8th Grade Unit 2 - Human Impacts on Earth

Content Area: **Science**
Course(s): **Science Grade 8**
Time Period: **MP2**
Length: **45 days**
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NJSLS - Science

MS-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
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-ESS3-5	Ask questions to clarify evidence of the factors that have caused climate change over the past century.
MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Science and Engineering Practices

Asking Questions and Defining Problems

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

Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)

Constructing Explanations and Designing Solutions

Apply scientific principles to design an object, tool, process or system. (MS-ESS3-3)

Engaging in Argument from Evidence

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)

Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)

Developing and Using Models

Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)

Analyzing and Interpreting Data

Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)

Disciplinary Core Ideas

ESS3.C: 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)

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: 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)

ETS1.A: Defining and Delimiting Engineering Problems

The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles

and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)

ETS1.B: Developing Possible Solutions

A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)

There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2, MS-ETS1-3)

Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MSETS1-3)

Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C: Optimizing the Design Solution

Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)

The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)

Crosscutting Concepts

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-ESS3-4)

Stability and Change

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

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-ESS3-4, MS-ETS1-1)

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-ESS3-3, MS-ETS1-1)

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)

Rationale and Transfer Goals

Students construct an understanding of the ways that human activities affect Earth's systems. Students use practices to understand the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts on the development of these resources. Students also understand that the distribution of these resources is uneven due to past and current geoscience processes or removal by humans. Students then analyze and interpret data and design solutions to build on their understanding of the ways that human activities affect Earth's systems. The crosscutting concepts of patterns, cause and effect, and stability and change are called out as organizing concepts for these disciplinary core ideas. In this unit of study students are expected to demonstrate proficiency in asking questions, analyzing and interpreting data, constructing explanations, and designing solutions. Students are also expected to use these practices to demonstrate an understanding of the core ideas.

Enduring Understandings

Overuse of existing resources and careless industrial practices have caused pollution of air, groundwater and

surface water and soil.

If societies continue to consume resources at the current rate, we must develop new technologies and renewable energy resources to maintain our standard of living.

Human actions have affected climate change and understanding this will help lead to useful solutions.

Essential Questions

How might we treat resources if we thought about the Earth as a spaceship on an extended survey of the solar system? (How would astronauts manage their resources?)

How can basic chemistry be used to explain the mechanisms that control the global temperature and the atmosphere?

How do we monitor the health of the environment (our life support system)?

Content - What will students know?

- 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.
- Increases in human population and per-capita consumption of natural resources impact Earth's 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.
- Cause and effect relationships may be used to predict how increases in human population and per-capita consumption of natural resources impact Earth's systems.
- The consequences of increases in human populations and consumption of natural resources are described by science.

- Science does not make the decisions for the actions society takes.
- Scientific knowledge can describe the consequences of human population and per-capita consumption of natural resources impacting Earth's systems but does not necessarily prescribe the decisions that society takes.
- Stability in Earth's surface temperature might be disturbed either by sudden events or gradual changes that accumulate over time.
- Human activities and natural processes are examples of factors that have caused the rise in global temperatures over the past century.
- Human activities play a major role in causing the rise in global temperatures.
- 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 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.
- Evidence that some factors have caused the rise in global temperature over the last century can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities.
- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species.
- Changes to Earth's environments can have different impacts (negative and positive) for different living things.
- 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.
- Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.
- 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.

Skills - What will students be able to do?

- 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.
- Ask questions to identify and clarify a variety of evidence for an argument about the factors that have

caused the rise in global temperatures over the past century.

- Ask questions to clarify human activities and natural processes that are major factors in the current rise in Earth's mean surface temperature.
- Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Activities - How will we teach the content and skills?

- Inspire Science Earth and Space Unit 3 Module 1: Lesson 1 Impact on Land
- Inspire Science Earth and Space Unit 3 Module 1: Lesson 2 Impact on Water
- Inspire Science Earth and Space Unit 3 Module 1: Lesson 3 Impact on Atmosphere
- Inspire Science Earth and Space Unit 3 Module 1: Lesson 4 Impact on Climate
- Inspire Science Earth and Space Unit 3 Module 2: Lesson 1 Human Population Growth
- Inspire Science Earth and Space Unit 3 Module 2: Lesson 2 People and the Environment
- MS-ESS3-3 Lesson Examples
- MS-ESS3-4 Lesson Examples
- MS-ESS3-5 Lesson Examples

Evidence/Assessments - How will we know what students have learned?

- Inspire Science Labs
- Inspire Science STEM Module Projects
- Inspire Science Earth and Space Unit 3 Module 1 Assessment
- Inspire Science Unit 3 Module 2 Assessment
- Daily Warm Ups
- Daily Exit Tickets
- Grade 8 Unit 2 Benchmark Assessment

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
• 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. • Increases in human population and per-capita consumption of natural resources impact Earth's 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. • Human activities and natural processes are examples of factors that have caused the rise in global temperatures over the past century. • Human activities play a major role in causing the rise in global temperatures. • 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).	By the end of Grade 5, students understand that: Populations live in a variety of habitats, and change in those habitats affects the organisms living there. Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. When the environment changes in ways that affect a place's physical characteristics, temperature, or resource availability, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. Students also know that populations live in a variety of habitats, and change in those habitats affects the organisms living there. A simple design problem can be solved through the development of an object, tool, process, or system, and the solution can include several criteria for success and constraints on materials, time, or cost. Students know that they can test two different models of the	5-ESS3-1 Activities K-ESS3-3 Activities

	same proposed object, tool, or process to determine which better meets criteria for success. Students also analyzed data to refine a problem statement or the design of a proposed object, tool, or process and used data to evaluate and refine design solutions. They applied scientific ideas to solve design problems and generate and compare multiple solutions to a problem based on how well they met the criteria and constraints of the design solution. Students have made claims about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.	

Key Resources

Inspire Science

NOAA Education Resources

21st Century Life and Careers

9.2.8.CAP.8	Compare education and training requirements, income potential, and primary duties of at least two jobs of interest.

Career Readiness, Life Literacies, & Key Skills

9.4.8.CI.1	Assess data gathered on varying perspectives on causes of climate change (e.g., cross-cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).

9.4.8.CT.1	Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
9.4.8.CT.2	Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.CT.3	Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
9.4.8.IML.3	Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).
9.4.8.IML.4	Ask insightful questions to organize different types of data and create meaningful visualizations.
9.4.8.IML.5	Analyze and interpret local or public data sets to summarize and effectively communicate the data.
9.4.8.TL.1	Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
9.4.8.TL.2	Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).

Interdisciplinary Connections/Companion Standards

NJSLS ELA

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS3-4, MS-ESS3-5, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ETS1-3)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2, MS-ETS1-3)

WHST.6-8.1 Write arguments focused on discipline content. (MS-ESS3-4)

WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ESS3-3, (MS-ETS1-2)

WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ESS3-3,

MS-ETS1-1)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-4, (MS-ETS1-2)

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ETS1-4)

NJSLS Mathematics

MP.2 Reason abstractly and quantitatively. (MS-ESS3-5, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4)

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS3-3, MS-ESS3-4)

7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-ESS3-3, MS-ESS3-4)

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-1), (MS-ESS3-2), (MS-ESS3-3, MS-ESS3-4, MS-ESS3-5)

7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-1, MS-ETS1-2, MS-ETS1-3)

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-3, MS-ESS3-4, MS-ESS3-5)

7.SP Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. (MS-ETS1-4)