Environmental Literacy Unit Plan

Grade: 6: Earth and Space Science
Title: ***Earth and Human Activity***
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NGSS Unit Plan

Title of Unit	Earth and Human Activity	**Grade Level**	6
Curricular Theme (s)	*Earth Science*	**Time Frame**	
Essential Question(s) to be Addressed	What are the consequences of human activity on air, land and water over time?		

Background Information and Context

NGSS Performance Expectations:

- **MS-ESS3-5.** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
- **MS-ESS3-1.** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
- **MS-ESS3-2.** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- **MS-ESS3-4.** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*

Applicable Common Core Standards (CCSS ELA and CCSS Math)

ELA/Literacy

- **RL.6.1.** Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
- **W.6.1.** Write arguments to support claims with clear reasons and relevant evidence.
  - **A.** Argumentative Writing. Introduce claim(s) and organize the reasons and evidence clearly.
  - **B.** Support claim(s) with clear reasons and relevant evidence, using credible sources and demonstrating an understanding of the topic or text.
  - **C.** Use words, phrases, and clauses to clarify the relationships among claim(s) and reasons.
  - D. Establish and maintain a formal style.
  - **E.** Provide a concluding statement or section that follows from the argument presented.
- **SL.6.4.** Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

- **SL.6.5.** Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.
- **SL.6.6.** Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grade 6 Language standards 1 and 3 for specific expectations.)

Mathematics

- **6.NS.C.8.** Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.
- **6.SP.A.2.** Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
- **6.SP.B.4.** Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
- **6.SP.B.5.** Summarize numerical data sets in relation to their context, such as by:
  - **A.** Reporting the number of observations.
  - **B.** Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
  - **C.** Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
  - **D.** Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

Prior Understandings

- Humans can not eliminate natural hazards but can attempt to reduce their impacts.
- Energy and fuels come natural sources, some are renewable and some are nonrenewable.
- Our use (agriculture, industry and everyday life) of these energy and fuels can affect the environment.
- Individuals and communities are doing things to help protect Earth's resources and environments.
- The efforts of humans need to be monitored to assess effectiveness.
- Geoscience processes that changes the Earth and impact the distribution of resources.
- Humans have the technology to forecast some but not all natural hazards and they can be predicted with various accuracy.
- Water, land and air are all connected and changes in one areas creates changes in another
- Water and air create changes on land.
- Small changes on Earth can lead to large changes over time.

Community Connections: Sustainability Initiative

Students will design and present a solution to mitigate human impact on the environment (water, air, land) in their community. The design is to not only include a method to mitigate the effects of storm water, but to monitor this method over time (**ESS3-3**)

Field Trips/Community Partnerships

To enrich the experiences described in the learning sequence of this document, students may participate in one or more of the following field experiences:

- **Earth Force / Caring for Our Watershed Competition**. Students design a method to help improve the health of their local watershed and present their designs in a competition with other students across the city. (www.caringforourwatersheds.com)
- **Aquatic Resources Education Center**. Students can visit the Aquatic Resources Education Center in Anacostia Park. There, students can see organisms that live in the watershed, participate in a water flow table demonstration, and canoe tour the Anacostia River and discuss the implication of human activities on the health of the River. (doee.dc.gov/arec)
- **Canal Park**. Students have the opportunity to visit a self-sustaining park that includes a number of 'green' technologies regarding water collection. (www.canalparkdc.org)
- **Green Building**. Students can tour a 'green' building that includes a number of technologies designed to meet LEED (Leadership in Energy & Environmental Design) building certification
- **National Building Museum**. Students can tour the 'Designing for Disaster' exhibit, detailing engineering solutions to designing buildings in areas vulnerable to natural hazards. Teachers may also obtain curriculum material kits which allow students to design their own disaster proof building. (http://www.nbm.org/exhibitions-collections/exhibitions/designing-for-disaster.html)

Disciplinary Core Ideas: (Students will know ...)

- **ESS3.D. Global Climate Change.** Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and *reducing human vulnerability to whatever climate changes do occur* depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)
- **ESS3.A. Natural Resources.** Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet *as a result of past geologic processes*. (MS-ESS3-1)
- **ESS3.B. Natural Hazards.** Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can *help forecast the locations and*

likelihoods of future events. (MS-ESS3-2)

- **ESS3.C. Human Impacts on Earth Systems.** Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth *unless the activities and technologies involved are engineered* otherwise. (MS-ESS3-3, MS-ESS3-4)
- **ESS3.D. Human Impacts on Earth Systems.** Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. *But changes to Earth's environments can have different impacts (negative and positive) for different living things*. (MS-ESS3-3)

Science and Engineering Practices: (Students will ...)

