NEPTUNE TOWNSHIP SCHOOL DISTRICT

Laboratory Environmental Science Curriculum

Grade 9-12



NEPTUNE TOWNSHIP SCHOOL DISTRICT Office of the Superintendent 60 Neptune Blvd. Neptune, NJ 07753-4836

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NEPTUNE TOWNSHIP SCHOOL DISTRICT

LABORATORY ENVIRONMENTAL SCIENCE CURRICULUM

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NEPTUNE TOWNSHIP SCHOOL DISTRICT Laboratory Environmental Science

Acknowledgements

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This curriculum guide is aligned to the 2020 New Jersey Students Learning Standards for Science and includes instructional strategies and resources that focus on developing scientifically literate students. This curriculum guide is designed around a student-centered approach and provides the opportunity for students to explore the human impact on the environment.

The committee members are commended for their dedication in creating this curriculum guide. It is our hope that this guide will serve as a valuable resource for the staff members who teach this course and that they will feel free to make recommendations for its continued improvement.

NEPTUNE TOWNSHIP SCHOOL DISTRICT

DISTRICT MISSION STATEMENT

The primary mission of the Neptune Township School District is to prepare all of our students for a life-long learning process and to become confident, competent, socially-and culturally-conscious citizens in a complex and diverse world. It is with high expectations that our schools foster:

- A strong foundation in academic and modern technologies
- A positive, equitable, and varied approach to teaching and learning
- An emphasis on critical thinking skills and problem-solving techniques
- A respect for and an appreciation for our world, its resources, and its diverse people
- A sense of responsibility, good citizenship, and accountability.
- An involvement by the parents and the community in the learning process

Neptune Township School District

Educational Outcome Goals

The students in the Neptune Township schools will become life-long learners and will:

- Become fluent readers, writers, speakers, listeners, and viewers with comprehension and critical thinking skills.
- Acquire the mathematical skills, understandings, and attitudes that are needed to be successful in their careers and everyday life.
- Understand fundamental scientific principles, develop critical thinking skills, and demonstrate safe practices, skepticism, and open-mindedness when collecting, analyzing, and interpreting information.
- Become technologically literate.
- Demonstrate proficiency in all New Jersey Student Learning Standards (NJSLS).
- Develop the ability to understand their world and to have an appreciation for the heritage of America with a high degree of literacy in civics, history, economics and geography.
- Develop a respect for different cultures and demonstrate trustworthiness, responsibility, fairness, caring, and citizenship.
- Become culturally literate by being aware of the historical, societal, and multicultural aspects and implications of the arts.
- Demonstrate skills in decision-making, goal setting, and effective communication, with a focus on character development.
- Understand and practice the skills of family living, health, wellness and safety for their physical, mental, emotional, and social development.
- Develop consumer, family, and life skills necessary to be a functioning member of society.
- Develop the ability to be creative, inventive decision-makers with skills in communicating ideas, thoughts and feelings.
- Develop career awareness and essential technical and workplace readiness skills, which are significant to many aspects of life and work.

LABORATORY ENVIRONMENTAL SCIENCE

COURSE DESCRIPTION (5 Credits)

Laboratory Environmental Science is an introductory laboratory course that provides students with a sound foundation in basic principles and unifying concepts of Environmental Science and Biology. Topic selection is based on major themes of modern environmental sciences such as: humans and sustainability; science and ecological principles; sustaining biodiversity and natural resources. This course will provide the students with the tools to be able to identify problems that are both natural and human-made, to observe and examine solutions, and evaluate preventative strategies.

INTEGRATED SOCIAL AND EMOTIONAL LEARNING COMPETENCIES

The following social and emotional competencies are integrated in this curriculum document:

Self-	Self-Awareness	
x	Recognize one's own feelings and thoughts	
x	Recognize the impact of one's feelings and thoughts on one's own behavior	
	Recognize one's personal traits, strengths and limitations	
x	Recognize the importance of self-confidence in handling daily tasks and challenges	
Self-	Management	
x	Understand and practice strategies for managing one's own emotions, thoughts and behaviors	
x	Recognize the skills needed to establish and achieve personal and educational goals	
	Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals	
Socia	al Awareness	
x	Recognize and identify the thoughts, feelings, and perspectives of others	
x	Demonstrate an awareness of the differences among individuals, groups, and others' cultural backgrounds	
x	Demonstrate an understanding of the need for mutual respect when viewpoints differ	
x	Demonstrate an awareness of the expectations for social interactions in a variety of setting	
Resp	oonsible Decision Making	
x	Develop, implement and model effective problem solving and critical thinking skill	
x	Identify the consequences associated with one's action in order to make constructive choices	
x	Evaluate personal, ethical, safety and civic impact of decisions.	
Rela	tionship Skills	
x	Establish and maintain healthy relationships	
x	Utilize positive communication and social skills to interact effectively with others	
x	Identify ways to resist inappropriate social pressure	
	Demonstrate the ability to present and resolve interpersonal conflicts in constructive ways	
	Identify who, when, where, or how to seek help for oneself or others when needed	

Unit Plan Title	Laboratory Safety
Suggested Time Frame	2-4 days

Overview / Rationale

Safety in the laboratory and classroom setting is important for students and teachers. Safety is reviewed in science courses at the beginning of each school year and should be demonstrated and adhered to by teachers and students in all laboratory activities including demonstrations and lab investigations.

Stage 1 – Desired Results		
Established Goals: Teachers have a duty of care to demonstrate, model and ensure classroom safety for all students and staff with all activities planned in lessons including but not limited to any that utilize laboratory equipment, materials and chemicals.		
 Essential Questions: How can accidents and injuries be avoided in the classroom and laboratory settings? What steps should be taken to respond to emergencies and accidents in the classroom, laboratory and workplace setting? 	 Enduring Understandings: Safety precautions are important for all areas of life and should be practiced by everyone on a daily basis. It is important that safety practices are understood and exercised in the classroom, laboratory, and on the job. 	
 Knowledge: Students will know Lab safety rules and expectations Names and uses of lab equipment Location and use of safety equipment 	 Skills: Students will be able to Explain appropriate health and safety practices in the classroom and laboratory. Identify common hazards in the classroom and laboratory. Identify name and the use of specific lab equipment Explain how to respond to various safety situations and accidents. Demonstrate how to use basic lab equipment and safety equipment. 	

