Environmental Science Curriculum Map 2024

updated 9/1/2024

Unit	Topics	Time Frame	Standards
Introduction to Environmental Science	Sustainability Types of Natural Resources Carrying Capacity Human Population Growth Tragedy of the Commons Earth's Spheres Biogeochemical Cycles Convection Currents Feedback loops	38 Periods	HS-ESS2-2 HS-ESS2-3 HS-ESS2-5 HS-ESS2-6 HS-ESS3-1 HS-ESS3-3 HS-ESS3-6
Climate Change, Energy, and Minerals Resources	The Greenhouse Effect The Carbon Cycle Feedback Loops Involved in Climate Change Fossil Fuels Nuclear Power Renewable Energy Resources Mining	45 Periods	HS-ESS2-4 HS-ESS2-6 HS-ESS3-2 HS-ESS3-3, HS-ESS3-4 HS-ESS3-5 HS-ESS3-6 HS-ETS1-1 HS-ETS1-3 HS-LS2-7
Water Resources	Availability of Freshwater Resources Effects of Climate Change on Freshwater Resources Water Pollution Fresh Water Treatment Ocean Pollution Ocean Acidification	20 Class Periods	HS-ESS3-1 HS-ESS3-3 HS-ESS3-4 HS-ESS3-6 HS-ETS1-1 HS-LS2-7 HS-ETS1-3

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Biodiversity	Types of Biodiversity Importance of Biodiversity Quantifying Biodiversity Sampling Methods Reasons for Biodiversity Loss Invasive Species Overharvesting/Overfishing Effects of Climate Change on Biodiversity Methods for Protecting Biodiversity	31 Periods	HS-ESS3-3 HS-ESS3-4 HS-ESS3-6 HS-ETS1-1 HS-LS2-7 HS-ETS1-3

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Unit 1 Summary: Introduction to Environmental Science

This unit introduces students to the discipline of environmental science. Grounded in empirical science, environmental science has a wider scope than the traditional sciences because of its interdisciplinary approach to identifying and solving emerging and pressing problems. Students will apply the scientific knowledge and skills they have developed thus far through their study of the biological, chemical, and physical sciences. They will study the impact of human activity on the environment and society in light of current problems such as energy supplies, global climate change, and resource consumption. This course promotes sustainability in local settings such as the home and school, and at the national and global level. This unit frames science in a political and social light that promotes democratic and active citizenship. Students will learn how environmental practices and policies are developed, with an eye on social justice and activism. Students will be empowered by learning about careers in environmental science in addition to opportunities to take action to solve problems. The following unit on climate change will build on these themes through direct application and concrete examples.

Essential Questions:

These questions establish inquiry to unify the unit's assignments and assessments.

What is the focus of environmental science?
What are the benefits of sustainability?
How do environmental scientists identify, research, and solve environmental problems?
How can we best balance our own interests and needs with the health of the environment?
How do Earth's spheres interact to provide the basic materials such as nutrients that support life and human societies?
What factors determine how a population's size changes?
How might the human population change?
What impacts do human activity have on Earth's systems?

Vocabulary/Key Terms

Tier 2 Terms	Tier 3 Terms
Resources, natural, fossil fuels, coal, crude oil, natural gas, populations, industrialized, non-industrialized, privatization, commons, environmental science, environmentalism, activism, water cycle, carbon cycle, nitrogen cycle, phosphorus cycle, spheres, system, input, output, positive feedback, negative feedback	Renewable, nonrenewable, inexhaustible, limiting factor, carrying capacity, logistic growth, exponential growth, demographic transition, tragedy of the commons, sustainability, biogeochemical cycles, biosphere, geosphere, atmosphere, hydrosphere, cryosphere, precipitation, uptake, infiltration, condensation, feedback loop, convection current

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Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests= 40%)
Test 1: Population Dynamics
Test 2: Environmental Systems

Minor Assessments: Quizzes (20%)
Teacher generated quizzes will be used to assess for deeper or more specific understanding

Labs/Projects (30%)

Lab work will involve data collection and analysis using traditional data collection methods and/or simulation modeling. Example labs can be found linked to this document (more labs will be added to this folder as they are created).