Asking Questions and Defining Problems
Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.

- Ask questions to identify and clarify evidence of an argument. (MS-ESS3-5)

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to determine similarities and differences in findings. (MS-ESS3-2)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) 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. (MS-ESS3-1)
- Apply scientific principles to design an object, tool, process or system. (MS-ESS3-3)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-ESS3-4)

Crosscutting Concepts (Students will connect ...)

Patterns

- Graphs, charts, and images can be used to identify patterns in data. (MS-ESS3-2)

Cause and Effect

- Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (MS-ESS3-3)
- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1, MS-ESS3-4)

Stability and Change

- Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-5)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ESS3-1, MS-ESS3-4)
- The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-ESS3-2, MS-ESS3-3)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

- Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-ESS3-4)

Performance Task

Performance Task Description: *(Note: The performance task should include elements from the three dimensions from the NGSS (both knowing and doing)*

People are moving to DC at an alarming rate. In 2013, more than 80,000 people moved to the DC Metro Area. This area is already one of the most threatened watersheds. As the population in DC continues to grow, this will put more strain on the Earth's natural resources.

Students will work as teams of scientists (hydrologists, meteorologists, and geologists) who have gathered to examine the current condition of the DC Watershed. They will define the problem for city officials and recommend solutions to monitor and mitigate the effects of the DC area's growing human population.

Goal	• Persuade the DC Council (constructing an argument based on evidence) that current population increase is putting a strain on our natural resources based on what you know about past distribution of resources and how that distribution has changed. • Propose solutions to monitor and minimize the impact of humans on these resources including potential future forecasts if we do not invest in the proposed solutions. (Construct explanations and design **solutions**)
Role	You are a Hydrologist, Meteorologist, or Geologist (teacher or student selected)
Audience	DC Council
Situation	The human population of DC is increasing and putting a strain on the areas natural resources.
Product/ Performance	You will write a testimony arguing (and describing evidence) that population increase in DC is putting a strain on our Earth's natural resources (**ESS3-4, 5**) that includes an explanation of how resources are changed as a result of removal by humans (**ESS3-1**) and a forecast of potential natural hazards based on current and past data (**ESS3-2**). You will then propose a solution (or menu of solutions) to monitor and minimize human impacts on natural resources (**ESS3-3**).
Standards and Criteria for Success	Student presentations need to include data analysis, models, feedback mechanisms, climate changes as a result of energy flow into and out of Earth's systems, influences on human activity, evidence-based forecast of rate of climate change, future impacts to Earth's systems, and constraints and criteria for solutions that account for societal needs and wants.
Other Evidence	**MS-ESS3-5.** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. • Students develop a question chart asking clarifying questions about the evidence presented **MS-ESS3-2.** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. • Based on a map/past data sets students will forecast the likelihood of specific natural hazards occurring • Students analyze the development of technology that is used to track natural

	hazards such as earthquakes and hurricanes • Students evaluate the methods of mitigation based on the abilities to forecast them (touch on school safety procedures during these events) **MS-ESS3-1.** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. • Students write an explanation (using claim, evidence, and reasoning) of how resources on Earth are unevenly distributed due to both geoscience processes and human activities based on evidence gathered during explorations. **MS-ESS3-4.** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. • Students write an argument (using claim, evidence, and reasoning, and rebuttal) responding to the question: *"What effect(s) has the increase in human population and per capita consumption of natural resources in the Chesapeake Bay had on each of Earth's systems: hydrosphere, biosphere, geosphere, atmosphere?"* **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. • Students create a solution proposal that addresses monitoring and minimizing human impact on the environment. (Their proposal may be a tool or method.) (Examples of human activities could include: fracking, water redistribution, storm water runoff, agriculture, etc.)

Grouping Strategies	**Materials and Equipment Required**
There are three roles per team: hydrologist, meteorologist, geologist • Students work in 'expert' groups (all hydrologists will work together) and then switch to their 'teams.' • Group students *heterogeneously* during the 'expert group' phase of the instructional sequence and then move to *homogeneous* groups during the 'team' phase in which they develop their final performance task.	Depending on the format of testimony/design proposal that a teacher has selected, different materials will need to be utilized for the performance task. For example, if students are required to write a letter, paper, pencil, and or computer word processors should be provided.

