Kenilworth Public Schools
Curriculum Guide

Content Area: Environmental Science
Grade: 10-12
BOE Approved: 3/13/17

Revision Date: 5/11/20
Submitted by: Dale Sona
BOE Revision Approved: N/A

Environmental Science Grade 11 & 12

Unit 1- Introduction to Environmental Science	Unit 2- Ecology	Unit 3- Humans and the Environment	Unit 4- Earth's Resources	Unit 5- Toward a Sustainable Future

Weeks 1-6	Weeks 7-15	Weeks 16-22	Weeks 23-33	Weeks 34-38
Unit Description: Overview of environmental science and the history of humans in the environment.	*Unit Description:* Biotic and abiotic components interact to form an interconnected system, species adapt to their environment through the process of evolution by natural selection.	*Unit Description:* Describe Earth's climate and explore ways that human activities may be causing climate change. There is an abundance of water on earth but only a small percentage is suitable for human consumption. There are different kinds of pollutants that affect air quality. Air pollution has short-term and long-term health effects.	*Unit Description:* Discuss the economic importance of miners, surface and subsurface mining techniques, the environmental ramifications of mining, and the laws regulating mining and mine reclamation. Introduce students to the fundamentals of energy use. Renewable and alternative energy resources play an increasingly important role in reducing our dependence on nonrenewable energy sources.	*Unit Description* Discuss how human health is affected by environmental conditions. Discuss health problems related to human produced pollution, as well as the connection between human diseases and organisms that serve as pathogens and vectors.
Unit Targets: • Define interrelationships among concepts and	*Unit Targets:* • Cite evidence that the transfer and transformation of	*Unit Targets:* • Explain the difference between weather and climate	*Unit Targets:* • Describe methods of mining	*Unit Targets:* • List five pollutants, their sources, and their possible effects on human health

patterns of evidence found in different central scientific explanations • Compare over time the impact of human activity on the cycling of matter and energy through ecosystems • Assess (using maps, local planning documents, and historical records) how the natural environment has changed since humans have inhabited	matter and energy links organisms to one another and to their physical settings • Predict what would happen to an ecosystem if an energy source was removed • Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of population • Predict how and explain why the disappearance of a species (or several species) would impact the larger system • Explain all of the possible species' interactions within a given hotspot ecosystem, including food web relationships and symbiotic pairings	• Explain why Earth's atmosphere is like the glass in a greenhouse • Describe what a warmer earth might be like • Explain how the ozone layer shields the Earth from much of the sun's harmful radiation • Discuss how chemical hazards affect human health.	• Describe important potential environmental consequences of mining • Define reclamation • Explain how fuels are used to generate electricity in an electric power plant • Pros and cons of fossil fuels • Advantages and disadvantages of nuclear power • List six forms of renewable energy and compare their advantages and disadvantages	• Explain emergent diseases • Describe challenges to sustainability • Describe major developments in US environmental history • Identify ways in which the choices that you make as an individual may affect the environment

Environmental Science- Grades 11 & 12

Unit title: History of Environmental Science

Unit summary: Explain the values of making informed, thoughtful decisions about the environment. All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge.

Primary interdisciplinary connections:
MP.2/ HSN-Q.A.3

21st Century Themes:
Global Awareness, Media Literacy, Critical Thinking and Problem Solving, Communication and Collaboration

Learning Targets

NJSLS Standards: HS-ESS3-1/ HS-ESS3-4/HS-ESS2-1.

Technology Standards: 8.1.12.C.1,8.1.12.D.4, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.5

ELA Companion Standards: WHST.9-12.7/ SL.11-12.5/

Content Statements:

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.
2	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
3	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

Big Idea:
Students understand core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world. Scientific knowledge builds on itself over time. The growth of scientific knowledge involves critique and communication, which are social practices that are governed by a core set of values and norms.

Unit Essential Questions:

- What have humans done to alter the environment over time?
- What do we mean in science when we say that we stand on the shoulders of giants?
- How has the environment changed over time?

Unit Enduring Understandings:

- Understanding the development of scientific ideas is essential for building scientific knowledge.

