cause and Effect** ♣ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS2-8)
- **Scale, Proportion, and Quantity** ♣ Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2)

CONNECTIONS TO ENGLISH

RH.11-12.4. Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines *faction* in *Federalist* No. 10).

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.

Highlighted Career Ready Practices:

9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences.
9.1.12.B.1 Present resources and data in a format that effectively communicates the meaning of the data and its implications for solving problems, using multiple perspectives.
9.1.12.C.5 Assume a leadership position in guiding the thinking of peers in a direction that leads to the successful completion of a challenging task or project.

9.1.12.D.1 Interpret spoken and written communication within the appropriate cultural context.
9.1.12.F.2 Demonstrate a positive work ethic in various settings, including the classroom and during structured learning experiences
9.4.12.O.1 Demonstrate language arts knowledge and skills required to pursue the full range of postsecondary education and career opportunities.

SEL Practices & Competencies:

- Self-Awareness
- Self-Management
- Social Awareness
- Responsible Decision-Making
- Relationship Skills

Overall Goal (What is the big idea?) Unit 1: Environmental science helps us understand the natural world. Students will explain the focus of environmental science and conduct a scientific investigation. They will describe, use evidence and model the recent trends in human population and resource consumption. Students will also discuss, compare, conclude and predict humans' relationship to the environment (ethics) and humans' influence on it (environmental footprint).

Pre-Assessment: For unit: Pre-assessment quiz (in supplemental folder); **For topic:** KWL chart; **Daily:** Do Now question

Please include interdisciplinary connections resources and plan in each activity

(SLO) Student Learning Objectives (with standards)	**Student Learning Strategies**	**Formative Assessment ***suggested but not limited to the following*** **	**Activities ***suggested but not limited to the following*** **	**Modifications & Reflections ***suggested but not limited to the following*** **
WALT Analyze the focus of environmental science through research with videos, discussions, text	Think/Pair/Share Cooperative learning Interactive Notebook page (Vocabulary)	Observations Review of Notebook pages	**Video:** What is environmental science? Definition and scope of the field (Study.com) **RH.11-12.4.**	Frayer model (include drawings) to be put in Interactive notebook **Video Focus Questions** (in supplemental folder)

readings and a composition. **HS-LS2-2.**		Video Focus Question Answers Rubric Do Now Answer Exit Ticket Answer	**Vocabulary** – text p. 4-10* **RI.11-12.1** **CER:** Ozone Article – "Fixing the Hole in the Sky" Textbook p.3*	CER questions/worksheet (in supplemental folder)
WALT survey the recent trends in human population and resource consumption through analysis of video and text then group presentation. **HS-LS2-1.** **HS-ESS3-2.**	Non Fiction Text Group Discussion/Presentation Cooperative learning Interactive Notebook page (Vocabulary) Exit Ticket	Observations Video Focus Question Answers Review of Notebook work Rubric Do Now Answer Exit Ticket Answer	**Video**: Meeting the Increase In Global Energy Demand **RH.11-12.4.** **Vocabulary:** renewable/non-renewable resources; sustainability **Text:** p7 Check for understanding: How do we use resources sustainably? Group Discussion/Presentation*	**Video Focus Questions** (in supplemental folder) Frayer model (include drawings) to be put in Interactive notebook Group work
WALT Explain and evaluate the study of environmental ethics through non-fiction readings, debate and written recommendation.	Non Fiction Text Debate Cooperative learning Problem based Learning	Observations Review of Notebook pages Video Focus Question Answers	**Video:** What is the tragedy of the commons? **Debate:** Sharing is Good/ Sharing is Trouble	**Group Video focus question:** In your own words, describe tragedy of the commons.

HS-ESS3-2.	Presentation Claim/Evidence/Reasoning Writing exercise	Rubric Do Now Answer Exit Ticket Answer Kahoot Review	**Text: p.11:** Assessment #3: Think it through* **RH.11-12.4.** **Vocabulary:** p21* **Lab Stations Activity:** Groups take an ethical position explain, give example and show positive/negative views on position. **Interactive notebook page** of Ethical Views with examples. **Video:** Environmental Ethics and Human Values. Definition and Impact on Environmental Problems **Video:** End of Easter Island **Video**: What were they saying when they cut down the last tree on Easter Island **RI.11-12.1**	White boards used for group presentations/Lab stations activity Drawings on interactive notebook encouraged **Video focus question:** Which resource was exploited? **Video focus question:** What were the natives saying?