Learning Plan/Instructional Sequence

ENGAGE:

Performance Expectation: MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Common Core Connection

CCSS.ELA-LITERACY. **SL.6.6:** Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See Grade 6 Language Standards 1 and 3 for specific expectations.)

Students should know…

ESS3.D: Global Climate Change: Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and *reducing human vulnerability to whatever climate changes do occur* depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)

- The difference between **weather** and **climate**
- Global temperatures are rising and have risen over the past century
- Small changes over time can accumulate*
- The **greenhouse effect**
- Human activities (burning **fossil fuels** for electricity, agriculture) have contributed to an increase in the **greenhouse effect***
- **Climate change** and its effects on humans can be mitigated

***Crosscutting Concepts**

Stability and Change: Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

Students should …

- View photos of Chesapeake Bay post storms and map of the Chesapeake Bay and areas that may become submerged and generate questions about what is happening and why?*
- View photos of evidence of climate change and generate research questions about each photo* that could help answer the overarching question: How is this evidence of how Earth's climate has changed over time?
- Conduct Greenhouse effect lab experiment **(Students collect and represent data. What are the math content connections?)**
- Analyze a graph of CO_2 vs Global Temperature **(What are the math connections?)**
- View evidence of factors that effect global climate change and ask clarifying questions* (questions that can be researched) regarding the images.
- Analyze a graph of industry vs CO2 vs Global Temperatures.

- Collect evidence from the greenhouse effect lab and CO2 vs Global Temperature Graph. Then, ask questions about the data* and how it can be further evidence of climate change.

***Science and Engineering Practices**
Asking Questions: Ask questions to identify and clarify evidence of an argument.

Teacher will…

- Provide images
- Ask students to observe, infer, and question
- Facilitate discussion
- Provide evidence photos and descriptions and ask students to determine the evidences' relevance to the discussion of climate change.
- Facilitate greenhouse effect lab and data analysis **(Where is the resource list/suggestions/asks that CASE might be able to assist with??)**
- Provide students with evidence of human factors that contribute to global climate change
- Facilitate discussion and ask probing questions about the presented information.

Evidence of Learning Statements
Students develop a question chart asking clarifying questions about the evidence presented

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EXPLORE:

Performance Expectation: MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

CCSS.ELA

RL.6.1 - READING. Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

CCSS MATH

6.RP.A.3. Use **Ratio and Proportion** reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

- **A.** Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
- **B.** Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?
- **C.** Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
- **D.** Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Students should know…

ESS3.B: Natural Hazards. Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can *help forecast the locations and likelihoods of future events*. (MS-ESS3-2)

- Explore how human life is impacted by these events (For example—increases in insurance policies, revisit map of submerged areas in the Chesapeake Bay* and read an accompanying article explaining how scientists were able to create the map using forecasting techniques and technologies
- A **natural hazard** is an earthquake, hurricane, volcanic eruption, tornado, flood, tsunami, long term changes to the environment (sea level rise, glaciers melting, deforestation, agricultural changes), etc.
- These hazards are more likely to occur in certain locations.* For example—flooding occurs near water, Earthquakes happen near plate boundaries
- Humans **map** these phenomena with global satellite systems and other technologies*
- Humans use what we know about the location of these past natural hazards and current data to inform **forecasts** about future catastrophes*
- Some natural hazards can be forecasted better than others. For example—earthquakes can happen unexpectedly
- Depending on the location, humans have developed technology and other mitigation strategies specific to their threat of natural hazard*

***Crosscutting Concepts**

- *Patterns*: Graphs, charts, and images can be used to identify patterns in data.
- *Influence of Science, Engineering, and Technology on Society and the Natural World*: All human activity draws on natural resources and has both short and long term consequences, positive as well as negative, for the health of people and the natural environment

***Science and Engineering Practices**

- *Analyzing and Interpreting Data*—Analyze and interpret data to determine similarities and differences in findings.