Unit Learning Targets
Students will…

- Define interrelationships among concepts and patterns of evidence found in different central scientific explanations.
- Compare over time the impact of human activity on the cycling of matter and energy through ecosystems
- Assess (using maps, local planning documents, and historical records) how the natural environment has changed since humans have inhabited.
- Describe the history of U.S. environmental policy.
- Identify major international institutions involved in environmental policy.
- Define Earth's geosphere, lithosphere, biosphere, atmosphere, and hydrosphere.

Evidence of Learning

Summative Assessment:
Labs, Unit Tests

Formative Assessments:

- Quizzes
- Chapter Tests
- Homework
- Webquests
- Projects
- Diagrams of Earth's spheres

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Project on environment through time • Project on domesticated plant or animal • Pros and cons of industrial revolution • Poster on Major Environmental issues • Diagram of Earth's spheres Advanced Learners- research how specific groups of people impacted the environment. Write a research paper explaining the details and impact they had. SE/BSI- create a poster on how humans impacted the environment during the industrial revolution.	Weeks 1 - 2
Teacher Resources	*Teacher Note*
• Textbooks	

• PowerPoint • Lab Materials • Chromebooks	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:

- Use of visual and multisensory formats
- Use of assisted technology
- Use of prompts
- Modification of content and student products
- Testing accommodations
- Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:

- Adjusting the pace of lessons
- Curriculum compacting
- Inquiry-based instruction
- Independent study
- Higher-order thinking skills
- Interest-based content
- Student-driven instruction
- Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:

- Pre-teaching of vocabulary and concepts
- Visual learning, including graphic organizers
- Use of cognates to increase comprehension
- Teacher modeling
- Pairing students with beginning English language skills with students who have more advanced English language skills
- Scaffolding
- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups

Environmental Science- Grades 11 & 12

Unit title: Ecology

Unit summary: Biotic and abiotic components interact to form an interconnected system, species adapt to their environment through the process of evolution by natural selection.

Primary interdisciplinary connections:
MP.2 / MP.4

21st Century Career and Life Themes:
Global Awareness, Media Literacy, Critical Thinking and Problem Solving, Communication and Collaboration

Learning Targets

NJSLS Standards: HS-LS2-6/ HS-LS2-7/ HS-LS4-5

Technology Standards:
8.1.12.C.1, 8.1.12.D.4, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.5

ELA Companion Standards: WHST.9-12.9/ SL.11-12.4

Content Statements:

1	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
2	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
3	Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Big Idea:
All animals and most plants depend on both other organisms and their environment to meet their basic needs. The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, are driven by Earth's internal and external sources of energy, and are impacted by human activity. Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms. Earth consists of diverse and interdependent organisms. Humans make choices that can have an impact on biodiversity. Biodiversity includes diversity of individuals, species, and ecosystems. Because all living things are connected, maintaining diversity is critical to the health of

the planet.

Unit Essential Questions:

- How are organisms dependent on each other?
- How does the earth's chemical composition influence the existence of life on earth?
- What kinds of adaptations to different environments have been seen among animals?
- What would happen if a predator was removed from its ecosystem?
- How does energy flow through familiar ecosystems?
- What are the common ecological relationships between and among species and their environments?
- What effects do agriculture and urban development have on ecosystems?

Unit Enduring Understandings:

- The survival of organisms is affected by interactions with each other and their environment and can be altered by human manipulation
- Living things are dependent on essential minerals and nutrients provided by earth
- Life depends on energy flow within systems
- An ecosystem transfers matter and energy from one organism to another
- The interaction between living organisms and nonliving components in an environment affect the ecosystem
- Humans change environments in ways that can be beneficial or detrimental to themselves and other living organisms

Unit Learning Targets
Students will…

- Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting
- Predict what would happen to an ecosystem if an energy source was removed
- Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of populations
- Predict how and explain why the disappearance of a species (or several species) would impact the larger system
- Explain all of the possible species' interactions within a given hotspot ecosystem, including food web relationships and symbiotic pairings
- Explain the difference between biotic and abiotic factors
- Discuss how an organisms habitat relates to its survival
- Describe the four primary mechanisms of biological evolution
- Explain the difference between a producer and a consumer
- Describe what happens to a community after a disturbance
- Explain how biomes are characterized
- Describe the economic benefits of biodiversity