Interdisciplinary Connections

NJSLS English Language Arts (2016):

NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.

NJSLS Career Readiness,Life Literacies, and Key Skills (2020) https://www.nj.gov/education/cccs/2020/2020%20NJSLS-CLKS.pd

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving.

9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

NJSLS Computer Science and Design Thinking (2020)

https://www.nj.gov/education/cccs/2020/2020%20NJSLS-CSDT.pdf

8.2.12.NT.1: Explain how different groups can contribute to the overall design of a product.

Student Resources

HS Safety Contract (Flinn)

https://www.flinnsci.com/high-school-student-safety-contract---english/dc10494/

MS Safety Contract (Flinn)

https://www.flinnsci.com/middle-school-science-safety-contract/dc10642/

Spanish version available online

Teacher Resources

Flinn Safety Course for teachers online (free with registration) <u>https://labsafety.flinnsci.com/</u>

NSTA Safety Resources https://www.nsta.org/topics/safety

Duty of Care https://static.nsta.org/pdfs/DutyOfCare.pdf

Safety and the NGSS

https://static.nsta.org/pdfs/Safety%20and%20the%20Next%20Generation%20Science%20Stand ards_29Oct2020_FINAL.pdf

Safety Practices with Demonstrations https://static.nsta.org/pdfs/MinimumSafetyPracticesAndRegulations.pdf

Labeling of Chemicals <u>https://static.nsta.org/pdfs/GloballyHarmonizedSystemOfClassificationAndLabelingOfChemical</u> <u>s.pdf</u>

Eye Protection https://www.nsta.org/eye-protection-and-safer-practices-faq

Stage 2 – Assessment Evidence

Pre-Assessments:

Safety- What do you know?

Formative Assessments:

Pre-lab discussions should be included in all lessons when an activity is planned.

Lab equipment- names and uses

Room layout and safety equipment location

Use of Safety equipment- eye wash, hood, fire blanket, fire extinguisher

Summative Assessments:

Safety Test- teacher/department created

Performance Task(s):

Safety Practical

Stage 3 – Learning Plan

- Explain and demonstrate lab expectation
- Safety tour of classroom- hood, eyewash, safety gas valve, eye goggle cabinet
- Practice fire drill
- Review Safety equipment name, location, use
- Review scenarios and how to call for help
- Model how to handle lab equipment
- Name lab equipment and use
- Review safety procedures
- Explain how to dispose of chemicals and broken glass

Unit Plan Title	Unit 1:Introduction to Environmental Science
Suggested Time Frame	3 weeks

Overview / Rationale

Students will gain an understanding as to how Environmental Science is an interdisciplinary science and study how humans interact with the living and nonliving parts of the environment. Students will demonstrate an understanding of how the environment is everything around us and we interact in a complex web of relationships that connect us to one another and the world we live in.

Stage 1 – Desired Results

Established Goals:

New Jersey Student Learning Standards - Science (2020)

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. [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]

HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.* [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]

HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.* [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]

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. [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]

 Essential Questions: What are the Earth's relative life support systems and how are we dependent on them? How is environmental science an interdisciplinary science? How do we interact with the environment? What general problems are being created by our interactions with the environment? What is sustainability and how is it 	 Enduring Understandings: Earth is a system that consists of many components acting together. Many disciplines of science are necessary to successfully study and manage our environment. Earth's resources are being degraded due to human interactions with the environment. Humans have altered Earth's environment in several ways throughout human history.
 important to environmental science? What is an Ecological Footprint? How do nutrients cycle through the environment? 	• Matter and chemicals cycle through each of earth's spheres.
Knowledge:	Skills:
 Students will know Major fields of study that contribute to environmental science. Earth's systems are interdependent and all life depends on and contributes to them. Environment is comprised of interdependent systems: geosphere, atmosphere, hydrosphere, and biosphere Sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources Scientists and engineers can make 	 Students will be able to Describe the parts of earth's spheres. Describe how matter cycles through earth's spheres. Describe the tragedy of the commons Distinguish between renewable and nonrenewable resources. Construct an explanation based on evidence for how the availability of natural resources, and how the occurrence of natural hazards are connected to human activity. Use a computational representation to illustrate the relationship among Earth systems and how those relationships are

major contributions by developing	being modified due to human activity.
technologies that produce less pollution	• Illustrate how Earth's interacting
and waste and that preclude ecosystem	systems cause feedback effects on other
degradation.	Earth systems.
• How the law of conservation applies to	• Model the biogeochemical cycles.
the behavior of nutrients in the	• Explain the importance of bacteria to
environment.	the nitrogen cycle.

Interdisciplinary Connections

NJSLS - English Language Arts (2016):

RST.9-10.1: 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. (HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-4)

RST.9-10.8: Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.(HS-ESS3-2),(HS-ESS3-4) WHST.9-10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1)

NJSLS - Mathematics (2016):

HSN.Q.A.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. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-6)

HSN.Q.A.2: Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1),(HS-ESS3-4),,(HS-ESS3-6)

HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-6)

NJSLS - Career Readiness, Life Literacies, and Key Skills (2020)

https://www.nj.gov/education/cccs/2020/2020%20NJSLS-CLKS.pdf

9.1.12.CFR.1: Compare and contrast the role of philanthropy, volunteer service, and charities in community development and quality of life in a variety of cultures.

9.1.12.FP.5: Evaluate how behavioral bias (e.g., overconfidence, confirmation, recency,loss aversion, etc.) affects decision-making

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition

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).

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

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).

NJSLS - Computer Science and Design Thinking (2020) https://www.nj.gov/education/cccs/2020/2020%20NJSLS-CSDT.pdf 8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena. 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system in the environment. 8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience. 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution. 8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.