Students should do…

- Analyze and interpret data from multiple sources - maps, charts, graphs
- *Forecast future events based on data

Teacher will…

- Provide multiple sources of data: maps, charts, graphs
- Facilitate discussions regarding data
- Provide the reading materials

Evidence of Learning Statements

- Based on a map/past data sets, students will forecast the likelihood of specific natural hazards occurring
- Students analyze the development of technology that is used to track natural hazards such as earthquakes and hurricanes

- Students evaluate the methods of mitigation based on the abilities to forecast them (include school safety procedures during these events)

EXPLAIN:

Performance Expectation: MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

Common Core Connections

CCSS MATH -Statistics and Probability

- **6.SP.B.4.** Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
- **6.SP.B.5.** Summarize numerical data sets in relation to their context, such as by:
  - **A.** Reporting the number of observations.
  - **B**. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
  - **C.** Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
  - **D.** Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

Students should know…

ESS3.A: Natural Resources: Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet *as a result of past geologic processes*. (MS-ESS3-1)

- A **resource** is…
- These resources come from the four spheres of Earth—**biosphere**, **atmosphere**, **geosphere**, **hydrosphere**.
- The difference between **renewable** and **nonrenewable** resources
- **Geologic processes** (fossil fuels, groundwater) **(FRACKING is not a geological practice. It is a technology developed by humans for a particular purpose)**
- **Cause**: Geological processes; **Effect**: Uneven distribution of resources*
- Humans can also affect this distribution of resources via activities to collect and use them.*
- Reliable **evidence is...**

***Crosscutting Concepts**

- *Cause and Effect*—Relationships may be used to predict phenomena in natural or designed systems
- *Influence of Science, Engineering, and Technology on Society and the Natural World*—All human activity draws on natural resources and has both short and long term consequences,

positive as well as negative, for the health of people and the natural environment

***Science and Engineering practices**

- *Construct Explanations and Design Solutions*: Construct a scientific explanation based on valid and reliable evidence obtained from sources.

Students should do…

- Identify resources as renewable and nonrenewable
- Explore how geosciences processes result in uneven resource distribution
- Examine how human processes further result in uneven resource distribution (connected to data introduced in earlier sequence)
- Construct an explanation with valid and reliable evidence*

Teacher will…

- Provide students with definitions of renewable and non renewable resources
- Facilitate student exploration on uneven resource distribution (For example, sedimentation and runoff)
- Ask students how humans may exacerbate uneven resource distribution
- Provide a rubric, model, and directions for creating a scientific explanation

Evidence of Learning Statements

Students write an explanation of how resources on Earth are unevenly distributed due to both geoscience processes and human activities based on evidence gathered during explorations.

ELABORATE:

Performance Expectation: MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Common Core Connections

CCSS ELA-LITERACY

W.6.1. Write arguments to support claims with clear reasons and relevant evidence.

- **A.** Argumentative Writing: Introduce claim(s) and organize the reasons and evidence clearly.
- **B.** Support claim(s) with clear reasons and relevant evidence, using credible sources and demonstrating an understanding of the topic or text.
- **C.** Use words, phrases, and clauses to clarify the relationships among claim(s) and reasons.
- **D.** Establish and maintain a formal style.
- **E.** Provide a concluding statement or section that follows from the argument presented.

Students should know…

ESS3.C: Human Impacts on Earth Systems: Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth *unless the activities and technologies involved are engineered* otherwise. (MS-ESS3-3, MS-ESS3-4)

- Humans depend on Earth for resources*
- As human population rises, demand for resources rise and resource supply lowers*
- As we use Earth's resources, we damage Earth. For example—fracking, and water processing*
- Technologies can be used to mitigate these damages
- **Empirical** evidence **is derived from experiment or field studies**
- **Reasoning is based on** evidence

***Crosscutting Concepts**

- *Cause and Effect*—Relationships may be used to predict phenomena in natural or designed systems
- *Influence of Science, Engineering, and Technology on Society and the Natural World*—All human activity draws on natural resources and has both short and long term consequences, positive as well as negative, for the health of people and the natural environment
- *Science Addresses Questions About the natural and Material World*—Scientific knowledge can describe the consequences of actions, but does not necessarily prescribe the decisions that society takes.