Evidence of Learning

Summative Assessment:

Labs, Unit Tests

Formative Assessments:

- Quizzes
- Chapter Tests
- Homework
- Webquests
- Online classwork

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Create food chains and food webs • Identify biotic and abiotic factors in local environment • Locate areas of succession in and around school • Biome project • Owl pellet lab • Human Population debate • Planet Earth biome videos • Invasive species project • Research project on species interactions (predator/prey, parasitism, mutualism, commensalism) • Endangered species presentation Advanced Learners- go to a local park and create a detailed food web using all the organisms you observed. Write a report on each specific organism, label them appropriately (herbivore, carnivore, omnivore, and decomposer). SE/BSI- walk around the school grounds and catalog all of the biotic and abiotic factors that you can find. In groups, create a mural showing your findings.	Weeks 3-10
Teacher Resources	*Teacher Note*
• Textbooks • PowerPoint • Lab Materials • Chromebooks • Internet	

Differentiating Instruction:

Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:

- Use of visual and multisensory formats
- Use of assisted technology
- Use of prompts
- Modification of content and student products
- Testing accommodations
- Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:

- Adjusting the pace of lessons
- Curriculum compacting
- Inquiry-based instruction
- Independent study
- Higher-order thinking skills
- Interest-based content
- Student-driven instruction
- Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:

- Pre-teaching of vocabulary and concepts
- Visual learning, including graphic organizers
- Use of cognates to increase comprehension
- Teacher modeling
- Pairing students with beginning English language skills with students who have more advanced English language skills
- Scaffolding
- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups

Environmental Science- Grades 11 & 12

Unit title: Humans and the Environment

Unit summary:

Upon learning about the Earth's climate students will explore ways that human activities may be causing climate change. There is an abundance of water on earth but only a small percentage is suitable for human consumption. There are different kinds of pollutants that affect air quality. Air pollution has short-term and long-term health effects.

Primary interdisciplinary connections: MP.2 / MP.4/ HSN-Q.A.1/ HSN-Q.A.3

21st Century Career and Life Themes:

Global Awareness, Media Literacy, Critical Thinking and Problem Solving, Communication and Collaboration

Learning Targets

NJSLS Standards: HS-ESS3-1/HS-ESS3-5/ HS-ESS3-6

Technology Standards: 8.1.12.C.1, 8.1.12.D.4, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.5

ELA Companion Standards: RST.11-12.1/ RST.11-12.7/ WHST.9-12.2

Content Statements:

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.
2	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.
3	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity

Big Idea:

All animals and most plants depend on both other organisms and their environment to meet their basic needs. The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, and are driven by Earth's internal and external sources of energy, and are impacted by human activity. Students should be active, informed citizens who value diversity and promote cultural understanding by working collaboratively to address challenges that are inherent in living in an interconnected world.

Unit Essential Questions:	**Unit Enduring Understandings:**
• How are organisms dependent on each other? • How does the earth's chemical	• The survival of organisms is affected by interactions with each other and their environment and can be altered by human

composition influence the existence of life on earth?
- How is the ocean a major influence on weather and climate?
- How will Arctic warming affect global climate systems?
- How will people and their environment be affected by climate change?
- How do people affect the oceans and atmosphere?
- How has our climate changed in the past 100 years?

manipulation.
- All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

Unit Learning Targets
Students will…

- Explain the difference between weather and climate
- Explain how the ozone layer shields the earth from much of the sun's harmful radiation
- Explain why earth's atmosphere is like the glass in a greenhouse
- Describe what a warmer earth might be like
- Describe how technological advances have contributed to human population growth
- Explain recent trends in human population growth
- Discuss social factors that affect population growth
- Describe how infectious diseases spread
- Explain why emerging diseases are important to monitor and control
- List the types of environmental health hazards
- Discuss how chemical hazards affect human health
- Discuss how earthquakes affect structures on Earth's surface
- Describe the environmental impacts of urbanization
- Explain the impacts sprawl has on an area