Possible Labs

- Rabbit Population Gizmo
- Coral Reef Gizmo
- Bald Eagle Case Study
- Population Ecology Graph Activity
- Tragedy of the Commons fishing lab
- Natural Resource Use Simulation Lab

Additional Resources

The People Connection- Literacy Activity

Resources

- Textbook: Pearson Environmental Science Your World Your Turn (Sections 1.1, 3.2, 3.3, 4.3, 8.1, 8.2, 12.2)
- Gizmos- https://gizmos.explorelearning.com/
- High Adventure Science- https://learn.concord.org/has
- Legends of Learning Games - https://www.legendsoflearning.com/learning-objectives/biodiversity-and-health-of-ecosystems/
- NASA Classroom Content and Lesson Plans https://www.nasa.gov/langley/education/classroom
- NGSS HUB- https://ngss.nsta.org/Classroom-Resources.aspx
- Earth Science Week: Classroom Activities, categorized by the Next Generation Science Standards https://www.earthsciweek.org/classroom-activities/ngss
- California Academy of Sciences https://www.calacademy.org/educators/science-lesson-plans-for-high-school

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- Activelylearn.com
- World of 7 Billion Population Education Resources

Accommodations and Modifications

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

STANDARDS for Learning Targets		
NJSLS	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSL8)**
HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.	**ELA** RI.CR.11–12.1. Accurately cite a range of thorough textual evidence and make relevant connections to strongly support a comprehensive analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. RI.MF.11–12.6. Synthesize complex information across multiple sources and formats to develop ideas, resolve conflicting information, or develop an interpretation that goes beyond explicit text information (e.g., express a personal point of view, new interpretation of the concept). W.IW.11–12.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. W.WR.11–12.5. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating	**CTE** 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data. 9.3.ST-ET.2 Display and communicate STEM information **Technology** 8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results. 8.1.12.A.5 Create a report from a relational database consisting of at

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HS-ESS2-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. HS-ESS3-3. Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity. 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.	understanding of the subject under investigation. W.WR.11–12.5. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. **Mathematics** MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. N.Q A. Reason quantitatively and use units to solve problems N.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. N.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	least two tables and describe the process, and explain the report results.

Sample Measurable Objectives for Lesson Planning
• Differentiate between Environmental Science and Environmentalism • Categorize natural resources as renewable, nonrenewable or inexhaustible • Explain what carrying capacity is and identify limiting factors that affect an environment's carrying capacity

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- Read population growth curves and describe what is happening to a population during different sections of the graph
- Describe the rate of human population growth in light of natural resource use
- Describe the three stages of the demographic transition based on changes on birth and death rates.
- Describe the tragedy of the commons and provide two real world examples
- Explain how laws and regulations can protect environments and conserve natural resources
- Develop a basic environmental policy following a simplified framework.
- Define the four spheres of Earth's systems and cite examples from each.
- Use a model to show how Earth's materials are transformed and reused as they move between Earth's spheres
- Describe the results of a positive feedback loop and a negative feedback loop
- Provide examples of one positive and one negative feedback loop that occur in nature

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Unit 2 Summary: Climate Change, Energy and Mineral Resources

This unit will begin with a discussion of what climate means on a regional and global scale, and what natural factors affect it. There are many natural reasons for climate change, such as, the change in the shape of Earth's orbit, the tilt of Earth's axis, the reflectivity of the atmosphere, and the amount of solar radiation the sun gives off. Climate is driven by the distribution of heat and precipitation around the globe, so, with an essential understanding of the difference between weather and climate, students will examine climate through the lens of the water cycle. We can examine natural climate change through geological, paleontological, and other natural means, providing us a basis for the pace and rate of climate change. They will then look at the carbon cycle in a similar light, as studying the imbalance in the carbon cycle will recall the urbanization unit, generating questions about the current climate.

On the other hand, anthropogenic factors that affect climate include the release of greenhouse gasses such as carbon dioxide, methane, and water vapor from the combustion of fossil fuels, deforestation, and other human activities. Therefore, the focus of the unit will shift to an exploration of evidence and consequences of climate change due to global warming via the greenhouse effect.

We have already seen the effects of climate change; the frequency and severity continues to accelerate. Habitat loss and habitat change has led to changes in species diversity. The distribution of animals and plants due to changes in behavioral patterns has destabilized ecosystems. An additional consequence of carbon emissions is ocean acidification, the result of carbon dioxide diffusing into the oceans, which threatens global marine ecosystems.