Teacher will…

- Provide data and graphing supplies
- Facilitate viewing and discussion of sources
- Provide examples and facilitate discussion around current technologies to mitigate impacts
- Provide a rubric, model, and directions for the argument task

Students should do…

- Graph the relationship between human population and an estimated amount of a natural resource (oil and/or natural gas**)** **(Please list the CCSS Math connection for this activity)**
- Analyze bias in different sources about how human use of resources impacts Earth*
- Evaluate current technologies being used or developed to mitigate the impact of humans*
- Construct an argument based on empirical evidence and scientific reasoning (CER)*

Evidence of Learning Statements

Students write an explanation (using claim, evidence, and reasoning) responding to the question: *"What effect(s) has the increase in human population and per capita consumption of natural resources in the Chesapeake Bay had on each of Earth's systems: hydrosphere, biosphere, geosphere, atmosphere?*

EVALUATE:

Performance Expectation: MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Common Core Connections

CCSS ELA-LITERACY

- **SL.6.4.** Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
- **SL.6.5.** Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.

Students should know …

ESS3.C: Human Impacts on Earth Systems

- Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth *unless the activities and technologies involved are engineered* otherwise. (MS-ESS3-3, MS-ESS3-4)
- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. *But changes to Earth's environments can have different impacts (negative and positive) for different living things*. (MS-ESS3-3)
- Natural **habitats** are where animals live
- These habitats can be affected by human activities*
- These impacts can be different for different organisms*

Crosscutting Concepts

- *Cause and Effect*: Relationships can be classified as **causal** or **correlation** and correlation does not necessarily imply causation.
- *Influence of Science, Engineering, and Technology on Society and the Natural World*: The uses of technologies and any limitations on their use are driven by individual or societal means, desires, and values.

Science and Engineering Practices

- *Constructing Explanations and Designing Solutions*: Apply scientific principles to design an object, tool, process, or system.

Teacher will…

- Facilitate exploration of habitats
- Ask probing questions about *why* habitats have changed
- Facilitate discussion around previous explorations
- Provide rubric, modeling, and directions for design solution

Students should …

- View different habitats around their school and look for evidence of habitat degradation
- Reflect on earlier explorations of geoscience processes and human activities that influence Earth's resources and their impact on habitats.
- Design a tool, process, or system to solve a problem*
- Devise a way to monitor the impact of that tool, process, or system*

Evidence of Learning Statements

Students create a solution proposal that addresses monitoring and minimizing human impact on

the environment. (Their proposal may be a tool or method.) (Examples of human activities could include: fracking, water redistribution, storm water runoff, agriculture, etc.)

NARRATIVE

At the beginning of the unit, students will be engaged with a map of the Chesapeake Bay watershed depicting areas that may eventually become submerged. The teacher will also provide students the opportunity to view several pieces of evidence of global climate change. For example, students will view a picture of a fossil tropical plant found in Antarctica. Students should generate questions as to what is happening and why. The teacher will facilitate discussions and focus students toward researchable questions, that when answered, will help students answer the overarching question for the unit: **How have humans impacted the Earth's land, air, and water?**

Students will be encouraged to explore the answers to their questions from the beginning of the unit. As students complete various investigations, such as the effects of greenhouse gases on temperature and view other provided sources of data, the teacher will guide their thinking as to how humans may have contributed to the patterns they see in the data. Then students will be shown pictures of human activity on Earth. As students are provided with pictorial evidence of human activity, students will then begin to correlate the human activity with the data collected and viewed earlier.

Students will then consider the resources in their immediate area (the Chesapeake Bay Watershed). After students identify the resources in the area (land, water, fuel, etc.), the teacher will ask students to classify the resources as renewable and non renewable. The teacher will guide their thinking to the conclusion that humans are using more nonrenewable resources **than** renewable and that this use leads to the uneven distribution of resources. Students will confirm this assertion by investigating a scale model of 'fracking' and how sediment run-off can occur as a result of resource removal from the Earth. Students should come to the conclusion that not only does sediment run-off, but so does trash, hazardous chemicals, etc.

At this time, the teacher will provide students with a graph of human population vs. resource consumption, as well as pictures of habitats that have been degraded due to the resource removal explored earlier. Additionally, they should be shown the same map of the submerged areas of the Chesapeake Bay watershed. While viewing this data, students should be guided to the ideas from the start of the unit and begin to formulate an explanation to the question: how have humans impacted Earth's land, air, and water.

As students craft their explanations, they should draw on evidence from the explorations, graphs, and handouts from the unit. Once they have identified the problem and explained it, they will use it to prepare a testimony for the DC City Council. **Along with** their testimony, students will design a solution to mitigate the effects of the human population. If possible, students should explore Canal Park to see examples of some solutions in action. Once students have designed a viable solution and solid testimony, they should share their ideas with the class via a mock hearing or gallery walk.