Evidence of Learning

Summative Assessment:
Labs, Unit Tests

Formative Assessments:

- Quizzes
- Chapter Tests
- Homework
- Online program classwork
- Projects

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Project on layers of the atmosphere • Poster on migrating plants and animals due to climate change • Pros and cons of industrial revolution • BPA debate • Human Population Control debate • Indoor air pollution audit • Natural disasters presentation • Sprawls impact in your community/state Advanced Learners- research how much fresh water is on the planet. Create a working model of a water filter to be tested in class. Explain the detailed steps of water filtration plants. SE/BSI- draw a poster on the layers of the atmosphere, make sure you include a temperature line and explain why the temperature is changing in each layer.	Weeks 16-22
Teacher Resources	*Teacher Note*
• Textbooks • PowerPoint • Lab Materials • Chromebooks	

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- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups

Environmental Science- Grades 11 & 12

Unit title: Earth's Resources

Unit summary:

This unit discusses the economic importance of minerals, surface and subsurface mining techniques, the environmental ramifications of mining, and the laws regulating mining and mine reclamation. Students will learn that this unit affects them directly in everyday life.

Primary interdisciplinary connections:

MP.2/ MP.4/ HSN-Q.A.3

21st Century Career and Life Themes:

Global Awareness, Media Literacy, Critical Thinking and Problem Solving, Communication and Collaboration

Learning Targets

NJSLS Standards: HS-ESS3-2 /HS-ESS3-1. / HS-ESS3-4. / HS-ESS2-2.

Technology Standards:

8.1.12.C.1, 8.1.12.D.4, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.5

ELA Companion Standards: RST.11-12.1/ RST.11-12.2/ WHST.9-12.2

Content Statements:

1	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
2	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.
3	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
4	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

Big Idea:

In the United States, energy consumption patterns produce a great demand for fuels in the transportation, industrial, residential, and commercial sectors. These all have consequences on our economy, environment, and politics.

Unit Essential Questions:	Unit Enduring Understandings:
• How minerals are formed? • What are the methods of mining? • What are the 7 potential environmental impacts of mining?	• Distinguish among forms of energy (e.g. nuclear, electrical, gravitational), sources of energy (e.g., electrical, mechanical, chemical, light, sound) and usable energy

• How do we generate electricity from fossil fuels? • How does coal, oil, and natural gas form? • What is the difference between nuclear fusion and nuclear fission?	resources (oil, gas, coal, active/passive solar, wind, hydroelectric, biomass, tidal, geothermal, fission (U), fusion (H)) and their impact on the environment.

Unit Learning Targets
Students will…

- Explain how minerals form
- Explain different types of mining
- Explain the term reclamation
- Describe different sources of energy and analyze the advantages and disadvantages of each
- Explain the importance of managing specific renewable resources
- Discuss the current levels of deforestation in the United States and in developing nations
- Explain how soil forms
- Explain the importance of industrial agriculture and the green revolution
- Discuss genetically modified food
- Describe the advantages and disadvantages of industrial food production
- Discuss how fresh water can be both renewable and limited
- List the three primary categories of freshwater use
- Discuss the sources and effects of major pollutants found in the ocean
- Identify the four main layers of the atmosphere
- Describe how air pollutants affect human health
- Describe the international efforts to reduce the ozone hole

Evidence of Learning

Summative Assessment:
Labs, Unit Tests

Formative Assessments:

- Quizzes
- Chapter Tests
- Homework
- webquests

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Mineral project • Energy PowerPoint presentation • Poster (how does a power plant work)	Weeks 23-33

• Compost pile outdoors • Plantings in courtyard • Rocks and minerals lab • Create a water filtration system • Eutrophication diagram • Poster on layers of atmosphere • Food Inc. video Advanced Learners- write a proposal to your town's mayor explaining which type of renewable energy source your town should switch to. Explain how it will help financially, and how it will help the environment. SE/BSI- create a PowerPoint or Poster on a Mineral found in your state. Explain what it is used for and how we extract it from the ground.	
Teacher Resources	*Teacher Note*
• Textbooks • PowerPoint • Lab Materials • Chromebooks • Internet	

Differentiating Instruction:
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And Gifted & Talented Students

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Examples of Strategies and Practices that Support Gifted & Talented Students:

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- Inquiry-based instruction
- Independent study
- Higher-order thinking skills
- Interest-based content
- Student-driven instruction

- Real-world problems and scenarios

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- Scaffolding
- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups

Environmental Science- Grades 11 & 12

Unit title: Toward a Sustainable Future

Unit summary:

This unit addresses how human health is affected by environmental conditions. The unit examines human health problems that are related to natural and human-produced pollution, as well as the connection between human diseases and organisms that serve as pathogens and vectors.