Student Resources

Primary Source Readings: <u>https://www.eh-resources.org/</u>, <u>NOAA Hazardous Spill Reports</u>, <u>Origins of the EPA</u>, <u>EPA: Earth Day</u>, <u>RachelCarson.org</u>, <u>The Conservation Legacy of Theodore</u> <u>Roosevelt</u>

Secondary Source Readings - <u>What are the Ingredients for Life?</u>, <u>NASA Earth Observatory- The</u> <u>Carbon Cycle</u>,

Supporting Text pages: Unit 1: Studying Earth pgs. 1-49

Technology: Chromebook with internet

Teacher Resources

Textbooks: Environmental Science (Foresman-Wesley (2003) Technology: Chromebook with internet Websites: Global Footprint Network Teaching Sustainability - Vanderbilt University Videos: Youtube: What is Environmental History?, What is Sustainability?, Ted-Ed: What is the Tragedy of the Commons?, Ecological Footprint: Do We Fit Our Planet? Biogeochemical Cycles (Bozeman Science), Ted Ed Feedback loops

Stage 2 – Assessment Evidence

Pre-Assessments:

Graphic organizers, Venn diagrams, informational surveys, vocabulary pre-assessment quiz, student interest survey

Formative Assessments: Review Questions, Lab activities, Quizzes, projects NOAA - Sphere Interaction Activity

Summative Assessments: Unit test

Performance Task(s): Lab activities, projects

Stage 3 – Learning Plan

Suggested Learning Activities:

Fields of Study -Agriculture, industry, population ecology, climatology, etc. Environmental quality: Climate Change, Clean Water, Air Quality Human Population: Population Growth, Hunger and Food, Information and Education Natural resources: Biodiversity Loss, Conservation of Forests and Nature Preserves, Marine resources, Energy Resources Earth's spheres, systems and their interactions **Biogeochemical cycles** Photosynthesis and Cell respiration Human interaction with the environment How humans have altered the environment throughout history Sustainability and economics **Environmental Policy** Easter Island Decline **Ecological Footprint** Carbon/chemical reservoirs: Carbon Cycle Game https://teachingapscience.com/tragedy-commons-5e/

Unit Plan Title	Unit 2: Ecology
Suggested Time Frame	5 weeks

Overview / Rationale

Students will understand organisms' interactions with each other and their physical environment, how organisms obtain resources, change the environment, and how these changes affect both organisms and ecosystems. In addition, students demonstrate an ability to investigate the role of biodiversity in ecosystems and the role of animal behavior on survival of individuals and species. Students have increased understanding of interactions among organisms and how those interactions influence the dynamics of ecosystems.

Stage 1 – Desired Results

Established Goals:

New Jersey Student Learning Standards - Science (2020)

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. [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.]

HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow 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. [Clarification Statement: Examples of models could include simulations and mathematical models.] [Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.]

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. [Clarification Statement: Examples of

changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. [Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model.] [Assessment Boundary: Assessment is limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.]

HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.* [Clarification Statement: Emphasis is on both qualitative and quantitative evaluations of devices. Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. Examples of constraints could include use of renewable energy forms and efficiency.] [Assessment Boundary: Assessment for quantitative evaluations is limited to total output for a given input. Assessment is limited to devices constructed with materials provided to students.]

Essential Questions:	Enduring Understandings:
• How are living things dependent upon	• Ecosystems are composed of many
each other and their environment?	interconnected parts that often interact
 How do ecologists organize and study 	in complex ways.
life?	• Biotic and abiotic factors affect an
 How and why do organisms interact 	ecosystem.
with their environment and what are the	• Natural Selection is responsible for
effects of these interactions?	evolution.
• What are the components of an	• After a disturbance, organisms in an
ecosystem?	environment follow a pattern of change
• How is natural selection related to	over time, known as ecological
evolution?	succession.
• How does an organism's adaptations	• Primary succession occurs on a surface
ensure its survival?	where no ecosystem existed before,
• What happens to ecosystems when the	whereas secondary succession occurs
environment changes?	on a surface where an ecosystem
• How are ecosystems related to biomes?	existed before.
• What are threats to biomes?	• Biomes are classified by their climate
• What role does the environment play in	conditions and vegetation.
an organism's survival and	• Scientists classify ecosystems into large
reproduction?	areas called biomes.

 How do organisms interact with the living and nonliving environments to obtain matter and energy? How do energy and nutrients move through communities? 	 Biomes are described by their vegetation because specific climate conditions support the growth of specific types of vegetation. Climate determines which plants can grow in an area. Latitude and altitude affect climate in similar ways. The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. 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. Energy transfer between trophic levels is inefficient.
Knowledge:	Skills:
Students will know	Students will be able to
• How organisms interact with biotic and	 Identify biotic and abiotic factors. Describe the components of an
ADJOUC JACIOIS IN THEIR ENVIRONMENT.	 Describe the components of an ecosystem
• How an organism's natural relates to its survival	 Discuss how an organism's habitat
• The process of evolution by natural	relates to its survival
selection.	• Explain how natural selection is related
• The process of adaptation.	to evolution.
• How habitats are important for	• Describe how humans have changed
organisms.	species through artificial selection.
• Types of succession.	• Differentiate primary and secondary
• The characteristics, plants, and animals	succession.
that define each biome.	• Describe human activities that affect
• The human threats to biomes.	the biosphere, ways to decrease this
• How energy is transferred from the sun	disturbance.
to producers and then to consumers.	 Identify numan factors that may degrade approximation and biodiversity.
 How energy transfer in a food web is 	 Identify biomes based on climate and
• How chargy transfer in a root web is more complex than energy transfer in a	• Identity biomes based on emilate and latitude
food chain	 Predict how human impact will affect
• Why an energy pyramid is a	the future of biomes
representation of trophic levels.	 Model how energy is transferred from

• How the process of photosynthesis provides a vital connection between the sun and the energy needs of living systems.	 the sun to producers and then to consumers. Differentiate between energy transfer in the food web and energy transfer in a food chain. Examine the relationship between the sun, photosynthesis, and the energy needs of living systems. Model the effect of inefficient energy transfer on community structure. Distinguish between the effect of direct and indirect feeding relationships.

Interdisciplinary Connections

NJSLS ELA (2016)

RST.9-10.6 Determine the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. (HS-L 2-3)

RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.(HS-LS2-6),(HS-LS2-7)

RST.9-10.8 Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-6),(HS-LS2-7) WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.(HS-LS2-3) (HS-LS2-7)

WHST.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.(HS-LS2-7)

NJSLS Mathematics (2016)

MP.2 Reason abstractly and quantitatively. (HS-LS2-4),(HS-LS2-6),(HS-LS2-7)

MP.4 Model with mathematics. (HS-LS2-4)

HSN.Q.A.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. (HS-LS2-4),(HS-LS2-7)

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-4),(HS-LS2-7)

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-4),(HS-LS2-7)

HSS-ID.A.1 Represent data with plots on the real number line. (HS-LS2-6)

HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (HS-LS2-6)

HSS-IC.B.6 Evaluate reports based on data. (HS-LS2-6)

NJSLS Career Readiness,Life Literacies, and Key Skills (2020)

https://www.nj.gov/education/cccs/2020/2020%20NJSLS-CLKS.pdf

9.1.12.CFR.1: Compare and contrast the role of philanthropy, volunteer service, and charities in community development and quality of life in a variety of cultures.