			Writing assignment: How is Easter Island an example of the Tragedy of the Commons? What could the natives have done differently to be a sustainable people?	
AWBAT Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. **HS-ESS3-3**		Notebook check	S.ID.B.6a p. 61 Textbook: Ecological Footprints Activity	

21st Century Theme Targeted – Global awareness: Using 21st century skills to understand and address global issues					
21st Century Skills Targeted					
Creativity & Innovation	**Information Literacy**	**Media Literacy**	**Critical Thinking & Problem Solving**	**Communication & Collaboration**	**Life & Careers**
End of Easter Island What were they saying when they cut down the last tree on Easter Island	Text Readings: **CER:** Ozone Article – "Fixing the Hole in the Sky" Textbook p.3*	Videos: What is environmental science? Definition and scope of the	Environmental Ethics and Human Values. Definition and Impact on Environmental Problems	What is the tragedy of the commons? p. 61 Textbook:	Meeting the Increase In Global Energy Demand

Writing assignment: How is Easter Island an example of the Tragedy of the Commons? What could the natives have done differently to be a sustainable people?		field (Study.com)	**Lab Stations Activity:** Groups take an ethical position explain, give example and show positive/negative views on position.	Ecological Footprints Activity	
Summative Assessments: (include rubrics & exemplars) Unit 1 Test (test and rubrics in supplemental folder)					
***Textbook Used:** Environmental Science, Your World, Your Turn Pearson 2011					

Unit 2: Economics and the Environment
Time Frame: 15 days

Essential Questions

*What are two basic concepts of economics and how do they apply to environmental science?
*What is the relationship between economics and the environment?
*How can economies work toward sustainability?

Unit 2 Standards

Standards/CPIs (Cumulative Progress Indicators) taught and assessed:

PERFORMANCE EXPECTATIONS

HS-ESS3-2 Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-LS2-7 . Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

DISCIPLINARY CORE IDEAS

ESS2.D: Weather and Climate
ESS3.C: Human Impacts on Earth Systems
LS2.D: Social Interactions and Group Behavior

SCIENCE and ENGINEERING PRACTICES

Using Mathematics and Computational Thinking
Developing and Using Models

CROSS CUTTING CONCEPTS

Cause and Effect
Scale, Proportion, and Quantity

CONNECTIONS TO MATH

Math:

S-IDC. Interpret linear models

7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
9. Distinguish between correlation and causation.

CONNECTIONS TO ENGLISH

RH.11-12.2. Determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas.

CONNECTIONS TO SOCIAL STUDIES

6.3 12 C1 How can individuals, groups, and societies apply economic reasoning to make difficult choices about scarce resources? What are the possible consequences of these decisions for individuals, groups, and societies?

Highlighted Career Ready Practices:

9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences.
9.1.12.B.1 Present resources and data in a format that effectively communicates the meaning of the data and its implications for solving problems, using multiple perspectives.
9.1.12.C.5 Assume a leadership position in guiding the thinking of peers in a direction that leads to the successful completion of a challenging task or project.
9.1.12.D.1 Interpret spoken and written communication within the appropriate cultural context.
9.1.12.F.2 Demonstrate a positive work ethic in various settings, including the classroom and during structured learning experiences
9.4.12.O.1 Demonstrate language arts knowledge and skills required to pursue the full range of postsecondary education and career opportunities.

SEL Practices & Competencies:

- Self-Awareness
- Self-Management
- Social Awareness
- Responsible Decision-Making

• Relationship Skills

Overall Goal (What is the big idea?) Sustainability is affected by economics. In this unit students will create a supply/demand graph and cost/benefit chart and apply it to a situation to form a conclusion. Students will also evaluate a large chain store's efforts to become more sustainable and by reasoning, support (or not) their methods as well as give alternative or additional advice for sustainability.
Pre-Assessment: Unit 2 Pretest; KWL chart; Do Now Questions

(SLO) Student Learning Objectives (with standards)	**Student Learning Strategies**	**Formative Assessment ***suggested but not limited to the following***	**Activities ***suggested but not limited to the following***	**Modifications & Reflections ***suggested but not limited to the following***
WALT Analyze and apply the relationship between economics and the environment. **HS-ESS3-2.**	Non Fiction Text Video Cooperative learning Problem based Learning Representational Imagery Interactive Notebook page (Vocabulary)	Observations Review of Notebook pages Video Focus Question Answers Rubric Do Now Answer Exit Ticket Answer Post Lab answers	**S-IDC. Interpret linear models** **Textbook:** Draw graph depicting supply and demand (p37)* **Vocabulary:** p36* **PowerPoint** "Economics and Environmental Policy" (supplemental folder) S-IDC.7.9. **Interpret linear models** **Quick Lab:** Cost/benefit analysis (p37 Textbook)	Frayer model (include drawings) to be put in Interactive notebook Group work on White boards for Quick Lab/graph

