Comprehensive Science

Unit Title: **Unit 1: Matter and Energy Transformations in Ecosystems**

Stage 1: Desired Results

Standards & Indicators:

NJSLS Science:
(HS-LS1-5)- Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
(HS-LS1-6) Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules
(HS-LS1-7). Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy
(HS-LS2-5)- Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
(HS-LS2-3)- Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
(HS-LS2-4)- Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

Science and Engineering Practices(SEP)
Developing and Using Models Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show how relationships among variables between systems and their components in the natural and designed worlds. Develop a model based on evidence to illustrate the relationships between systems or components of a system. (HS-LS2-5) (HS-LS1-7)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.Use mathematical representations of phenomena or design solutions to support claims. (HS-LS2-4)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-6)

Disciplinary Core Ideas (DCI)
- The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)
- As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (HS-LS1-7)
- Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce

populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-2)

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2
- Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HS-LS2-3)
- Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. (HS-LS2-4)
- Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. (HS-LS2-5)

Crosscutting Concepts (CCC)

- **Scale, Proportion, and Quantity** Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2)
- **Systems and System Models** Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-LS2-5)
- **Energy and Matter** Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-LS1-5)Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. (HS-LS2-4) Energy drives the cycling of matter within and between systems. (HS-LS2-3)
- **Scientific Knowledge is Open to Revision in Light of New Evidence** Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-2), (HS-LS2-3)

Career Readiness, Life Literacies and Key Skills

Standard	Performance Expectations	Core Ideas
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).	Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.

Central Idea/Enduring Understanding:	Essential/Guiding Question:
• How do matter and energy cycle through ecosystems	

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	• Why do astrobiologists look for water on planets and not oxygen when they search for life on other planets?
Content: Ch. 1 The Nature of Life Ch. 2 The Chemistry of Life	**Skills(Objectives):** • Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

Interdisciplinary Connections:

- **ELA NJSLS**
  - **W.WR.9–10.5.** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
  - **SL.UM.9–10.5.** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest.
- **Math NJSLS**
  - **MP 4-**Model with mathematics.
  - **N.Q-1**-Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays

Stage 2: Assessment Evidence

Performance Task(s): • Support claims for the cycling of matter and flow of energy among organisms in an ecosystem using conceptual thinking and mathematical representations of phenomena. • Construct and revise an explanation for the cycling of matter and flow of energy in aerobic and anaerobic conditions, based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	**Other Evidence:** • Vocab quiz, written assessment, oral assessment • Chapter Test

Stage 3: Learning Plan

Learning Opportunities/Strategies: • 3.3 and 3.4 Foundation Ed • Study.com • Cycle of matter flow chart • Cycle of matter coloring activity • Cycle of matter drawing activity • Webquest • Chapter 3.4 Cycles of Matter Person- Miller & Levine pg. 79-86	**Resources:** http://study.com/academy/lesson/cycles-of-matter-the-nitrogen-cycle-and-the-carbon-cycle.html Miller & Levine Biology Textbook- Pearson 2019 LGBT and Disabilities Resources: • LGBTQ-Inclusive Lesson & Resources by Garden State Equality and Make it Better for Youth • LGBTQ+ Books DEI Resources:

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	• Learning for Justice • GLSEN Educator Resources • Supporting LGBTQIA Youth Resource List • Respect Ability: Fighting Stigmas, Advancing Opportunities • NJDOE Diversity, Equity & Inclusion Educational Resources • Diversity Calendar

Differentiation *Please note: Teachers who have students with 504 plans that require curricular accommodations are to refer to Struggling and/or Special Needs Section for differentiation