In order to create a more personal connection, we will end the unit with how human societies are affected by climate change, yet how students can be empowered to confront the challenges created by climate change. They can contemplate personal lifestyle changes, career choices, and political actions to be part of local and global communities that face a variety of threats due to climate change.

This unit covers the types of energy and mineral resources available on Earth and focuses on weighing the costs and benefits of resource extraction and utilization. The unit will begin with an exploration into the various energy resources, which can be categorized as non-renewable, renewable, and inexhaustible. Students will learn that these energy sources (with the exception of geothermal energy) are transformed from solar energy. Students will discover that each energy resource has its own benefits and costs. Students will learn that "green" energy resources may also depend on mineral resources.

Students will weigh the costs and benefits of resource extraction and utilization, and explore ways to promote responsible consumption of resources. The energy and mineral resources unit follows the units on biodiversity, urbanization, and water resources. The flow of these four units is designed to develop a systems approach that stresses the interconnectedness and interrelatedness of human activity and the sustainability of environmental health. Connections to this theme of sustainability will be made again later in the climate unit.

Essential Questions:

These questions establish inquiry to unify the unit's assignments and assessments.

- What factors affect how the sun warms the Earth?
- How is climate change over long time scales?
- How do we discover evidence for past climate change?
- How does climate change affect people?

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- Is it safe to depend on any single energy resource to meet all of our needs?
- How do we balance our needs for resources with the needs of the environment?
- At what point could the cost of mining outweigh the benefits?

Vocabulary/Key Terms

Tier 2	Tier 3
Fossil fuels, carbon dioxide, positive feedback, negative feedbacks, greenhouse effect, insulation, fossil fuels, carbon cycle, reflect, absorb, climate, weather, oil, coal, natural gas, passive, active, organic, mining, uranium, radium, fusion, fission, minerals, heat pump, renewable, turbine, dam	Albedo effect, Greenhouse gasses, climate change, emissions, carbon sink, carbon source, respiration, photosynthesis, industrial evolution, nuclear, solar power, wind power, thermal pollution, geothermal energy, hydropower, biomass, crystalline, strip mining, solution mining, placer mining, petroleum, meltdown, reactor, fracking, concentrated solar power,

Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests= 40%)

Test 1: Climate Change and Fossil Fuels

Test 2: Alternative Energy Resources

Test 3: Extracting Fossil Fuels and Mining

Minor Assessments: Quizzes (20%)

Teacher generated quizzes will be used to assess for deeper or more specific understanding

Labs/Projects (30%)

Lab work will involve data collection and analysis using traditional data collection methods and/or simulation modeling. Example labs can be found linked to this document (more labs will be added to this folder as they are created).

Possible Labs

NASA Are We Warming the Earth Module

Gizmo - Greenhouse Effect

HAS Global Climate Change Model: Making Predictions About Future Climate

How To Predict Hurricanes

Poker Chip Model: Global Carbon Pools and Fluxes

Daisy World (Feedback Loops/ Albedo)

Pretzel Power (Teacher Guide)

Cookie Coal Mining

Additional Unit Resources

How three coastal communities are dealing with rising seas? Literacy Activity

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Fossil Fuel Rock L3 Literacy Activity
“The Science, Politics, and Economics of Climate Change” Activelylearn.com literacy activity
“Analyze and Interpret Data: Ocean Acidification” Activelylearn.com literacy activity
Climate Feedback Loops Activity

Resources

- Textbook: Pearson Environmental Science Your World Your Turn (Sections 3.2, 3.4, 13.1, 13.2, 13.3, 16.1, 16.2, 17.2, 17.3, 18.1, 18.2, 18.3)
- Gizmos- https://gizmos.explorelearning.com/
- High Adventure Science- https://learn.concord.org/has
- Legends of Learning Games - https://www.legendsoflearning.com/learning-objectives/biodiversity-and-health-of-ecosystems/
- NASA Classroom Content and Lesson Plans https://www.nasa.gov/langley/education/classroom
- NGSS HUB- https://ngss.nsta.org/Classroom-Resources.aspx
- Earth Science Week: Classroom Activities, categorized by the Next Generation Science Standards https://www.earthsciweek.org/classroom-activities/ngss
- California Academy of Sciences https://www.calacademy.org/educators/science-lesson-plans-for-high-school
- Activelylearn.com

Accommodations and Modifications

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

STANDARDS for Learning Targets		
NJSLS	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSL8)**
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.	**ELA** RI.CR.11–12.1. Accurately cite a range of thorough textual evidence and make relevant connections to strongly support a comprehensive analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text.	**CTE** 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data. 9.3.ST-ET.2 Display and

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HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

HS-ESS3-3. Create a computational simulation to illustrate the relationships among the management of natural resources,
the sustainability of human populations, and biodiversity.

HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

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's systems.

HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and

RI.MF.11–12.6. Synthesize complex information across multiple sources and formats to develop ideas, resolve conflicting information, or develop an interpretation that goes beyond explicit text information (e.g., express a personal point of view, new interpretation of the concept).

W.IW.11–12.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

W.WR.11–12.5. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

W.WR.11–12.5. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Mathematics
MP.2 Reason abstractly and quantitatively.

MP.4 Model with mathematics.

N.Q A. Reason quantitatively and use units to solve problems

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

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

communicate STEM information

Technology
8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.

8.1.12.A.5 Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.

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aesthetics, as well as possible social, cultural, and environmental impacts.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Sample Measurable Objectives for Lesson Planning

- Identify the three ways that solar radiation is transferred as it enters Earth's atmosphere
- Describe the greenhouse effect
- Cite evidence for anthropogenic global warming
- Explain three methods used to study climate change
- Use a model to describe the cycling of carbon among Earth's four spheres
- Identify the role of Earth's carbon sinks, especially forests, in regulating climate
- Describe the role that positive and negative feedback loops altered by climate change have on sea level rise
- Describe the role that positive and negative feedback loops altered by climate change have on weather patterns and extreme weather events
- Describe the impact that the increase in global temperature has on food production
- Identify the costs and benefits of using fossil fuels as our main energy source
- Describe three ways that we can eliminate the need for fossil fuels in the generation of electricity
- Identify the costs and benefits of using nuclear power for the generation of electricity
- Identify the costs and benefits of using hydroelectric power for the generation of electricity
- Identify the costs and benefits of using geothermal power for the generation of electricity
- Identify the costs and benefits of using wind power for the generation of electricity
- Identify the costs and benefits of using solar power for the generation of electricity
- Identify the costs and benefits of using biomass for the generation of electricity
- Evaluate available modes of transportation based on advantages and disadvantages
- Define what a mineral is and describe uses for mineral resources such as lithium
- Describe different methods that are used for mining such as hydraulic fracturing
- Explain how metals are processed
- Describe the negative impacts of mining on the environment and society
- Evaluate the costs and benefits of mining in light of regulation
- Describe ways that mineral extraction and use can become more responsible

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Unit 3 Summary: Water Resources

This unit will explore the impact of human activity on the Earth's water resources. The unit will begin with a discussion about the importance of the Earth's freshwater resources. The focus will start off on how much of the Earth's water is usable fresh water as opposed to salt water and where usable water can be found. Students will explore how water travels through a watershed and how it is stored as groundwater in aquifers. Although humans are not always conscious of it, our everyday activities have major effects on our freshwater resources. Freshwater resources are not distributed evenly through space or time. They are often used faster than groundwater stores can be replenished. Many areas around the globe are experiencing water shortages. Climate forecasts are predicting that this problem will continue. Conservation practices and new technologies are necessary for adapting to the global water crisis.

Water quality is a concern in addition to the amount of the water supply. The focus of the unit will shift to examine water pollution, most notably its sources and its effects on both freshwater resources and marine ecosystems. The unit will culminate with a discussion about regulating activities that affect water resources and treating water. The crises facing municipal water supplies will also be addressed.

Essential Questions:

If the Earth has so much water, why do we need to conserve it?
What human activities have the biggest impact on water loss?
How does water pollution affect humans and ecosystems?
How will climate change affect water resources?

Vocabulary/Key Terms

Tier 2	Tier 3
Water, pollution, runoff, fresh, liquid, personal, recreational, domestic, salt water, freshwater, evenly, unevenably, sustainably, overuse, pores, pump, well	Point source, nonpoint source, toxic, nutrient, bacterial, sediment, groundwater, surface water, industrial, agricultural, aquifer, recharge, desalination, permeable, impermeable

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Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)
Test on Water Resources

Minor Assessments: Quizzes (20%)
Teachers generated quizzes will be used to assess for deeper or more specific understanding

Labs/Projects (30%)
Lab work will involve data collection and analysis using traditional data collection methods and/or simulation based material. Example labs can be found linked to this document (more labs will be added to this folder as they are created).