AWBAT Evaluate or refine a technological solution that reduces impacts of human activities on natural systems **HS-ESS3-4** **AWBAT Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.** **HS-LS2-7**			Conclude questions 1-3* **Video:** Walmart Goes Green on ABC's Good morning America **Video:** Walmart goes green to cut costs **Lab:** "Working Trees" lab (Pearson) (Supplemental Folder) Rare Bird Eggs for Sale Activity(p335-37) (Project Wild) **S-IDC. Interpret linear models** Tijuana River BMDs and SSO BMDs P. 61 Text: Analyze Data #28 Interpret Graphs #29 Calculate/Explain **6.3 12 C1** **RI.11-12.1** Page 61 Text Write About It #30	**Video focus questions**: See supplemental folder

21st Century Theme Targeted – Global Awareness, Financial, Economic, and Business Literacy

This unit covers Global awareness during explanation of international environmental policy. Financial, Economic and Business literacy is covered during activities relating to the relationship between economics and the environment (ex. Cap and trade game)

21st Century Skills Targeted

Creativity & Innovation	**Information Literacy**	**Media Literacy**	**Critical Thinking & Problem Solving**	**Communication & Collaboration**	**Life & Careers**
Lab: "Working Trees" lab (Pearson) (Supplemental Folder)	**Textbook:** Draw graph depicting supply and demand (p37)*	**Video:** Walmart Goes Green on ABC's Good morning America **Video:** Walmart goes green to cut costs	Tijuana River BMDs and SSO BMDs P. 61 Text: Analyze Data #28 Interpret Graphs #29 Calculate/Explain	Rare Bird Eggs for Sale Activity(p335-37) (Project Wild) Page 61 Text Write About It #30	**Quick Lab:** Cost/benefit analysis (p37 Textbook) Conclude questions 1-3*

Summative Assessments: (include rubrics & exemplars)

Unit 2 Test (test and rubrics in supplemental folder)

***Textbook Used:** Environmental Science, Your World, Your Turn Pearson 2011

Unit 3: Environmental Policy
Time Frame: 15 days

Standards

Standards/CPIs (Cumulative Progress Indicators) taught and assessed:

PERFORMANCE EXPECTATIONS

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.

HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

DISCIPLINARY CORE IDEAS

SCIENCE and ENGINEERING PRACTICES

CROSS CUTTING CONCEPTS

CONNECTIONS TO SOCIAL STUDIES

Social Studies:

6.1.9-12.A**: A. Civics, Government, and Human Rights** How do citizens, civic ideals, and government institutions interact to balance the needs of individuals and the common good? How have economic, political, and cultural decisions promoted or prevented the growth of personal freedom, individual responsibility, equality, and respect for human dignity?

CONNECTIONS TO ENGLISH

RH.11-12.4. Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines *faction* in *Federalist* No. 10).

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.

Overall Goal (What is the big idea?) Environmental policies can protect the environment.
Pre-Assessment: Unit 3 Pretest (Supplemental Folder)

(SLO) Student Learning Objectives (with standards)	**Student Learning Strategies**	**Formative Assessment ***suggested but not limited to the following***	**Activities ***suggested but not limited to the following***	**Modifications & Reflections ***suggested but not limited to the following***
A**WBAT Evaluate the past and future direction of U.S and international environmental policy.** **HS-ESS2-4**	Non Fiction Text Video Debate Cooperative learning Problem based Learning Presentation Demonstration	Observations Review of Notebook pages Video Focus Question Answers Rubric/Answer keys Do Now Answer Exit Ticket Answer Kahoot Survey answers	**Research** Environmental legislation: www.law360.com Environmental Regulation & Legislation to watch in 2017 **Kahoot** survey and **Video**: PBS Election Central website: Interactive map, "Candidates and issues" **Video:** PBS NewsHour video Story: How Paris is different from past climate change negotiations	Frayer model (include drawings) to be put in Interactive notebook **Video Focus questions**/Prompts (supplemental folder) Kahoot survey (reflection)

