Unit 5: Waste

Content Area: **Science**
Course(s):
Time Period: **MP3**
Length: **25 days**
Status: **Published**

NJSLS - Science

9-12.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.
9-12.HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
9-12.HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
9-12.HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
9-12.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.

Science and Engineering Practices

Analyzing and Interpreting Data

Analyze data using computational models to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking

Use a computational representation of phenomena or design soluons to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Soluons

Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' invasions, models, theories, simulations, and 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)

Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (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 migraines. (HS-ESS3-1)

ESS3.C: Human Impacts on Earth Systems

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

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)

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 actives. (HS-ESS3-6)

Crosscutting 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)

Systems and System Models

When investing 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

Change and rates of change can be quantified and modeled over very short or very long periods. Some system changes are irreversible. (HS-ESS3-5)

Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4)

Rationale and Transfer Goals

This is an overview of our society's waste problems. Society produces many types of solid wastes, and these must be disposed of properly. Producing less waste, recycling, buying recycled products, composting and changing the types of materials that we use can help alleviate the problem.

Enduring Understandings

- Waste is a byproduct of things that we need and use in daily life.
- As our population continues to increase, the amount of waste is also going to increase.
- The amount of land available is going to continue to decrease, so we need to find more effective ways of dealing with waste.
- We should be separating biodegradable materials from regular waste, and using that in compost binds to supplement agriculture. Next, materials that can be recycled should be separated and collected. Glass and aluminum can be recycled over and over again. Plastic and paper can be recycled, but not indefinitely. The recycled product is generally a lower grade.
- We can buy less, and reuse more of what we already have to reduce waste.
- Some companies convert products that would normally be going into the trash into new and innovative designs. There is a growing market for this.
- We need to shop smarter when we shop. Packaging contributes a great deal of waste. Buying locally will reduce the need for lots of packaging.
- Coming up with beer materials for packaging is also something we need to explore. One example would be using packing peanuts made from starch (which biodegrades) instead of styrofoam (which isn't recyclable).
- We have choices in the things that we buy, and we can choose which companies to support, and which not to support. We also have the choice to recycle and compost, since both are available in the Lindenwold Community. To not do these things only reinforces the phrase " Out of sight, out of mind."

Essential Questions

- How do human activities influence the global ecosystem?
- What are the relationships among earth's systems and how are those relationships being modified due to human acvity?
- What is the current rate of global or regional climate change and what are the associated future impacts on Earth's systems?
- How can the impacts of human activities on natural systems be reduced?

Content - What will students know?

- Resource vitality has guided the development of human society.
- Natural hazards and other geologic events have shaped the course of human history.
- Natural hazards and other geologic events have significantly altered the sizes of human populations and have driven human migration.
- Empirical evidence is required to differentiate between cause and correlation and make claims about how the availability of natural resources, occurrence of natural hazards, and climate changes have influenced human activities.

Skills - What will students be able to do?

- Describe the difference between biodegradable and non-biodegradable, and give examples for each.
- Describe how a modern landfill operates.
- Explain 2 environmental problems caused by landfills.
- Identify methods that we can use to reduce waste.
- Summarize the steps that an item must go through to be recycled.
- Make your recycled paper.
- Compost organic materials while in school to reduce the school's waste. Explain the benefit to others.
- Correlate waste reduction with consumerism, by explaining how consumers that want
- reduced waste are willing to pay for it by buying recycled products.
- Help your community by assisting in our school-wide recycling program. Track the data for the school.
- Give an item that would be heading to the trash a different look or a different use.
- Assist in our "Santa's Workshop," which is in place to sell gently used items to families in our community.
- Create a new look for someone by using donated clothes from Goodwill or a consignment shop.
- Encourage our school to drop the bottled water habit by buying an LHS thermos, which can be filled with tap water.
- Examine ways that our school could reduce waste. Create a written plan to address the problem, and then present it for approval.
- Describe the characteristics of hazardous waste.
- Explain methods in place to treat hazardous waste safely.
- Encourage the 3Rs into your life: at home, at work, and school. Get your family and friends on board.