Performance Task Rubrics

Define the Problem

Explain the effects of human population increase the DC/Chesapeake Watershed

	Claim	Evidence	Reasoning	Rebuttal
4	Accurately describe the relationship between human population increase and Earth's system with detail.	More than 3 pieces of empirical evidence are present (both qualitative and quantitative).	Connects all pieces of evidence to the claim with logical explanation.	Includes at-least one alternate claim and a detailed explanation of why that claim is inconsistent with the evidence already presented.
	Shows full understanding of potential human impacts on the environment as evident through detailed introduction of problem.	All evidence presented is relevant to the claim and accurate.	Includes a complete description of scientific concepts related to human impacts on the environment with thoughtful connection to the claim.	All specific evidence referenced.
3	Accurately describe the relationship between human population increase and Earth's system.	At-least 3 pieces of empirical evidence are present (both qualitative and quantitative).	Connects most pieces of evidence to the claim with logical explanation.	Includes at-least one alternate claim and a mostly detailed explanation of why that claim is inconsistent with the evidence already presented.
	Shows understanding of potential human impact on the environment as evident through	All evidence presented is relevant to the claim and accurate	Includes a complete description of scientific concepts related to human impacts on the environment	Most specific evidence referenced

	introduction of problem.			
2	State the relationship between human population increase and Earth's system with partial accuracy.	At-least 2 pieces of empirical evidence are present (both qualitative and quantitative).	Connects some pieces of evidence to the claim with logical explanation.	Includes at-least one alternate claim and a limited explanation of why that claim is inconsistent with the evidence already presented.
	Shows basic understanding of potential human impact on the environment.	Some evidence presented is relevant to the claim and partially accurate.	Includes a mostly description of scientific concepts related to human impacts on the environment.	Some specific evidence referenced.
1	Inaccurately state the relationship between human population increase and Earth's system with partial accuracy.	Only 1 piece of empirical evidence is present.	Connection of pieces of evidence to the claim is unclear.	Includes at-least one alternate claim with no explanation of why that claim is inconsistent with the evidence already presented.
	Shows limited understanding of potential human impact on the environment.	Evidence presented may not be relevant to the claim or accurate.	Includes an unclear or incomplete description of scientific concepts related to human impacts on the environment.	Little or no specific evidence referenced.

Propose a Solution

Solution to monitor and minimize human impact on Earth's System: DC/Chesapeake Watershed				
	Claim	**Evidence**	**Reasoning**	**Potential Limitations**
4	Solution for minimizing impact could result in clear environmental improvement Includes a detailed plan for monitoring over time.	Accurate empirical evidence of efficacy of proposed solution is presented (qualitative and quantitative).	Summarize the ways in which science is applied and used to address the identified problem with detail.	Accurately describe potential limitations.
	Uses new approaches or existing techniques in a highly creative manner.	All relevant evidence is included.	The solution reflects a deep understanding of the issue, its solution and complexity.	Propose revised design based on limitations.
3	Solution for minimizing impact could result in potential environmental improvement.	Mostly accurate empirical evidence of efficacy of proposed solution is presented (qualitative and quantitative).	Summarize the ways in which science is applied and used to address the identified problem with some detail.	Accurately describe potential limitations.
	Includes a mostly detailed plan for monitoring over time. Uses new approaches or existing techniques in a creative manner.	Most relevant evidence is included.	The solution reflects an adequate understanding of the issue, its solution and complexity.	
2	Solution for minimizing impact could result in	Some accurate empirical evidence of efficacy of	Summarize the ways in which science is applied and used to	Describe potential limitations of solution with

	limited environmental improvement.	proposed solution is presented (qualitative and quantitative).	address the identified problem.	some accuracy.
	Includes a somewhat detailed plan for monitoring over time Uses existing techniques in a common application	Some relevant evidence is included	The solution presents a basic understanding of the issue, its solution and complexity.	
1	Solution has little or no environmental improvement.	Inaccurate empirical evidence of efficacy of proposed solution is presented (qualitative and quantitative)	State the ways in which science is used to address the identified problem.	Describe potential limitations of solution with limited success
	Includes a vague plan for monitoring over time Uses techniques that are irrelevant or unrealistic	Limited relevant evidence is included	The solution presents limited understanding of the issue, solution and its complexity	