AWBAT Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs. **HS-ETS1-3**	Interactive Notebook page (Vocabulary)	Game outcome Rubric	**RH.11-12.4.** RH.11-12.4 **Vocabulary** words: p48* Cap and Trade **game** (supplementary folder) **6.1.9-12.A.** **RI.11-12.1** **CER:** Cleaning Tides of San Diego and Tijuana	Frayer model (include drawings) to be put in Interactive notebook Written game instructions Question prompts for CER
AWBAT Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. **HS-ESS3-3**	Problem based Learning Cooperative learning	Review of Notebook pages Rubric	Ecological Footprints p. 61 Text Ecological Footprint Calculator:	**How big is my ecological footprint?**

21st Century Theme Targeted – Global Awareness, Civic Literacy
This unit covers Civic Literacy and Global Awareness during activities involving United States Environmental Law History and International Laws and treaties.

21st Century Skills Targeted					
Creativity & Innovation	**Information Literacy**	**Media Literacy**	**Critical Thinking & Problem Solving**	**Communication & Collaboration**	**Life & Careers**
Cap and Trade **game** (supplementary folder)	**Research** Environmental legislation: www.law360.com Environmental Regulation & Legislation to watch in 2017	**Kahoot** survey and **Video**: PBS Election Central website: Interactive map, "Candidates and issues"	**Video:** PBS NewsHour video Story: How Paris is different from past climate change negotiations	**CER:** Cleaning Tides of San Diego and Tijuana	Ecological Footprints p. 61 Text
Summative Assessments: (include rubrics & exemplars) Unit 3 Test (test and rubrics in supplemental folder)					
***Textbook Used:** Environmental Science, Your World, Your Turn Pearson 2011					

Unit 4: Dynamic Earth Systems
Time Frame: 30 days

Essential Questions

***** How do changes in the geosphere affect the atmosphere?

*How do the properties and movements of water shape Earth's surface and affect its systems?

* How does carbon cycle among the hydrosphere, atmosphere, geosphere, and biosphere?

* How do living organisms alter Earth's processes and structures?

Standards

Standards/CPIs (Cumulative Progress Indicators) taught and assessed:

PERFORMANCE EXPECTATIONS

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.

HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

HS-ESS2-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

HS-ESS2-7 Construct an argument based on evidence about the simultaneous co-evolution of Earth's systems and life on Earth.

DISCIPLINARY CORE IDEAS

ESS2.A: Earth Materials and Systems

• Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-2.)

ESS2.C: The Roles of Water in Earth's Surface Processes

• 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. These 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. (HS-ESS2-5)

ESS2.D: Weather and Climate

• 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. (HS-ESS2-2)

ESS2.D: Weather and Climate
• Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (HS-ESS2-6),(HSESS2-7)
• Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2- 6)

SCIENCE and ENGINEERING PRACTICES

Analyzing and Interpreting Data
• Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HSESS2-2)
Planning and Carrying Out Investigations
• Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-ESS2-5)
Developing and Using Models
• Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS2-6)
Engaging in Argument from Evidence
• Construct an oral and written argument or counter-arguments based on data and evidence. (HS-ESS2-7)

CROSS CUTTING CONCEPTS

Stability and Change
• Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS2-2)
• Much of science deals with constructing explanations of how things change and how they remain stable. (HS-ESS2-7)
Structure and Function
• The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. (HS-ESS2-5)
Energy and Matter
• The total amount of energy and matter in closed systems is conserved. (HS-ESS2-6)

Influence of Engineering, Technology, and Science on Society and the Natural World
• New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS2-2)

CONNECTIONS TO MATH

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 multistep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS2-2), (HSESS2-6) 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

English Language Arts/Literacy

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-ESS2-2) RST.11-12.1
Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS2-2) RST.11-12.2
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-ESS2-5) WHST.11-12.7
Write arguments focused on discipline-specific content. (HS-ESS2-7) WHST.9-12.1

Overall Goal (What is the big idea?) Humans impact Earth's natural systems which influence our environment, and in turn, life on Earth.