9.1.12.FP.5: Evaluate how behavioral bias (e.g., overconfidence, confirmation, recency, loss aversion, etc.) affects decision-making

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a)

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

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).

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

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).

NJSLS Computer Science and Design Thinking (2020)

https://www.nj.gov/education/cccs/2020/2020%20NJSLS-CSDT.pdf

8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change

8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate,

and support different interpretations of real-world phenomena.

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumer

8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system in the environment.

8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.

8.2.12.ETW.3: Identify a complex, global environmental or climate change issue,

develop a systemic plan of investigation, and propose an innovative sustainable solution. 8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.

Student Resources

Primary Source Readings: LiveScience- Darwin's Theory of Evolution

Secondary Source Readings: <u>ReadWorks: Fighting to Save an Iconic Species</u>, <u>Biotic and Abiotic</u>, <u>BBC- Evolution by Natural Selection</u>, <u>Berkeley.edu- Adaptation</u>, <u>Kent.edu- Human Interface and its Effects on Biomes</u>

Supporting Text pages: Unit 2: Ecological Interactions pgs. 50-107 Unit 3: Biomes pgs. 108-183

Technology: Chromebook with internet

Teacher Resources

Texts: - Environmental Science. Foresman-Wesley(2003)

Technology: Chromebook with internet

Websites: <u>PBS Learning - Arctic Food Web</u> <u>Project Learning Tree - Mt St Helens Succession</u> Carbon Cycle NOAA, <u>Marine Food Pyramid</u>, <u>NatGeo- Photosynthesis Infographic</u>

Videos: <u>Ecological Succession: Change is Good (Crash Course Ecology)</u> Types of Adaptations (High School Science 101)

Stage 2 – Assessment Evidence

Pre-Assessments: Graphic organizers, Venn diagrams, informational surveys, vocabulary pre-assessment quiz

Formative Assessments: Review Questions, Lab activities, Quizzes, Projects, PhET Natural Selection activity, Succession games, <u>Biotic & Abiotic Factors worksheet</u>, World Climate & Biomes activity,

Summative Assessments: Unit test

Performance Task(s): Lab activities, projects, Food Web Project, Food Pyramid, Endangered / Invasive Species Google Slides Projects, Ecocolumn project

Stage 3 – Learning Plan

Ecosystem Structure: Ecocolumn Project Biotic/abiotic factors: <u>Biotic/Abiotic factors</u> Biomes: World Climate & Biome Lab Food Webs / Biomass: Food Web Project Trophic levels: Food Pyramid Activity Natural Selection and Evolution: <u>PhET Natural Selection</u> <u>Darwin's Finch Adaptation Lab</u> Succession: <u>BioMan Succession Game</u>, <u>Succession Board game</u> Bird Beak Adaptation Activity

Unit Plan Title	Unit 3: Populations
Suggested Time Frame	3 weeks

Overview / Rationale

Students will explore the properties of populations, how populations increase or decrease in response to their environment, and how populations of different species interact. Additionally students will investigate human population growth and demographics, as well as the relative environmental problems that come with it. Populations will then be linked to biodiversity on Earth and its importance in environmental sustainability and our future.

Stage 1 – Desired Results

Established Goals:

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. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. [Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.]

HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]

HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.* [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]

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. [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]

Essential Questions:

- What factors determine whether, and how, a population's size changes?
- What are the important characteristics of a population?
- Why is biodiversity on Earth important to the health of our ecosystems and the organisms within them?
- Which types of threats are having the largest impact on biodiversity?
- What is the Endangered species act and how has it affected species loss in the United States and around the world?
- How does rapid human population growth affect our environment?
- What are the properties of a population and how do they change or affect a population?
- What are the major types of species interactions and how do they affect population size?
- What is the carrying capacity of a population and how does it change with environmental conditions?

Enduring Understandings:

- Many factors contribute to the size and growth of populations.
- Population growth adds stress to the environment.
- Loss of biodiversity results in a loss of ecosystem stability.
- Populations can grow at different rates.
- There are natural limits to population growth.
- The interactions and interdependence of organisms in ecosystems are both cooperative and competitive.
- Increased human population growth has resulted in environmental stress on the environment.
- Population and carrying capacity of all species will be an important factor in preserving the environmental integrity of our Earth.
- Different countries are at different stages of demographic transition.
- Protecting entire ecosystems can be a more effective way of protecting individual species.

 Knowledge: Students will know Vocabulary terms including: populations density, dispersion, carrying capacity, species interactions, r/k selected species. Factors that affect population size. The impact of the industrial and scientific revolutions on human population growth. Types of species interactions. The main properties of populations and exponential growth. How population sizes in nature are regulated as a result of environmental factors. 	 The most common cause of extinction today is the destruction of habitats by humans. The desire to protect biodiversity often conflicts with other human interests. Skills: Students will be able to Discuss the factors that limit population size, such as availability of food, light, space, populations, predators and prey, competitors, disease. Investigate and communicate findings about factors that may affect the size and rate of human population growth. Describe how the reproductive behavior of individuals can affect the growth rate of their population. Demonstrate that competition between two species may lead to the elimination of one species or to the partitioning of resources.
 work. How scientists predict population sizes. How to make predictions about population trends based on age structure. Human population growth has accelerated in the last few centuries as a result of improvements in hygiene and increases in food production, which accompanied the industrial and scientific revolutions. International cooperation has led to increased recognition and protection of biodiversity worldwide. 	 Define and give examples of endangered and threatened species. Describe how populations are distributed. Explain what age structure graphs tell you about a population.