High-Achieving Students	On Grade Level Students	Struggling Students	Special Needs/ELL
Allow the use of technology on assignments Provide web-based projects to further expand class materials Allow students to collaborate in small groups	Provide visual aides Study guides Allow the use of technology on assignments Allow students to collaborate in small groups	Graphic Organizers Shorten assignments Grade for content not spelling and grammar Allow extra time for assignments if student goes to tutoring Provide visual aides Study guides Allow the use of technology on assignments Allow students to collaborate in small groups	Any student requiring further accommodations and/or modifications will have them individually listed in their 504 Plan or IEP. These might include, but are not limited to: breaking assignments into smaller tasks, giving directions through several channels (auditory, visual, kinesthetic, model), and/or small group instruction for reading/writing ELL supports should include, but are not limited to, the following:: Extended time Provide visual aids Repeated directions Differentiate based on proficiency Provide word banks Allow for translators, dictionaries

Unit Title: Unit 2: Interdependent Relationships

Stage 1: Desired Results

Standards & Indicators:

NJSLS Science:

- (HS-LS2-1)- Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
- (HS-LS2-2)- Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- (HS-LS2-6)- Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Science and Engineering Practices(SEP)

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Using Mathematics and Computational Thinking Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1) Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2)

Disciplinary Core Ideas (DCI)

- Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1), (HS-LS2-2)
- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2), (HS-LS2-6)

Crosscutting Concepts (CCC)

- **Scale, Proportion, and Quantity** The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1) Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2)
- **Stability and Change** Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6),
- **Scientific Knowledge is Open to Revision in Light of New Evidence** Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-2)Scientific argumentation is a mode of logical discourse used to clarify the strength of relationships between ideas and evidence that may result in revision of an explanation. (HS-LS2-6)

Career Readiness, Life Literacies and Key Skills

Standard	Performance Expectations	Core Ideas
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).	Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.

Central Idea/Enduring Understanding:	**Essential/Guiding Question:**
● How do organisms interact with the living and nonliving environments to obtain matter and energy?	● When they relocate bears, wolves, or other predators, how do they know that they will survive?

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	• What limits the number and types of different organisms that live in one place? • How can a one or two inch rise in sea level devastate an ecosystem? • How can a one or two inch rise in sea level devastate an ecosystem? • How can a one or two inch rise in sea level devastate an ecosystem?
Content: Ch. 8 Photosynthesis Ch. 9 Cell Respiration and Fermentation	**Skills(Objectives):** • Illustrate how interactions among living systems and with their environment result in the movement of matter and energy. • Graph real or simulated populations and analyze the trends to understand consumption patterns and resource availability, and make predictions as to what will happen to the population in the future. • Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. • Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. • Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Interdisciplinary Connections:

- **ELA NJSLS**
  - **W.WR.9–10.5.** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
  - **SL.UM.9–10.5.** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest.
- **Math NJSLS**
  - **MP 4-**Model with mathematics.
  - **N.Q-1**-Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays

Stage 2: Assessment Evidence

Performance Task(s): • Use quantitative analysis to compare relationships among interdependent factors and represent their effects on the carrying capacity of ecosystems at different scales	**Other Evidence:** • Vocab quiz, written assessment, oral assessment • Chapter Test

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• Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. • Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. • Use the concept of orders of magnitude to represent how factors affecting biodiversity and populations in ecosystems at one scale relate to those factors at another scale. • Evaluate the claims, evidence, and reasoning that support the contention that complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. • Construct explanations of how modest biological or physical changes versus extreme changes affect stability and change in ecosystems.	