Pre-Assessment: Unit 4 Pretest

(SLO) Student Learning Objectives (with standards)	**Student Learning Strategies**	**Formative Assessment ***suggested but not limited to the following***	**Activities ***suggested but not limited to the following***	**Modifications & Reflections ***suggested but not limited to the following***
AWBAT select satellite datasets to answer questions related to system interactions and feedbacks. **(HS-ESS2-2)**			MY NASA DATA Activity	

AWBAT "visit" different K-T boundary sites, evaluate the evidence found in the cores at each site, find these sites on a map, and predict where the impact crater is located. **(HS-ESS2-2)**			Finding the Crater Activity	
AWBAT explore images of the impacts of climate change over time to develop explanations from evidence of how an impact in one component of the Earth system has effects in other components of the Earth system (HS-ESS2-2)			Images of Change	
AWBAT use the Environmental Change Model of the Climate Reanlyzer to study the feedbacks in the climate system. HS-ESS2-2			Climate Reanalyzer:	
AWBAT create and run an investigation to determine the relationship between			USGS Realtime Water data Climate data	

streamflow and precipitation data, or another parameter. HS-ESS2-5				
AWBAT explore the atmosphere during the ice age and today. What happens when you add clouds? Change the greenhouse gas concentration and see how the temperature changes. Then compare to the effect of glass panes. Zoom in and see how light interacts with molecules. Do all atmospheric gases contribute to the greenhouse effect? HS-ESS2-5			Greenhouse Effect	
AWBAT model the carbon cycle and it's connection with Earth's climate. HS-ESS2-6			Earth Systems Activity	
AWBAT run a model of carbon sources and sinks and interpret results to develop their own model of the relationship of the carbon cycle to the Earth's climate HS-ESS2-6			Carbon and Climate	

AWBAT work through the content of the entire module called Carbon Connections which includes numerous models and interactives to gain a deeper understanding of the role of carbon in the climate system. HS-ESS2-6			Carbon Connections	
AWBAT construct an argument based on evidence about the simultaneous co-evolution of Earth's systems and life on Earth. **(HS-ESS2-7)**			Co-evolution of Earth's systems and life on Earth:	
AWBAT explore the co-evolution of the geology and biology found on Earth to develop arguments from evidence for the co-evolution of geology and biology found on Earth. **(HS-ESS2-7)**			EarthViewer (IPAd or Android) or for Chrome browsers:	

21st Century Theme Targeted – Global Awareness, and Health Literacy are targeted in this unit through activities involving Earth's cycles (water and nutrient), how humans affect these cycles and the outcomes.
21st Century Skills Targeted

Creativity & Innovation	Information Literacy	Media Literacy	Critical Thinking & Problem Solving	Communication & Collaboration	Life & Careers
USGS Realtime Water data Climate data	Earth Systems Activity MY NASA DATA Activity	Finding the Crater Activity Images of Change	Co-evolution of Earth's systems and life on Earth:	Greenhouse Effect	Climate Reanalyzer:
Summative Assessments: (include rubrics & exemplars) Unit 4 Test (test and rubrics in supplemental folder)					
***Textbook Used:** Environmental Science, Your World, Your Turn Pearson 2011					

Unit 5: Human Activity and Climate System
Time Frame: 30 days

Essential Questions

*What happens if we change the chemical composition of our atmosphere?

*How does carbon cycle among the hydrosphere, atmosphere, geosphere, and biosphere?

*How do changes in the geosphere effect the atmosphere?

*What happens to solar energy as it moves through the atmosphere and strikes a surface?

*What is the current rate of global or regional climate change and what are the associated future impacts to Earth's systems?

Standards

Standards/CPIs (Cumulative Progress Indicators) taught and assessed:

PERFORMANCE EXPECTATIONS

Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. (HS-ESS2-4)

(secondary to HS-ESS2-4) Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. (HS-PS4-4)

Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. (HS-ESS2-2)

(secondary to HS-ESS2-4) Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere (HS-ESS2-6)

(Secondary to HS-ESS2-4) Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. (HS-ESS1-4)

Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. (HS-ESS3-5)

DISCIPLINARY CORE IDEAS

PS4.B: Electromagnetic Radiation

• When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells. (HS-PS4-4)

ESS1.B: Earth and the Solar System

• Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes.
(secondary to HS-ESS2-4)

ESS2.A: Earth Materials and Systems

• The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (HS-ESS2-4)

• Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-2)

ESS2.D: Weather and Climate

• 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. (HS-ESS2-2), (HS-ESS2-4)

• Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (HS-ESS2-6)

• Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2- 6),(HS-ESS2-4)

ESS3.D: Global Climate Change

• Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. (HS-ESS3-5)

ESS1.B: Earth and the Solar System

• Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system. (HS-ESS1-4)

SCIENCE and ENGINEERING PRACTICES

Obtaining, Evaluating, and Communicating Information

• Evaluate the validity and reliability of multiple claims that appear in scientific and technical texts or media reports, verifying the data when possible. (HS-PS4-4)