Interdisciplinary Connections

NJSLS ELA (2016)

RST.9-10.1. 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. (HS-LS2-6),(HS-LS2-8), (HS-ESS3-4)

RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)

RST.9-10.8 Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

(HS-LS2-6),(HS-LS2-7),(HS-LS2-8)

WHST.9-10.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7)

NJSLS Mathematics (2016)

MP.2 Reason abstractly and quantitatively. (HS-LS2-6),(HS-LS2-7),(HS-ESS3-6)

MP.4 Model with mathematics. (HS-ESS3-3),(HS-ESS3-6)

HSN.Q.A.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. (HS-LS2-7),(HS-ESS3-4),(HS-ESS3-6)

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

(HS-LS2-7),(HS-ESS3-4),(HS-ESS3-6)

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-7),(HS-ESS3-4),(HS-ESS3-6)

HSS-ID.A.1 Represent data with plots on the real number line. (HS-LS2-6)

HSS-IC.A.1 Understand statistics as a process for making inferences about population

parameters based on a random sample from that population. (HS-LS2-6)

HSS-IC.B.6 Evaluate reports based on data. (HS-LS2-6)

NJSLS Career Readiness,Life Literacies, and Key Skills (2020)

https://www.nj.gov/education/cccs/2020/2020%20NJSLS-CLKS.pdf

9.1.12.CFR.1: Compare and contrast the role of philanthropy, volunteer service, and charities in community development and quality of life in a variety of cultures.

9.1.12.FP.5: Evaluate how behavioral bias (e.g., overconfidence, confirmation, recency, loss aversion, etc.) affects decision-making

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and ability.

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition

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).

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

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).

NJSLS Computer Science and Design Thinking (2020)

https://www.nj.gov/education/cccs/2020/2020%20NJSLS-CSDT.pdf

8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate chan

8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers

8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system in the environment.

8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.

8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.

8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.

Student Resources

Primary Source Readings: <u>Nature.com- Population Ecology</u>, <u>Nature.com- Species Interactions</u> and <u>Competition</u>, <u>NatGeo: Case Study: Point Sur State Marine Reserve</u>

Secondary Source Readings: <u>KhanAcademy-Population Ecology Review</u>, Changing Population Trends (PDF), How Populations Change in Size (PDF), How Species Interact with Each Other (PDF),

Supporting Text pages: Unit 4: People in the Global Ecosystem pgs. 184-231

Technology: Chromebook with internet

Teacher Resources

Texts: - Environmental Science. Foresman-Wesley (2003).

Technology: Chromebook with Internet

Websites: Nature.com, NationalGeographic.org, KhanAcademy.org https://www.ngsslifescience.com/science.php?/biology/lessonplans/C415/

Videos: <u>Ecological Carrying Capacity-Biology</u>, <u>Carrying Capacity & Limiting Factors</u>, <u>r and</u> <u>k selection (Bozeman Science)</u>

Stage 2 – Assessment Evidence

Pre-Assessments: Graphic organizers, Venn diagrams, informational surveys, vocabulary pre-assessment quiz

Formative Assessments: Review Questions, Lab activities, Quizzes, Projects, Raccoon Lab, Sampling Lab, Calculating Population Growth Rate

Summative Assessments: Unit test

Performance Task(s): Lab activities, projects, Predator/Prey lab, Power of the Pyramids lab

Stage 3 – Learning Plan
Species Interaction Symbiotic Strategies
Carrying Capacities (NGSS Life Science website)
Population Density
Limiting Factors to population growth
Predator / Prey Relationships
Human Population Growth
Human impact on the Environment (due to population growth)
Age Structure graphs

Unit Plan Title	Unit 4: Water, Air, and Land
Suggested Time Frame	5 weeks

Overview / Rationale

This unit explores human activities that disrupt ecosystems both positively and negatively and the methods employed to reduce impact. It examines human use of natural resources through many means, and the impacts on the environment.

Fresh water is a limited resource used for drinking and agriculture. Almost all the ways we use water contribute to water pollution. Agricultural practices in particular can cause environmental disruption. When harmful substances build up in the air to unhealthy levels, the result is air pollution. Most air pollution is a result of human activities, but pollutants can also come in natural resources. Farmland, rangeland, and woodland are being converted into suburbs and cities worldwide. As a result, conservation efforts to manage overuse of land are being implemented to ensure sustainability of resources.

Stage 1 – Desired Results

Established Goals:

New Jersey Student Learning Standards - Science (2020)

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. [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.]

HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.]

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. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. [Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.]

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. [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]

HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.* [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]

HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]

Encertical Occurting an	Enderster - Underster die en
• How is human activity impacting our	• Human pollution is a major threat to
natural air land and water resources?	our air land and water
• Why is freshwater a limited resource?	 Federal laws have been established to
• What are two sources of freshwater?	regulate pollution
• What are the sources of air pollutants?	• Anthropogenic disruptions are altering
• What are short and long term effects of	ecosystems on Earth
air pollution on health?	 Only a small fraction of Earth's water
What causes acid precipitation?	supply is freshwater
 How does an increase in greenhouse 	 Air pollution can affect human health.
gas cause global warming?	• All organisms depend on land and
• How can we successfully manage	water to survive and these resources
rangeland?	must be conserved.
• what are the environmental effects of deforestation?	• Infough proper preservation and conservation strategies, the Earth's
• How can we reduce daily water use?	resources can be sustained.
• Why do excess nutrients have a	• Food is produced through various
negative effect on water health?	methods each of which impact the
• How can we describe Earth's	environment.
atmosphere?	
• What measures can limit and prevent	
pollution of the atmosphere?	
• Why is it important to manage Earth's	
resources sustainably?	
• How do we use the land we live on?	
• How can we manage our growing	
demand for food with our need to	
protect the environment?	
• What is the effect of erosion on soil	
formation?	
Knowledge:	Skills:
Students will know	Students will be able to
AIR	AIR
• The difference between the greenhouse	• Identify greenhouse gases.
effect and global warming.	 Predict impacts of increased
Impacts of changes in composition of	greenhouse gas concentration.
our atmosphere.	• Analyze the impact of the Kyoto and
• Causes and effects of global warming.	Montreal Protocols.
• Efforts to prevent climate change,	• Predict the impact of the Paris Climate
including global government efforts.	Agreement.
Advantages and disadvantages of	• Analyze the advantages and
Alternative Energies.	disadvantages of wind turbines as well
• 5 primary air pollutants, and give	as the impact on the surface location
sources of each.	(land/water).

- The two major sources of air pollution in urban areas.
- How smog forms.
- How a thermal inversion traps air pollution.
- Short and long term effects of air pollution on human health.
- The causes and prevention of indoor air pollution.
- Human health problems caused by air pollution.
- The causes of acid precipitation.
- How acid precipitation affects humans.