Universal Access

Supporting English Language Learners

Reading, Writing, or Speaking Activity	**Supports for *Emerging* Learners**	**Supports for *Expanding* Learners**	**Supports for *Bridging* Learners**
Students **write** an argument (using claim, evidence, and reasoning,	• Teachers provide definitions of key words and sentence starters that could be used by students for	• Teachers should provide definitions of key words and sentence starters that could be used in their	• Teachers may provide differing levels of text for students to draw evidence from to support their

and rebuttal) responding to the question: *"What effect(s) has the increase in human population and per capita consumption of natural resources in the Chesapeake Bay had on each of Earth's systems: hydrosphere, biosphere, geosphere, atmosphere?"*	arguments. • Students may receive a template to help them to organize their final product. They may also be pulled into small groups to receive more individualized support. • Teachers may provide differing reading levels of text for students from which they can draw evidence to support their arguments. • Throughout the instructional sequence, teachers should provide multiple sources of evidence (pictures, data, maps, etc.) to allow students to access evidence to use for their final argument. • Teachers should alternate between homogenous and heterogeneous groupings to allow students exposure to a wide range of different language skills.	arguments. • Students may receive a template that allows them to organize their final product. They may also be pulled into small groups to receive more individualized supports. • Throughout the instructional sequence, teachers should provide multiple sources of evidence (pictures, data, maps, etc.) to allow students to access evidence to use for their final argument.	arguments. • Throughout the instructional sequence, teachers should provide multiple sources of evidence (pictures, data, maps, etc.) to allow students to access evidence to use for their final argument. • Teachers should fluctuate between homogenous and heterogeneous grouping to allow students exposure to a wide range of different language skills.
Students **create a proposal to describe a solution** to monitor and minimize human impact	• Teachers may also consider allowing students with limited writing/speaking capabilities to present their products in a different manner agreed upon by the	• Teachers should alternate between homogenous and heterogeneous grouping to allow students exposure to a wide range of different language skills.	Teachers should alternate between homogenous and heterogeneous grouping to allow students exposure to a wide range of different language skills.

on the environment. The proposal may concern a tool or method. (Examples of human activities could include: fracking, water redistribution, storm water runoff, agriculture, etc.)	teacher and student. • Teachers should alternate placing students between homogenous and heterogeneous groups to allow students exposure to a wide range of different language skills.		•

Supporting Struggling Learners

Activity	Supports for Students who need ***Minor*** Support	Supports for Students who Need ***Intensive*** Support
Students write and argument (using claim, evidence, and reasoning, and rebuttal) responding to the question: *"What effect(s) has the increase in human population and per capita consumption of natural resources in the Chesapeake Bay had on each of Earth's systems: hydrosphere, biosphere, geosphere, atmosphere?"*	• Students who need minor support can have access to sentence *starters* and *graphic organizers* for organizing their evidence and ideas in order to complete their final product • Students may need additional assistance in interpreting data by providing students with guiding/scaffolded questions concerning the data in question	• Students in need of intensive support may receive a *template* that allows them to organize their final product. They may also be pulled into *small groups* to receive more individualized supports. • Students may need additional assistance in interpreting data by providing students with guiding/scaffolded questions concerning the data in question
Students create a solution proposal that addresses monitoring and minimizing human impact on the	• Students may have the opportunity to choose the *content* of their design. For example, students may select a	• Students requiring intensive support may have the opportunity to choose the *content* of their design. For

environment. (Their proposal may be a tool or method. Examples of human activities could include: fracking, water redistribution, storm water runoff, agriculture, etc.)	particular facet of the environment to focus on. • Students may also have the opportunity to present their final *product* in a number of different ways. For example, students may write about their solution, create a Public Service Announcement, Song, Rap, etc. as long as all of the requirements of the rubric are met.	example, students may select a particular facet of the environment to focus on. • Students may also have the opportunity to present their final *product* in a number of different ways. For example, students may write about their solution, create a Public Service Announcement, Song, Rap, etc. as long as all of the requirements of the rubric are met. • Students requiring intensive support may also be shown *examples of exemplary work* and pulled into *small groups* for more individualized support.