Developing and Using Models

• Use a model to provide mechanistic accounts of phenomena. (HS-ESS2-4), (HS-ESS2-6)

Analyzing and Interpreting Data

• Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS2-1), (HS-ESS3-5)
Using Mathematical and Computational Thinking
• Use mathematical or computational representations of phenomena to describe explanations. (HS-ESS1-4)

Connections to Nature of Science Scientific Investigations
• Science investigations use diverse methods and do not always use the same set of procedures to obtain data. (HS-ESS3-5)
• New technologies advance scientific knowledge. (HS-ESS3-5)
• Science knowledge is based on empirical evidence. (HS-ESS3-5)

CROSS CUTTING CONCEPTS

Cause and Effect
• Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. (HS-PS4-4), (HS-ESS2-4)
Scale, Proportion, and Quantity
• Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). (HS-ESS1-4)
Stability and Change
• Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS2-2), (HS-ESS3-5)
Energy and Matter
• The total amount of energy and matter in closed systems is conserved. (HS-ESS2-6)

Connections to Engineering, Technology. and Applications of Science Influence of Engineering, Technology, and Science on Society and the Natural World
• New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS2-2)
• Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS1-4)

CONNECTIONS TO MATH

Reason abstractly and quantitatively. (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-6), (HSESS3-5) MP.2
Model with mathematics. (HS-ESS2-4), (HS-ESS2-6) MP.4
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-ESS2-4), (HS- ESS2-6), (HS-ESS3-5) HSN-Q.A.1

Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS2-4), (HS-ESS2-6), (HS-ESS3-5) HSN-Q.A.2
Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-6), (HS-ESS3-5) HSN-Q.A.3

English Language Arts

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-ESS2-2), (HS-ESS3-5) RST.11-12.1
Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS2-2), (HS-ESS3-5) RST.11-12.2
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-ESS3-5) RST.11-12.7
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-ESS2-4) SL.11-12.5

Overall Goal (What is the big idea?) Evidence exists of causes and consequences of a warming Earth.

Pre-Assessment: Unit 5 Pretest (Supplemental Folder)

(SLO) Student Learning Objectives (with standards)	**Student Learning Strategies**	**Formative Assessment ***suggested but not limited to the following***	**Activities ***suggested but not limited to the following***	**Modifications & Reflections ***suggested but not limited to the following***
AWBT EVALUATE the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.			Video: **Could electromagnetic radiation contribute to global warming?**	

HS-PS4-4				
AWBAT explain how environmental conditions (temperature and precipitation) impact glacial mass budget; identify where snow accumulates in a glacier and justify why. HS-ESS2-4			Glaciers	
AWBAT gather, display, and interpret incoming and outgoing solar radiation data to develop a model of the interactions of Earth's various surface types and incoming solar radiation. HS-PS4-4			MY NASA DATA	
AWBAT select scientific readings and datasets and identify relationships among solar variability, orbital cycles, and Earth's climate over various time scales. HS-ESS2-4 HS-PS4-4			Solar Variability & Orbital Cycles:	Modification of OER: Ice Cores and Orbital variations: Students apply the output of this visualization to develop a model of orbital changes as related to Earth's temperature over deep time.
AWBAT use the data on this website to assess diurnal, monthly, seasonal, and annual changes in the weather and climate parameters.			Climate Reanalyzer:	Alternatively, data may be acquired from NASA NEO or NASA Giovanni.

HS-ESS2-2				
AWBAT use the Environmental Change Model of the Climate Reanlyzer to study the feedbacks in the climate system. HS-ESS2-2			Climate Reanalyzer:	
AWBAT u understand how climate models are created and interpreted. They apply what they learn to the climate model outputs they interpret. HS-Esss2-4 HS- Ess2-6			Climate modeling 101 Climate modeling ouputs	
AWBAT develop and apply basic and/or advanced mathematical modeling skills to climate modeling. HS-ESS2-2			Carbon Cycle Lesson Plan	
AWBAT select from various paleoclimate datasets. They interpret the data and seek relationships among the datasets in order to understand changes in the Earth's climate over time. HS-ESS2-6			Paleoclimate Data Access	
AWBAT control the inputs of various climate forcings to observe the outputs on the climate system.			Carbon Connections Climate Model Carbon Connections	

AWBAT work through numerous models and interactives to gain a deeper understanding of the role of carbon in the climate system. HS-ESS2-6				
AWBAT construct an explanation and cite evidence for how changes in climate have influenced human activity. HS-ESS2-2			NASA - Climate Change Impacts EPA - Climate Change Impacts	
AWBAT explore images of the impacts of climate change over time to develop explanations from evidence of how an impact in one component of the Earth system has effects in other components of the Earth system. HS-ESS2-2			Images of Change	

21st Century Theme Targeted – Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Civic Literacy Health Literacy)

This unit covers Global awareness while exploring international environmental policy. Financial, Economic and Business is covered while explaining the relationship between economics and the environment and Civic Literacy is included during the introduction (Tragedy of the Commons) and US policies.