Activities - How will we teach the content and skills?

- Construct an explanation based on valid and reliable evidence for how the availability of natural resources, the occurrence of natural hazards, and climate changes have influenced human acvity.
- Use empirical evidence to differentiate between how the availability of natural resources, the occurrence of natural hazards, and climate changes have influenced human acvity.
- Use a computational representation to illustrate the relationships among Earth systems and how these relationships are being modified due to human acvity.
- Describe the boundaries of Earth systems.
- Analyze and describe the inputs and outputs of Earth systems.
- 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 on Earth systems.
- Quantify and model change and rates of change in geosciences data and rates of global or regional climate change and associated impacts on Earth systems.
- Evaluate or refine a technological solution that reduces the impacts of human actives on natural systems based on scientific knowledge and student-generated sources of evidence; prioritize criteria and tradeoff considerations.

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

Environmental Benchmark #3

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
• Empirical evidence is required to differentiate between cause and correlation and make claims about how the availability of natural resources, the occurrence of natural hazards, and climate changes have influenced human activities. • When investing or describing a system, the boundaries and initial conditions of the system need to be defined and	• All Earth processes are the result of energy flowing and cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and the maer that cycles produce chemical and physical changes in Earth's materials and living organisms. • The planet's systems interact over scales that range from microscopic to	• Resources from the Holt Environmental Science Text: o Using the Figure: NIMBY o Interpreting Stascs: Municipal Solid Waste o Career: The Wide World of Waste o MathPracce: Municipal Solid Waste o Skill Builder: Graphing o Using the Figure:

their inputs and outputs analyzed and described using models. • Although the magnitude of human impacts is greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. • 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. • Engineers continuously modify these systems to increase benefits while decreasing costs and risks. When evaluating soluons, it is important to take into account a range of constraints, including costs, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. • Identify methods that we can use to reduce waste. • The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and how these gases are absorbed by the ocean and biosphere. • Current models predict that, although future regional climate changes will be complex and will vary, average global temperatures will continue to rise.	global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. • Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lives. These resources are distributed unevenly around the planet as a result of past geologic processes. • 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. • The complex paerns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather paerns. • 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 environment can have different impacts (negative and positive) on 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. • Human activities, such as	The Recycling Center ○ Case Study: Paper of Plastic? ○ Graphic Organizer: Chain-of-Events Chart ○ Case Study: Green Chemistry ○ Points of View: Should Nuclear Waste be Stored at Yucca Mountain? ○ Map Skills: Recycling Centers

	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 • Because these paerns are so complex, weather can only be predicted probabilistically. • The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over me, and globally redistributing it through ocean currents.	

Key Resources

Climate Change Impacts: NOAA Education Resources that can be used to teach climate science.

Digital Library for Earth System Education: DLESE is the Digital Library for Earth System Education, a free resource that supports teaching and learning about the Earth system. DLESE's development was funded by the National Science Foundation and continues to be built by a distributed community of educators, students, and scientists to support Earth system education at all levels. DLESE is operated by the National Center for Atmospheric Research (NCAR) Computational and Information Systems Laboratory and the NCAR Library on behalf of the education community.

Career Readiness, Life Literacies, & Key Skills

TECH.9.4.12.CT.3	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).
TECH.9.4.12.CT.4	Participate in online strategy and planning sessions for course-based, school-based, or other project and determine the strategies that contribute to effective outcomes.
TECH.9.4.12.GCA.1	Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
TECH.9.4.12.IML.2	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources.
TECH.9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).
TECH.9.4.12.IML.4	Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
TECH.9.4.12.IML.5	Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).
TECH.9.4.12.IML.6	Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).
TECH.9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).

Interdisciplinary Connections/Companion Standards

LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.