Supporting Advanced Learners

Activity	Extensions for Advanced Students
Students write an argument (using claim, evidence, and reasoning, and rebuttal) responding to the question: *"What effect(s) has the increase in human population and per capita consumption of natural resources in the Chesapeake Bay had on each of Earth's systems: hydrosphere, biosphere, geosphere, atmosphere?"*	Conduct further research related to effects of humans on ecosystems. They may also have access to geographic information systems (GIS) in order to collect more evidence for their argument.
Students create a solution proposal that addresses monitoring and minimizing human impact on the	Explore the engineering design process further by testing their proposed solution, collecting data on its efficacy, and then redesigning it improve the design.

environment. (Their proposal may be a tool or method.) (Examples of human activities could include: fracking, water redistribution, storm water runoff, agriculture, etc.)	

Connecting to the Core: NGSS Aligned Performance Task

(Note: Add additional sections as needed)

ELA Connections - *(Reading, Writing or Speaking Activity)* *listed in Learning and Instructional Sequence*

The following **Reading** standards will be addressed as part of writing the letter and creating the presentation. Students will be reading informational text, viewing videos, and seeing images

- **RL.6.1.** Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

The following **Writing** standards will be addressed through the writing task. Students will:

- **W.6.1.** Write arguments to support claims with clear reasons and relevant evidence:
  - **A.** Argumentative Writing. Introduce claim(s) and organize the reasons and evidence clearly.
  - **B.** Support claim(s) with clear reasons and relevant evidence, using credible sources and demonstrating an understanding of the topic or text.
  - **C.** Use words, phrases, and clauses to clarify the relationships among claim(s) and reasons.
  - **D.** Establish and maintain a formal style.
  - **E.** Provide a concluding statement or section that follows from the argument presented.

The following **Speaking and Listening** standards will be addressed through the presentation task:

- **SL.6.4.** Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
- **SL.6.5.** Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.
- **SL.6.6.** Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grade 6 Language standards 1 and 3 for specific expectations.)

Math Connections – *listed in Learning and Instructional Sequence*

The following **Ratio and Proportion** standards will be addressed as part of writing the letter and creating the presentation. Students will be analyzing data in order to determine ratios and percentages related to cause and effect on various topics; global warming data, human population increase, mapping natural hazard locations and geoscience process, resource distribution and use.

- **6.RP.A.3.** Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
  - **A.** Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
  - **B.** Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?
  - **C.** Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
  - **D.** Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

The following **Statistics and Probability** standard will be addressed when student organize their data for the letter and presentation as evidence.

- **6.SP.B.4**. Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
- **6.SP.B.5.** Summarize numerical data sets in relation to their context, such as by:
  - **A.** Reporting the number of observations.
  - **B.** Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
  - **C.** Giving quantitative measures of center (median and/or mean) and variability

(interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

- **D.** Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

RESOURCES

Chesapeake Bay Watershed maps

- http://www.cbf.org/about-the-bay/more-than-just-the-bay/chesapeake-bay-watershed-geography-and-facts
- http://www.cbf.org/about-the-bay/maps
- http://www.whrc.org/mapping/chesapeake/landcover.html
- http://en.wikipedia.org/wiki/Category:Chesapeake_Bay_watershed (compare this and the next link Chesapeake vs Potomac - Potomac feeds into Chesapeake)
- http://commons.wikimedia.org/wiki/File:Potomacwatershedmap.png
- https://www.google.com/search?q=chesapeake+bay+watershed&client=firefox-a&hs=Gwx&rls=org.mozilla:en-US:official&channel=sb&tbm=isch&tbo=u&source=univ&sa=X&ei=t22QVJ62EubGsQSjpIHgCQ&ved=0CCcQsAQ&biw=1060&bih=669
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Interactive maps of water level/climate change

- http://sealevel.climatecentral.org/
- http://www.chesapeakeadaptation.org/ (National Geographic)
- http://geology.com/sea-level-rise/ (NASA data)
- http://www.climatehotmap.org/ (Union of Concerned Scientists)
- http://warmingworld.newscientistapps.com/
- http://www.npr.org/news/specials/climate/interactive/

Additional resources with links to water

- http://climate.nasa.gov/climate_resource_center/interactives/quizzes (NASA)
- http://climate.nasa.gov/interactives/quiz_global_temp/quiz

CCSS-M and **-ELA notations refer to**: Common Core State Standards Initiative. Available URL: http://www.corestandards.org/read-the-standards/

ESS notations refer to: National Research Council. 2012. A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press. Available URL: http://www.nap.edu/catalog.php?record_id=13165