Stage 3: Learning Plan

Learning Opportunities/Strategies:	**Resources:**
• 4.1 and 4.2 Foundation ed, study.com, food web poster, cycles of matter poster, video • Chapter 3 The Biosphere Person- Miller & Levine pg. 64-86 • Study Workbook A 4.2 Niches and Community Interactions • 3.2-3.4 and 4.1 and 4.2 Foundation ed, webquest, POGIL • Chapter 5 Populations Person- Miller & Levine pg. 130-145 • Study Workbook A 5.2 Limits to Growth • Lab Manual B Data Analysis: Multiplying Rabbits • 4.2- 4.5 Foundation ed, you tube, graphing and mapping lab • Chapter 5 Populations Person- Miller & Levine pg. 130-145 • Chapter 5 Foundation ed, web quest, POGIL • Chapter 6 Humans in the Biosphere Person- Miller & Levine pg. 154-179 • Chapter 5 Foundation ed, you tube, ecosystems, video of interactions of organisms in an ecosystem • Chapter 6 Humans in the Biosphere Person- Miller & Levine pg. 154-179	http://study.com/academy/lesson/how-birth-immigration-emigration-death-affect-populations.html https://www.youtube.com/watch?v=QI2ixJeIxEU https://www.youtube.com/watch?v=8FPMP41LYJ8 https://www.youtube.com/watch?v=0zPcR7wgh0c Miller & Levine Biology Textbook- Pearson 2019 LGBT and Disabilities Resources: • LGBTQ-Inclusive Lesson & Resources by Garden State Equality and Make it Better for Youth • LGBTQ+ Books DEI Resources: • Learning for Justice • GLSEN Educator Resources • Supporting LGBTQIA Youth Resource List • Respect Ability: Fighting Stigmas, Advancing Opportunities • NJDOE Diversity, Equity & Inclusion Educational Resources • Diversity Calendar

Differentiation *Please note: Teachers who have students with 504 plans that require curricular accommodations are to refer to Struggling and/or Special Needs Section for differentiation

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High-Achieving Students	On Grade Level Students	Struggling Students	Special Needs/ELL
Allow the use of technology on assignments Provide web-based projects to further expand class materials Allow students to collaborate in small groups	Provide visual aides Study guides Allow the use of technology on assignments Allow students to collaborate in small groups	Graphic Organizers Shorten assignments Grade for content not spelling and grammar Allow extra time for assignments if student goes to tutoring Provide visual aides Study guides Allow the use of technology on assignments Allow students to collaborate in small groups	Any student requiring further accommodations and/or modifications will have them individually listed in their 504 Plan or IEP. These might include, but are not limited to: breaking assignments into smaller tasks, giving directions through several channels (auditory, visual, kinesthetic, model), and/or small group instruction for reading/writing ELL supports should include, but are not limited to, the following:: Extended time Provide visual aids Repeated directions Differentiate based on proficiency Provide word banks Allow for translators, dictionaries

Unit Title: Unit 3: Human Activities and Climate

Stage 1: Desired Results

Standards & Indicators:

NJSLS Science:

(HS-ESS3-1)- Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
(HS-ESS3-6)- Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
(HS-ESS3-5)- Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
(HS-ESS3-4)- Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
(HS-ETS1-3)- Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs 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(SEP)

Analyzing and Interpreting Data Analyzing data in 9–12 builds on K– 8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions

including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific knowledge, principles, and theories. Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1) Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4)

Disciplinary Core Ideas (DCI)

- Resource availability has guided the development of human society. (HS-ESS3-1)
- Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1)
- Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)
- 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 activities. (HS-ESS3-6)

Crosscutting Concepts (CCC)

- **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 investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3-6)
- **Stability and Change** Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-5) Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4)
- **Influence of Engineering, Technology, and Science on Society and the Natural World** Modern civilization depends on major technological systems. (HS-ESS3-1)Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS-ESS3-4)
- **Scientific Investigations Use a Variety of Methods** Science investigations use diverse methods and do not always use the same set of procedures to obtain data. (HS-ESS3-5)
- **Scientific Knowledge is Based on Empirical Evidence** Science knowledge is based on empirical evidence. (HS-ESS3-5) Science arguments are strengthened by multiple lines of evidence supporting a single explanation. (HS-ESS3-5)

Career Readiness, Life Literacies and Key Skills

Standard	Performance Expectations	Core Ideas
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are

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		needed.
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).	Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.