21st Century Skills Targeted (DO OVER-Add links)					
Creativity & Innovation	**Information Literacy**	**Media Literacy**	**Critical Thinking & Problem Solving**	**Communication & Collaboration**	**Life & Careers**
Climate modeling 101 Climate modeling ouputs	MY NASA DATA Solar Variability & Orbital Cycles:	Video: **Could electromagnetic radiation contribute to global warming?** Climate Reanalyzer:	Glaciers Carbon Connections Climate Model Carbon Connections Carbon Cycle Lesson Plan	Images of Change	Paleoclimate Data Access
Summative Assessments: (include rubrics & exemplars) Unit 5 Test (test and rubrics in supplemental folder)					
***Textbook Used:** Environmental Science, Your World, Your Turn Pearson 2011					

Unit 6: Human Activity and Sustainability **Time Frame: 30 days**
Essential Questions
*How do human activities influence the global ecosystem? *How might we change habits if we replaced the word “environment” with the word “life support system”? *Is the damage done to the global life support system permanent? *How can the impacts of human activities on natural systems be reduced?

*What are the relationships among earth's systems and how are those relationships being modified due to human activity?

Standards

Standards/CPIs (Cumulative Progress Indicators) taught and assessed:

PERFORMANCE EXPECTATIONS

Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. (HS-ESS3-1)

Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. (HS-ESS3-3)

(Secondary to HS-ESS3-3) Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. (HS-LS4-6)

Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. (HS-ESS3-4)

Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. (HS-ESS3-6)

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. (HS-ETS1-3)

DISCIPLINARY CORE IDEAS

ESS3.A: Natural Resources

• Resource availability has guided the development of human society. (HS-ESS3-1)

ESS3.B: Natural Hazards

• Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1)

LS4.C: Adaptation

• Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-6, secondary to HS-ESS3-3)

ESS3.C: Human Impacts on Earth Systems

• The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3) • Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)
ESS3.D: Global Climate Change
• Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. (HS-ESS3-6)
ESS2.D: Weather and Climate
• Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.
(secondary to HS-ESS3-6) ETS1.B: Developing Possible Solutions
• When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary to HS-ESS3-4)

SCIENCE and ENGINEERING PRACTICES

Constructing Explanations and Designing Solutions
• Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1)
• Design or refine a solution to a complex real world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4) Using Mathematics and Computational Thinking
• Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-ESS3-3)
• Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HSESS3-6)
• Create or revise a simulation of a phenomenon, designed device, process, or system. (HS-LS4-6)

CROSS CUTTING CONCEPTS

Cause and Effect
• Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3-1), (HS-LS4-6)
Systems and System Models
• When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3- 6)
Stability and Change
• Feedback (negative or positive) can stabilize or destabilize a system. (HSESS3-4), (HS-LS4-6)

• Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-3)

Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World
• Modern civilization depends on major technological systems. (HS-ESS3-3)
• Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS-ESS3-4)
• New technologies can have deep impacts on society and the environment, including some that were not anticipated. (HS-ESS3-3)

Connections to Nature of Science Science is a Human Endeavor
• Science is a result of human endeavors, imagination, and creativity. (HS-ESS3-3)

CONNECTIONS TO MATH

Reason abstractly and quantitatively. (HS-ESS3-1),(HS-ESS3-3),(HS-ESS3-4),(HS-ESS3- 6),(HS-ETS1-3) MP.2
Model with mathematics. (HS-ESS3-3),(HS-ESS3-6),(HS-ETS1-3) MP.4
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-ESS3-1),(HS-ESS3-4),(HSESS3-6) HSN-Q.A.1
Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3- 1),(HS-ESS3-4),(HS-ESS3-6) HSN-Q.A.2
Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-6) HSN-Q.A.3