WATER

- Factors that lead to water pollution.
- How Earth's water resources are distributed.
- Why fresh water is one of Earth's limited resources.
- The difference between groundwater and surface water in a watershed.
- The patterns of global water use.
- How water is treated so that it can be used for drinking.
- How water is used in home, in industry, and in agriculture.
- How dams and water diversion projects are used to manage freshwater resources.
- Five ways that water can be conserved.
- The difference between point-source pollution and nonpoint-source pollution.
- Why groundwater pollution is difficult to clean up.
- The major sources of ocean pollution, and explain the effects of pollution on ecosystems.
- How the ozone layer shields the Earth from the sun's radiation.
- How chlorofluorocarbons damage the ozone layer.
- How the ozone hole forms.

- Identify primary air pollutants, and give sources of each.
- Describe short and long term effects of air pollution on human health.
- Explain causes and preventions of indoor air pollution.
- Describe human health problems caused by air pollution.
- Explain the causes of acid precipitation. Explain how acid precipitation affects humans.
- Explain why carbon dioxide content of the atmosphere is increasing.
- Identify why the average global temperature is increasing.

WATER

- Identify effects of water pollution on an ecosystem.
- Identify natural fresh water reserves on Earth.
- Engineer a water filtration system.
- Interpret the impact to surrounding areas when Hydrologic Power Plants are built (dams).
- Explain how water can be both renewable and limited.
- Explain how most groundwater is accessed.
- Explain the significance of a watershed.
- Discuss how water ownership and water conservation are important in determining future water availability.
- Identify patterns of global water use.
- Explain how water is treated so that it can be used for drinking.
- Identify five ways that water can be conserved.
- Compare point-source pollution and nonpoint source pollution.

LAND

• Identify damage done to land through various mining processes.

 The damaging effects of UV radiation Why the ozone is still threatened. LAND Impacts to ecosystems due to mining. Management of waste (landfills and recycling). Land use management. Land conservation and urban planning. How humans use land. The concept of ecosystems. The urban crisis and what people are doing to deal with it. How urban sprawl affects the 	 Understand the need for recycling to prevent degradation of land. Proper management of landfills to prevent land and water pollution. Identify anthropogenic hazards to the environment. Explain how urban sprawl affects the environment. Understand how open spaces provide environmental benefits. Identify the benefits of preserving farmland. Explain the environmental effects of deforestation.
 How urban sprawl affects the environment. How open spaces provide 	 deforestation. Analyze the function of parks and of wilderness areas
 The benefits of preserving farmland.	
 Two ways rangeland can be managed sustainably. 	
 The environmental effects of deforestation. 	
• The function of parks and of wilderness areas	

Interdisciplinary Connections

NJSLS ELA (2016)

RST.9-10.8. Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

RST.9-10.1. 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.

RST.9-10.2. Determine the central ideas, themes, or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

RST.9-10.8. Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events,

scientific procedures/ experiments, or technical processes

WHST.9-10.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.9-10.7. 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.

NJSLS Mathematics (2016)

MP.2 Reason abstractly and quantitatively.

(HS-LS2-4),(HS-LS2-6),(HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-3),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

MP.4 Model with mathematics. (HS-LS2-4),(HS-ESS3-3),(HS-ESS3-6)

HSN.Q.A.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.

(HS-LS2-4),(HS-LS2-7),(HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

(HS-LS2-4),(HS-LS2-7),(HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

(HS-LS2-4),(HS-LS2-7),(HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

HSS-ID.A.1 Represent data with plots on the real number line. (HS-LS2-6)

HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (HS-LS2-6)

HSS-IC.B.6 Evaluate reports based on data. (HS-LS2-6)

NJSLS Career Readiness,Life Literacies, and Key Skills (2020)

https://www.nj.gov/education/cccs/2020/2020%20NJSLS-CLKS.pdf

9.1.12.CFR.1: Compare and contrast the role of philanthropy, volunteer service, and charities in community development and quality of life in a variety of cultures.

9.1.12.FP.5: Evaluate how behavioral bias (e.g., overconfidence, confirmation, recency, loss aversion, etc.) affects decision-making

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

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).

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

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).

NJSLS 2020 Computer Science and Design Thinking (2020)

https://www.nj.gov/education/cccs/2020/2020%20NJSLS-CSDT.pdf

8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change

8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers

8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system in the environment.

8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.

8.2.12.ETW.3: Identify a complex, global environmental or climate change, develop a systemic plan of investigation, and propose an innovative sustainable solution.

8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.

Student Resources

Primary Source Readings <u>El Nino vs La Nina</u>, <u>USGS.gov- Water Resources</u>, <u>NRDC.org- Water</u> <u>Pollution</u>, <u>Harvard.edu- Water Pollution</u>, <u>NOAA- Biomagnification</u>, <u>NatGeo- Ocean Currents</u>, <u>NRDC.org- Air Pollution</u>, <u>WHO- Air Pollution</u>, <u>NASA- Earth's Atmosphere</u>

Secondary Source Readings: Section 1: Water Resources (PDF), <u>Nature.com- Water Resources</u>, <u>ScienceDirect.com- Biomagnification</u>, Section 2: The Atmosphere (PDF), How We Use Land (PDF)

Supporting Text pages: Unit 6 - Chapters 19-22 pages 304-377

Technology: Chromebook with Internet

Teacher Resources

Texts: - Environmental Science. Foresman-Wesley (2003)

Technology: Chromebook with Internet

Websites:City Farm Sustainability ModelWorld air quality dataCity Farm GameWHO -Air PollutionWater Lesson Plans (Penn State)

Videos:Biomagnification & the Trouble with Toxins (Amoeba Sisters)El Nino and La Nina ExplainedHow Ocean Currents Affect Air TemperatureAir Pollution (Bozeman Science)Air Pollution - A Major Global Public Health IssueWhat is Eutrophication?Why so many fish are dying in the Gulf of MexicoDavid Attenborough Explains What We Need to Do to Stop Over-Fishing

Stage 2 – Assessment Evidence

Pre-Assessments: Graphic organizers, Venn diagrams, informational surveys, vocabulary pre-assessment quiz

Formative Assessments: Review Questions, Lab activities, Quizzes, projects, Layers of the Atmosphere graphing activity, Active Reading worksheet: Water Resources (PDF), Section 1: Water Resources reading & questions (PDF), Active Reading worksheet: Water Pollution (PDF), Active Reading worksheet: Urban Land Use (PDF),