Central Idea/Enduring Understanding:	**Essential/Guiding Question:**
● How do humans depend on Earth's resources? How and why do humans interact with their environment and what are the effects of these interactions?	● 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 activity? ● What is the current rate of global or regional climate change and what are the associated future impacts to Earth's systems? ● How can the impacts of human activities on natural systems be reduced? ● How can we address the immediate and long term effects of climate change?
Content: Ch. 3 The Biosphere Ch. 4 Ecosystems and Communities	**Skills(Objectives):** ● Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. ● Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. ● Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. ● Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. ● Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Interdisciplinary Connections:

- **ELA NJSLS**
  - **W.WR.9–10.5.** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
  - **SL.UM.9–10.5.** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest.

- **RST.11-12.8** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

- **Math NJSLS**
  - **MP 2-** Reason abstractly and quantitatively.
  - **MP 4-**Model with mathematics.
  - **N.Q-1**-Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays

Stage 2: Assessment Evidence

Performance Task(s):

- Construct an explanation based on valid and reliable evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- Use empirical evidence to differentiate between how the availability of natural resources, occurrence of natural hazards, and the changes in climate have influenced human activity.
- Use a computational representation to illustrate the relationships among Earth systems and how these relationships are being modified due to human activity.
- 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 evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
- Quantify and model change and rates of change in geosciences data and rates of global or regional change and associated impacts to Earth systems.
- Carbon Cycle Web-Quest
- Evaluate or refine a technological solution that reduces impacts of human activities on natural systems based on scientific knowledge and student-generated sources of evidence; prioritize criteria and trade off considerations.
- Integrate and evaluate multiple sources of information presented in diverse formats and media in order to evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- Read multiple sources in order to refine design solutions to reduce impacts of human activities on natural systems and create a coherent understanding of the problem.
- Evaluate the validity of hypotheses, data, analysis, and conclusions in a science or technical text about the impact of human activities on natural systems, verifying the data when possible and corroborating

Other Evidence:

- Vocab quiz, written assessment, oral assessment
- Chapter Test

or challenging conclusions with other sources of information.	

Stage 3: Learning Plan

Learning Opportunities/Strategies:

- Aquifer Activity
- Human Impact POGIL
- Case Study #3: Climate Change p. 177-179; Foundation ed.Climate Change p. 147-149
- Study Workbooks A & B 6.1 Worksheet; Foundation ed. lesson review pg 131
- National Geographic: The Human Footprint; Resource; Foundation ed.lesson review pg. 137.

Resources:

http://ngss.nsta.org/Resource.aspx?ResourceID=287

https://www.youtube.com/watch?v=BkPnjLG2BcE

Miller & Levine Biology Textbook- Pearson 2019

LGBT and Disabilities Resources:

- LGBTQ-Inclusive Lesson & Resources by Garden State Equality and Make it Better for Youth
- LGBTQ+ Books

DEI Resources:

- Learning for Justice
- GLSEN Educator Resources
- Supporting LGBTQIA Youth Resource List
- Respect Ability: Fighting Stigmas, Advancing Opportunities
- NJDOE Diversity, Equity & Inclusion Educational Resources
- Diversity Calendar

Differentiation *Please note: Teachers who have students with 504 plans that require curricular accommodations are to refer to Struggling and/or Special Needs Section for differentiation

High-Achieving Students	On Grade Level Students	Struggling Students	Special Needs/ELL
Allow the use of technology on assignments Provide web-based projects to further expand class materials Allow students to collaborate in small groups	Provide visual aides Study guides Allow the use of technology on assignments Allow students to collaborate in small groups	Graphic Organizers Shorten assignments Grade for content not spelling and grammar Allow extra time for assignments if student goes to tutoring Provide visual aides Study guides Allow the use of technology on assignments Allow students to collaborate in small groups	Any student requiring further accommodations and/or modifications will have them individually listed in their 504 Plan or IEP. These might include, but are not limited to: breaking assignments into smaller tasks, giving directions through several channels (auditory, visual, kinesthetic, model), and/or small group instruction for reading/writing ELL supports should include, but are not limited to, the following:: Extended time Provide visual aids Repeated directions Differentiate based on proficiency