English Language Arts

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-ESS3-1),(HS-ESS3-4) RST.11-12.1
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-ESS3-4), (HSETS1-3) RST.11-12.8
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. RST.11-12.7 (HS-ETS1-3)
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. RST.11-12.9 (HSETS1-3).
Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1) WHST.9-12.2
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.9-12.5

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. (HSLS4-6) WHST.9-12.7

Overall Goal (What is the big idea?) Natural resource consumption and occurrence of natural hazards are linked by human activity, therefore, humans can create ways to mitigate adverse impacts of human activity on biodiversity.
Pre-Assessment: Unit 6 Pretest

(SLO) Student Learning Objectives (with standards)	**Student Learning Strategies**	**Formative Assessment ***suggested but not limited to the following***	**Activities ***suggested but not limited to the following***	**Modifications & Reflections ***suggested but not limited to the following***
AWBAT read this explanation about how cost-benefit analysis is derived and applied in order to apply this model to design solutions related to human sustainability. HS-ESS3-1			Cost-Benefit Analysis Primer CBA to water sanitation.	
AWBAT play this game in order to evaluate competing design solutions for developing, managing, and utilizing energy resources based on cost-benefit ratios HS-ETS1-3			Carbon Stabilization Wedge:	
AWBAT Identify a strategy that would produce a sustainable use of resources in a simulation			One For All: A Natural Resources Game:	

game. Draw parallels between the chips used in the game and renewable resources upon which people depend. Draw parallels between the actions of participants in the game and the actions of people or governments in real-world situations. HS-LS4-6				
AWBAT explore this website to develop an understanding of how computational models of the impacts on biodiversity are created. AWBAT explore for a global perspective of land use and conservation efforts. HS-ESS3-3			Building Biodiversity and the PREDICTS project and GLOBIO project: Conservation Maps	
AWBAT assess the biodiversity in their schoolyards, and apply their model outputs to predict the changes in biodiversity as related to human impacts and the application of sustainable practices. HS-ESS3-1			Schoolyard Biodiversity:	

AWBAT read this article to learn how ecological economics models are developed and applied to further understand human impacts on our environment. HS-ESS3-1			=P*A*T Equation and Its Variants:	
AWBAT explore the simulations found at this website in order to create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. HS-ESS3-3			National Climate Assessment:	
AWBAT apply the stormwater runoff calculator to determine the impacts of landuse change, precipitation variations, and other parameters on runoff HS-ESS3-3			Stormwater Calculator Water Erosion Prediction Project	
AWBAT Explore Human Interactions with Natural Resources: This activity explores the various influences of human consumption of natural			The Bean Game:	

resources over time. (use this as a primer for making a computational model). HS-ESS3-3				
Students will develop a strategy to increase recycling and waste diversion for their school. HS-ESS3-4			NSA Challenge Recycling for a Cleaner World:	
This environmental study project allows a group of students to consider real environmental dilemmas concerning water use and provide solutions to these dilemmas. HS-ETS1-3			Land and People: Finding a Balance	
AWBAT access and explore a series of interactive maps displaying coral reef data from around the globe and develop hypotheses related to the impacts of climate change HS-LS4-6			Reefs at Risk NOAA Coral Reefs at Risk	
AWBAT collect data about their school field site through existing GLOBE protocols of phenology, land cover and soils as well as through new protocols focused on			GLOBE Carbon Cycle:	

biomass and carbon stocks in vegetation. Students participate in classroom activities to understand carbon cycling at local and global scales. Students expand their scientific thinking through the use of systems models				
ASWBAT Watch a segment of a NASA video and discuss how the earth is constantly changing.			Earth: Planet of Altered States:	

21st Century Theme Targeted – Global Awareness, Entrepreneurial Literacy, and Health Literacy					
21st Century Skills Targeted (DO OVER-Add links)					
Creativity & Innovation	**Information Literacy**	**Media Literacy**	**Critical Thinking & Problem Solving**	**Communication & Collaboration**	**Life & Careers**
Schoolyard Biodiversity:	I=P*A*T Equation and Its Variants:	GLOBE Carbon Cycle: Earth: Planet of Altered States:	Cost-Benefit Analysis Primer CBA to water sanitation. Stormwater Calculator Water Erosion Prediction Project	Carbon Stabilization Wedge: One For All: A Natural Resources Game:	Building Biodiversity and the PREDICTS project and GLOBIO project: Conservation Maps
Summative Assessments: (include rubrics & exemplars)					

Unit 6 Test (test and rubrics in supplemental folder)
***Textbook Used:** Environmental Science, Your World, Your Turn Pearson 2011