- From Here to There Investigating Water Pollution
- Water Pollution Lab
- Arsenic Case Study
- NASA What is happening to the Aral Sea?
- NASA The Nile a sustainable resource?
- Tracking Pollution a Hazardous Whodunnit?
- My NASA Data Glacial Retreat
- Cultural Eutrophication Hands on Lab
- Coral Reefs 1- Abiotic Factors Gizmo
- Ocean Acidification Hands On Lab

Practice (Homework/Classwork =10 %)
Practice assignments will include small group activities, literacy activities, teacher generated worksheets, ed-puzzles, and writing assignments. . Examples of activities can be found linked to this document (more activities will be added to this folder as they are created.)

Schuylkyll Punch Literacy Activity
Textbook 14.1 Worksheet
California Water Crisis Questions/ (Slide Presentation with Video Links)
Population Growth, Climate Change Sparking Water Crisis Article with questions
Textbook 14.2 Uses of Freshwater Worksheet
Textbook 14.3 Water Pollution Worksheet
Water Pollution Gizmo

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Formative Assessments:
Classwork will involve questioning techniques utilizing a variety of strategies.

Resources

https://marinedebris.noaa.gov/who-we-are
Textbook: Pearson Environmental Science Your World Your Turn (Chapter 14)
Gizmos- https://gizmos.explorelearning.com/
High Adventure Science- https://learn.concord.org/has
Legends of Learning Games - https://www.legendsoflearning.com/learning-objectives/biodiversity-and-health-of-ecosystems/
NASA Classroom Content and Lesson Plans https://www.nasa.gov/langley/education/classroom
NGSS HUB- https://ngss.nsta.org/Classroom-Resources.aspx
Earth Science Week: Classroom Activities, categorized by the Next Generation Science Standards
https://www.earthsciweek.org/classroom-activities/ngss
California Academy of Sciences https://www.calacademy.org/educators/science-lesson-plans-for-high-school
Activelylearn.com

Accommodations and Modifications

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

STANDARDS for Learning Targets		
NJSLS	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSL8)**
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.	**ELA** RI.CT.11–12.8. Analyze and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) documents of historical and scientific significance for their purposes, including primary source documents relevant to U.S. and/or global history and texts proposing scientific or technical advancements. RI.MF.11–12.6. Synthesize complex information across multiple sources and formats to develop ideas, resolve conflicting information, or develop an interpretation that goes	**CTE** 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data. 9.3.ST-ET.2 Display and communicate STEM information **Technology**

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HS-ESS3-3. Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-ESS3-6 Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

beyond explicit text information (e.g., express a personal point of view, new interpretation of the concept).

SL.II.11–12.2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

W.IW.11–12.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

W.WR.11–12.5. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

W.WR.11–12.5. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Mathematics

MP.2 Reason abstractly and quantitatively.

MP.4 Model with mathematics.

N.Q A. Reason quantitatively and use units to solve problems

N.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.

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

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

8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.

8.1.12.A.5 Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.

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Sample Measurable Objectives for Lesson Planning
• Explain how fresh water can be both renewable and limited • Describe the freshwater resources available to humans • Explain major causes and effects of surface water depletion • Explain the major causes and effects of groundwater depletion • Describe the effects that climate change will have on the future of water resources. • Describe solutions to groundwater depletion • Identify and describe the four main types of water pollution (biological, toxic, sediment and nutrient) • Distinguish between point source and nonpoint source pollution • Discuss methods to manage groundwater pollution • Evaluate methods to regulate and treat water resources • Describe marine debris and its impact on ocean ecosystems • Discuss ways to prevent and treat ocean pollution • Describe the effect of ocean acidification on marine ecosystems

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Unit 4 Summary: Biodiversity

Biodiversity considers the variety of life on Earth. It is important to understand biodiversity at different levels of biological organization for practical and ethical reasons. We can measure and protect biodiversity at the genetic, species, and ecosystem level to manage the variety and distribution of living things in ways that benefit and sustain the environment itself as well as human activities. By maintaining biodiversity, we can discover and develop valuable products and services. The loss of biodiversity signals environmental problems both locally and globally. Often, human activity directly or indirectly leads to the loss of biodiversity. Different legal efforts have supported solutions that protect biodiversity. These approaches have social and economic consequences that need to be evaluated by all citizens before being implemented.