			Provide word banks Allow for translators, dictionaries

Unit Title: **Unit 4: Human Activity and Biodiversity**

Stage 1: Desired Results

Standards & Indicators:

NJSLS Science:

- (HS-ESS3-3)- Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
- (HS-LS2-7)- Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- (HS-LS4-6)- Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
- (HS-ETS1-1)- Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- (HS-ETS1-3)- Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- (HS-ETS1-4)- Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Science and Engineering Practices(SEP)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-ESS3-3) Create or revise a simulation of a phenomenon, designed device, process, or system. (HS-LS4-6) Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. (HS-ETS1-4)

Asking Questions and Defining Problems Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations. Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (HS-ETS1-1)

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions 9–12 builds on K – experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles and theories. 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 (DCI)

- Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7)

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- Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1)
- Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)
- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)
- Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4)
- Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-6)

Crosscutting Concepts (CCC)

- **Stability and Change** Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-7)
- **Systems and System Models** Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows— within and between systems at different scales. (HS-ETS1-4)
- **Influence of Science, Engineering, and Technology on Society and the Natural World** New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1), (HS-ETS1-3)
- **Cause and Effect** Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS4-6)

Career Readiness, Life Literacies and Key Skills

Standard	Performance Expectations	Core Ideas
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).	Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.

Central Idea/Enduring Understanding:	Essential/Guiding Question:
• Would we treat our resources and life support system if we were on a rocket headed for Mars as we do in our own community right now?	• How might we change habits if we replaced the word environment with the word life support system? • Does reducing human impacts on our global life support system require social engineering or mechanical engineering? • Is the damage done to the global life support system permanent?

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	● How do our national policies to fight climate change compare to those of other nations? ● Are there possible, realistic steps that can be taken to reduce human impact? ● Can we redesign current industrial regulations to both improve commercial profits and reduce potential harmful effects? ● Why is low impact food sustainability necessary for a global life support system?
Content: Ch. 5 Population Ch. 6 Ecology	**Skills(Objectives):** ● Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. ● Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity ● Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. ● Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants ● Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. ● Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts ● Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Interdisciplinary Connections:

- **ELA NJSLS**
  - **W.WR.9–10.5.** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
  - **SL.UM.9–10.5.** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest.
- **Math NJSLS**
  - **MP 4-**Model with mathematics.

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- **N.Q-1**-Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data display

Stage 2: Assessment Evidence

Performance Task(s):

- Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations and biodiversity.
- Quantify and model change and rates of change in the relationships among management of natural resources, the sustainability of human populations, and biodiversity
- Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity based on scientific knowledge, student-generated sources of of evidence, prioritized criteria, and tradeoff considerations.
- Construct explanations for how the environment and biodiversity change and stay the same when affected by human activity.
  Evaluate a solution for reducing the impacts of human activities on the environment and biodiversity based on scientific knowledge, student-generated sources of evidence, prioritized criteria, tradeoff considerations.
- Analyze costs and benefits of a solution for reducing the impacts of human activities on the environment and biodiversity based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
- Invasive species presentation
- Create or revise a simulation based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations to test a solution to mitigate adverse impacts of human activity on biodiversity.
- Use empirical evidence to make claims about the impacts of human activity on biodiversity
- Break down the criteria for the design of a simulation to test a solution for mitigating adverse impacts of human activity on biodiversity into simpler ones that can be approached systematically based on consideration of tradeoffs.
- Conduct short as well as more sustained research projects to determine the impacts of human activities on the environment and biodiversity, synthesizing information from multiple sources.
- Synthesize information from a range of sources into a coherent understanding of the impacts of human activities on biodiversity and how to mitigate these impacts.