Primary interdisciplinary connections:

MP.2/ MP.4/ HSN-Q.A.3

21st Century Career and Life Themes:

Global Awareness, Media Literacy, Critical Thinking and Problem Solving, Communication and Collaboration

Learning Targets

NJSLS Standards: HS-ESS3-1. /HS-ESS3-3/ HS-ESS3-5.

Technology Standards:

8.1.12.C.1, 8.1.12.D.4, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.5

ELA Companion Standards: RST.11-12.1/ RST.11-12.2/ RST.11-12.7/ RST.11-12.8/ WHST.9-12.2

Content Statements:

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
2	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity
3	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

Big Idea:

Governments and people can affect environmental issues. Environmental decision making occurs at the level of the individual, the community, state or national government, and/or internationally.

Unit Essential Questions:	**Unit Enduring Understandings:**
• What are the five pollutants, their sources, and their possible effects on human health? • What is the the relationship between	• Toxic chemicals from both natural sources and human activities that pollute air, soil, water, and food may damage human health. After an outbreak of illness

waste, pollution, and human health? • Why are some diseases likely to spread as a result of global warming? • How can international meetings or agreements effect the environment? • What are some choices you could make today that would have some kind of effect on the environment?	occurs, epidemiologists attempt to find its origin and try to find ways to prevent future epidemics. Most pollutants come from human activities, but some pollutants occur naturally.

Unit Learning Targets

Students will…

- Describe some challenges to achieving sustainability
- Explain how economics and environmental science are related
- Describe major developments in US environmental history
- Describe how climate is affected by topography, volcanoes, regional vegetation, and periodic changes in Earth's orbit
- State the probable cause of global climate change
- Predict future effects of climate change on people
- Describe strategies for reducing greenhouse gases
- Explain how fossil fuels formed
- Predict the future of fossil fuels
- Explain how pollutants released by fossil fuels damage health and the environment
- Describe how a nuclear power plant generates electricity
- Explain the benefits of renewable energy resources
- Explain how river water can be used to generate electricity
- Analyze the benefits and costs of solar energy
- Explain how wind energy can be used to produce electricity
- Identify the three categories of waste
- Discuss the importance of reducing waste
- Describe how composting and recycling help reduce the amount of waste
- Identify agencies that regulate hazardous waste

Evidence of Learning

Summative Assessment:

Labs, Unit Tests

Formative Assessments:

- Quizzes
- Chapter Tests
- Homework
- Online book program
- webquests

Lesson Plans	
Activities/Interdisciplinary Connections	*Timeframe*
• Famous environmentalist PowerPoint project • Poster (toxins in your own home) • An Inconvenient Truth video • Documentaries on Climate Change • Poster on effects of climate change • Energy sources debate • Nuclear Power Plant dangers (Chernobyl) • Project- what energy source should we use in our area? • Research project- Where does our "trash" go? Advanced Learners- take pictures of ingredients of chemical containers in your house/garage. Make a PowerPoint explaining how some of the chemicals can impact human health and the environment. SE/BSI- create a poster listing what the average person can do to help better his/her local environment.	Weeks 34-38
Teacher Resources	*Teacher Note*
• Textbooks • PowerPoint • Lab Materials • Chromebooks	
Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students	
Examples of Strategies and Practices that Support Students with Disabilities: • Use of visual and multisensory formats • Use of assisted technology • Use of prompts • Modification of content and student products • Testing accommodations • Authentic assessments Examples of Strategies and Practices that Support Gifted & Talented Students: • Adjusting the pace of lessons • Curriculum compacting	

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