Summative Assessments: Unit test, Land Use Model Inquiry lab,

Performance Task(s): Lab activities, project, Tracking Pollution Lab

Stage 3 – Learning Plan		
Sources of groundwater and surface water		
Water conservation		
Water pollution: Tracking Pollution lab,		
Biomagnification: Biomagnification Lab		
Layers of atmosphere		
Weather, air currents and ocean currents		
El-Nino		
Air pollution <u>Air Quality Activities</u>		
Public and private land use		
Agriculture practices		
Cultural Eutrophication		
Overfishing and ocean sustainability		
City Farm Sustainability Model		
City Farm game		
Public land postcards		

Unit Plan Title	Unit 5: Our Sustainable Future
Suggested Time Frame	4 weeks

Overview / Rationale

In this unit, students will be able to describe the causes and predict the consequences of the warming of the earth. Students will be able to explain the effects of human influences on the atmosphere. Students will demonstrate the ability to identify nonrenewable and renewable resources and describe their potential uses, dependability, limitations and their effect on the environment.

Stage 1 – Desired Results

Established Goals:

New Jersey Student Learning Standards - Science (2020)

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. [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]

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. [Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).] [Assessment Boundary: Assessment is limited to one example of climate change and its associated impacts.]

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. [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]

HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedback that causes changes to other Earth systems. [Clarification Statement: Examples should include climate feedback, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.]

HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. [Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.] [Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.]

Essential Questions:

- How have humans impacted Earth's atmosphere?
- Why is the greenhouse effect important for Earth's climate?
- How can both natural and human caused changes in the environment lead to changes in human health?
- How is climate change affecting food availability for marine and terrestrial organisms?
- What effect does the use of nonrenewable energy have on the environment?
- What is energy and how is it used?
- How are fossil fuels formed and how are they obtained and used?
- What problems are associated with fossil fuel use?
- Do the benefits of renewable energy outweigh the costs?
- What does the evidence show about global climate change?
- How is solar energy used to heat buildings and provide electricity?
- How long will fossil fuels last?

Enduring Understandings:

- Sustainability will be a key factor in preserving the future environment and its relevant organisms.
- Climate change will have consequences for the Earth system and human lives.
- Climate change is a long term, global problem and the impacts will not spread evenly around the world.
- Future supply of resources depends upon affordability and how quickly the supply is used.
- Non renewables have finite lifetimes and conservation is critical to maintaining those supplies.
- Increasing Energy efficiency benefits people and the environment.
- Fossil fuels grant us a high energy yield with a high environmental cost.
- Renewable energy offers a low environmental cost with a low energy yield.

Knowledge:

Students will know...

- Types of renewable energy.
- Advantages and disadvantages of renewable resources.
- The reason(s) carbon dioxide content of the atmosphere is increasing.
- Why average global temperatures are increasing.
- Advantages and disadvantages of non renewable resources.
- Which types of fossil fuels are the most likely to be replaced in the future.
- Identify and dispel common misconceptions associated with global climate change.
- How the greenhouse effect alters climate, referencing both current and historic trends.
- Examples of greenhouse gasses and how they are produced.
- Human activities that contribute to greenhouse gas emissions.
- The potential impacts of climate change on ecosystems.
- Differences in the consumption of resources among developed and developing nations using factors such as population size, wealth and income, and varied geographic or economic distribution of resources.

Skills:

Students will be able to...

- Identify effects of climate change.
- Analyze atmospheric data.
- Predict future impacts of global warming.
- Analyze CO2 trends.
- Identify types of renewable energies.
- Explain the difference between weather and climate.
- Identify four factors that determine climate.
- Explain why different parts of the Earth have different climates.
- Discuss the role of wind patterns in determining climate change.
- Explain how oceans affect climate.
- Identify evidence of climate change.
- Explain the methods for studying climate change.
- Predict future effects of climate change.
- Describe strategies for reducing greenhouse gasses.
- Describe how human society uses energy resources.
- Explain how fossil fuel is formed.
- Predict the future of fossil fuels.
- Explain how pollutants released by fossil fuels damage health and the environment.
- Explain the benefits and current status of renewable energy resources.
- Explain how water can be used to generate electricity.
- Analyze the benefits and cost of using solar energy.
- Analyze the benefits and costs of wind energy.
- Describe the techniques for using solar energy to heat buildings and generate electricity.

Interdisciplinary Connections

NJSLS ELA (2016)

RST.9-10.8. Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

RST.9-10.1. 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.

RST.9-10.2. Determine the central ideas, themes, or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text

RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

RST.9-10.8. Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes

WHST.9-10.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.9-10.7. 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.

NJSLS Mathematics (2016)

MP.2 Reason abstractly and quantitatively.

(HS-LS2-4),(HS-LS2-6),(HS-ESS3-1),(HS-ESS3-2),(HS-ESS3-3),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

MP.4 Model with mathematics. (HS-LS2-4),(HS-ESS3-3),(HS-ESS3-6)

HSN.Q.A.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.

(HS-LS2-4),(HS-LS2-7),(HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

(HS-LS2-4),(HS-LS2-7),(HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

(HS-LS2-4),(HS-LS2-7),(HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

HSS-ID.A.1 Represent data with plots on the real number line. (HS-LS2-6)

HSS-IC.A.1 Understand statistics as a process for making inferences about population

parameters based on a random sample from that population. (HS-LS2-6) HSS-IC.B.6 Evaluate reports based on data. (HS-LS2-6)

NJSLS Career Readiness,Life Literacies, and Key Skills (2020)

https://www.nj.gov/education/cccs/2020/2020%20NJSLS-CLKS.pdf

9.1.12.CFR.1: Compare and contrast the role of philanthropy, volunteer service, and charities in community development and quality of life in a variety of cultures.

9.1.12.FP.5: Evaluate how behavioral bias (e.g., overconfidence, confirmation, recency, loss aversion, etc.) affects decision-making

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a)

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

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).

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

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).

NJSLS 2020 Computer Science and Design Thinking

https://www.nj.gov/education/cccs/2020/2020%20NJSLS-CSDT.pdf

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Student Resources

Primary Source Readings: <u>NRDC- Global Warming 101</u>, <u>EPA.gov- Ozone Layer Protection</u>, <u>EPA.gov- Learn About Sustainability</u>, <u>How Does Nuclear Energy Affect the Environment?</u>, <u>World-Nuclear.org- Chernobyl</u>. <u>Three Mile Island</u>

Secondary Source Readings: Effects of Global Warming readings (PDF packet),

Supporting Text pages: Unit 5 - Chapters 15-17, pages 234-283 Unit 7 - Chapters 24-25, pages 396-427

Technology- Ozone Lab, Energy Gallery walk, NASA- Ozone Hole

Teacher Resources

Texts: - Environmental Science. Foresman-Wesley (2003).