Other Evidence:

- Vocab quiz, written assessment, oral assessment
- Chapter Test

• Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on the impacts of human activity or biodiversity and how to mitigate these impacts. • Use a mathematical model to describe the management of natural resources, the sustainability of human populations, and biodiversity. Identify important quantities in relationships among management of natural resources, the sustainability of human populations, and biodiversity, and map their relationships using tools. Analyze these relationships mathematically to draw conclusions, reflecting on the results and improving the model if it has not served its purpose.	

Stage 3: Learning Plan

Learning Opportunities/Strategies:	**Resources:**
• Quick Lab: Reduce, Reuse, Recycle p. 155 • Study Workbooks A & B 6.2 Using Resources Wisely Worksheets • Foundation ed.lesson review pg. 137 • Lab Manual A: Acid Rain & Plants; Foundation ed. Design your own Lab. Acid Rain and Seeds p. 150 • Study Workbooks A & B 6.3 Biodiversity Worksheets; Foundation ed. lesson review pg 142 • Analyzing Data: American Air Pollution Trends p. 164 • Case Study #1: Atmospheric Ozone p. 175; Foundation ed. p. 145 • How do we make cities more sustainable? • Case Study #2: North Atlantic Fisheries p. 175; Foundation ed. p. 146 • Fields of Fuel Computer Game	http://www.cbsnews.com/news/the-threat-of-invasive-species/ http://environment.nationalgeographic.com/environment/energy/great-energy-challenge/big-energy-question/how-to-make-our-cities-more-livable-and-sustainable/ https://www.glbrc.org/education/classroom-materials/fields-fuel-computer-game Miller & Levine Biology Textbook- Pearson 2019 LGBT and Disabilities Resources: • LGBTQ-Inclusive Lesson & Resources by Garden State Equality and Make it Better for Youth • LGBTQ+ Books DEI Resources: • Learning for Justice • GLSEN Educator Resources • Supporting LGBTQIA Youth Resource List • Respect Ability: Fighting Stigmas, Advancing Opportunities • NJDOE Diversity, Equity & Inclusion Educational Resources • Diversity Calendar

Differentiation *Please note: Teachers who have students with 504 plans that require curricular accommodations are to refer to Struggling and/or Special Needs Section for differentiation

High-Achieving Students	On Grade Level Students	Struggling Students	Special Needs/ELL
Allow the use of technology on assignments Provide web-based projects to further expand class materials	Provide visual aides Study guides Allow the use of technology on assignments	Graphic Organizers Shorten assignments Grade for content not spelling and grammar	Any student requiring further accommodations and/or modifications will have them individually listed in their

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Allow students to collaborate in small groups	Allow students to collaborate in small groups	Allow extra time for assignments if student goes to tutoring Provide visual aides Study guides Allow the use of technology on assignments Allow students to collaborate in small groups	504 Plan or IEP. These might include, but are not limited to: breaking assignments into smaller tasks, giving directions through several channels (auditory, visual, kinesthetic, model), and/or small group instruction for reading/writing ELL supports should include, but are not limited to, the following:: Extended time Provide visual aids Repeated directions Differentiate based on proficiency Provide word banks Allow for translators, dictionaries

Pacing Guide

Course Name	Resource	Content Standards
UNIT 1 Matter and Energy Transformations in Ecosystems (10 Days)	**CHAPTERS 1-2** Days 1-10	HS-LS1-5 HS-LS1-6 HS-LS1-7 HS-LS2-3 HS-LS2-4 HS-LS2-5
UNIT 2 Interdependent Relationships (26 Days)	**CHAPTERS 8-9** Days 11-36	HS-LS2-1 HS-LS2-2 HS-LS2-6
UNIT 3 Human Activities and Climate (21 Days)	**CHAPTERS 3-4** Days 32-52	HS-ESS3-1 HS-ESS3-6 HS-ESS3-5 HS-ESS3-4

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UNIT 4 Human Activity and Biodiversity (21 Days)	**CHAPTERS 5-6** Days 53-73	HS-ESS3-3 HS-LS2-7 HS-LS4-6 HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4