Technology: Google Earth- <u>TimeLapse</u>

Websites: <u>https://climate.nasa.gov/</u> <u>https://www.epa.gov/sustainability/learn-about-sustainability</u> https://www.epa.gov/environmental-economics

Videos: http://www.bozemanscience.com/new-page http://video.nationalgeographic.com/video/greenhouse-gases http://www.bozemanscience.com/ap-es-034-global-climate-change Nuclear Energy Explained: Risk or Opportunity 88,000 tons of radioactive waste – and nowhere to put it TED-Ed How do wind turbines work? TED Ed - How do solar panels work? Hydropower 101 Tidal Power 101 Ocean Power Plant Generates Energy From Waves What is the Greenhouse Effect? Arctic Sea Ice Melting (1984 - 2020) | Time lapse Video What is Sustainability? The Futuristic Farms That Will Feed the World Environmental Econ: Crash Course Economics #22 **Stage 2 – Assessment Evidence**

Pre-Assessments: Graphic organizers, Venn diagrams, informational surveys, vocabulary pre-assessment quiz

Formative Assessments: Review Questions, Lab activities, Quizzes, projects, Active Reading worksheet: Global Change, Glaciers and Global Warming lab, Global Warming and the Oceans activity, Effects of Global Warming readings & questions (PDF), Historical Climate Cycles activity

Summative Assessments: Unit test, Ozone Depletion graphing activity,

Performance Task(s): Lab activities, project, Renewable Energy Project, Acid Deposition lab

Stage 3 – Learning Plan	
Non renewable energy sources	
Nuclear energy	
Energy reduction	
Renewable energy sources	
Global climate change	
Greenhouse effect	
CO2 levels	
Polar ice reduction	
Sustainability	
environmental economics	

Accommodations and Modifications:

Below please find a list of suggestions for accommodations and modifications to meet the diverse needs of our students. Teachers should consider this a resource and understand that they are not limited to the recommendations included below.

An accommodation changes HOW a student learns; the change needed does not alter the grade-level standard. A modification changes WHAT a student learns; the change alters the grade-level expectation.

Special Education and 504 Plans: All modifications and accommodations must be specific to each individual child's IEP (Individualized Educational Plan) or 504 Plan. All students with 504 plans should be provided the necessary tools to be successful in the course.

- Pre-teach or preview vocabulary
- Repeat or reword directions
- Have students repeat directions
- Use of small group instruction
- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments
- Repetition and time for additional practice
- Model skills/techniques to be mastered
- Extended time to complete task/assignment/work
- Provide a copy of class notes Strategic seating (with a purpose e.g. less distraction)
- Flexible seating
- Repetition and additional practice
- Use of manipulatives
- Use of assistive technology (as appropriate)
- Assign a peer buddy
- Emphasize key words or critical information by highlighting
- Use of graphic organizers
- Scaffold with prompts for sentence starters
- Check for understanding with more frequency
- Provide oral reminders and check student work during independent practice
- Chunk the assignment broken up into smaller units, work submitted in phases Encourage student to proofread assignments and tests
- Provide regular home/school communication
- Teacher checks student planner
- Provide student with clear expectations in writing and grading criteria for assignments (rubrics)

Testing Accommodations:

Students should receive all testing accommodations for Benchmark assessments that they receive for State testing.

- Setting: Alternate setting for assessments, small groups, screens to block distractions
- Presentation: large print, test readers, use of audio, fewer questions on each page

- Response: answer verbally, use large block answer sheet, speech-to-text dictation, accept short answers
- Allow for retakes
- Provide study guides
- Use of reference aids such as glossary, multiplication tables, calculator
- Alternate ways to evaluate (projects or oral presentations instead of written tests)
- Open-book or open-note tests

English Language Learners:

All modifications and accommodations should be specific to each individual child's LEP level as determined by the WIDA screening or ACCESS, utilizing the WIDA Can Do Descriptors.

- Pre-teach or preview vocabulary
- Repeat or reword directions
- Have students repeat directions
- Use of small group instruction
- Scaffold language based on their Can Do Descriptors
- Alter materials and requirements according to Can Do Descriptors
- Adjust number of paragraphs or length of writing according to their Can Do Descriptor
- TPR (Total Physical Response-Sheltered Instruction strategy) Demonstrate concepts through multi-sensory forms such as with body language, intonation
- Pair visual prompts with verbal presentations
- Repetition and additional practice
- Model skills and techniques to be mastered
- Native Language translation (peer, assistive technology, bilingual dictionary)
- Emphasize key words or critical information by highlighting
- Use of graphic organizers
- Scaffold with prompts for sentence starters
- Check for understanding with more frequency
- Use of self-assessment rubrics Increase one-on-one conferencing; frequent check ins
- Use study guide to organize materials
- Make vocabulary words available in a student created vocabulary notebook, vocabulary bank, Word Wall, or vocabulary ring
- Extended time
- Select text complexity and tiered vocabulary according to Can Do Descriptors
- Projects completed individually or with partners
- Use an online dictionary that includes images for words.

Students at Risk of Failure:

- Use of self-assessment rubrics for check-in
- Pair visual prompts with verbal presentations
- Ask students to restate information and/or directions

- Opportunity for repetition and additional practice
- Model skills/techniques to be mastered
- Extended time
- Provide copy of class notes
- Strategic seating with a purpose
- Provide students opportunity to make corrections and/or explain their answers
- Support organizational skills

High Achieving:

- Allow for student choice from a menu of differentiated outcomes; choices grouped by complexity of thinking skills; variety of options enable students to work in the mode that most interests them
- Allow students to pursue independent projects based on their individual interests
- Provide enrichment activities that include more complex material
- Allow opportunities for peer collaboration and team-teaching
- Set individual goals
- Conduct research and provide presentation of appropriate topics

NEPTUNE TOWNSHIP SCHOOL DISTRICT Office of the Superintendent 60 Neptune Blvd. Neptune, NJ 07753

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2022