Essential Questions:

What is biodiversity?
Why is biodiversity important?
How do we quantify biodiversity?
Why is global biodiversity decreasing?
How can we protect and preserve biodiversity?
What effects will climate change have on living organisms and ecosystems?

Vocabulary/Key Terms

Tier 2	Tier 3
biodiversity, ecosystem, quantitative, species data, tourism, medicine, agriculture, research, mobile, sedentary, invasive species, extinction, endangered species, predators, habitat change, habitat loss, overfishing, populations, climate change, pollution, cloning, treaty	genetic diversity, ecosystem diversity, species diversity, richness, relative abundance, ecosystem services, quadrat, transect, mark and recapture, urbanization, fogging, background rate of extinction, poaching, habitat fragmentation, mass extinction, native species, conservation concession, debt-for-nature swap, wildlife corridor, endangered species act, hotspot mapping,

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Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests= 40%)

Test 1: Defining and Quantifying Biodiversity

Test 2: Biodiversity Loss and Protection

Minor Assessments: Quizzes (20%)

Teachers generated quizzes will be used to assess for deeper or more specific understanding

Labs/Projects (30%)

Lab work will involve data collection and analysis using traditional data collection methods and/or simulation based material. Example labs can be found linked to this document (more labs will be added to this folder as they are created).

- **Prairie Ecosystem Gizmo**
- Bean biodiversity
- Effects of habitat fragmentation on spider biodiversity (also doubles as a literacy activity)
- Bean Biodiversity 4 Sampling Methods (Hands on)
- Bean Biodiversity Quadrat Sampling (Hands on)
- Tagging Lab (Hands on)
- Daisy World
- Missing Songbirds
- Fishing Activity
- Bye Bye Birdie Endangered Species Project

Practice (Homework/Classwork =10 %)

Practice assignments will include small group activities, literacy activities, teacher generated worksheets, ed-puzzles, and writing assignments. . Examples of activities can be found linked to this document (more activities will be added to this folder as they are created.)

- Biodiversity at Risk Reading
- 6th Mass Extinction Literacy Activity
- Golden Lion Tamarin
- Wildlife Corridors literacy activity
- As Big Animals Poop Out literacy activity
- Combating Desertification (literacy activity potential)
- Loss of Biodiversity Ed-Puzzle

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- Habitat Fragmentation Ed-Puzzle
- Ecosystem Services Ed-Puzzle
- 7.1: Our Planet of Life Worksheet
- 7.2 Extinction and Biodiversity
- 7.3 Protecting Biodiversity
- Richness and Relative Abundance Practice
- Mass Extinction POGIL

Formative Assessments:
Classwork will involve questioning techniques utilizing a variety of strategies.

Resources

- NASA Earth Data- https://www.earthdata.nasa.gov/learn/pathfinders/biological-diversity-and-ecological-forecasting-data-pathfinder
- Textbook: Pearson Environmental Science Your World Your Turn (Sections 1.1, 4.3, 8.1, 8.2, 3.2-3.4,& 12.2)
- Gizmos- https://gizmos.explorelearning.com/
- High Adventure Science- https://learn.concord.org/has
- Legends of Learning Games - https://www.legendsoflearning.com/learning-objectives/biodiversity-and-health-of-ecosystems/
- NASA Classroom Content and Lesson Plans https://www.nasa.gov/langley/education/classroom
- NGSS HUB- https://ngss.nsta.org/Classroom-Resources.aspx
- Earth Science Week: Classroom Activities, categorized by the Next Generation Science Standards https://www.earthsciweek.org/classroom-activities/ngss
- California Academy of Sciences https://www.calacademy.org/educators/science-lesson-plans-for-high-school
- Activelylearn.com

Accommodations and Modifications

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

STANDARDS for Learning Targets

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Science Curriculum Map 2024

NJSLS	Cross curricular	CTE(NJSLS 9) Technology(NJSL8)
HS-ESS3-3. Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity. HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. HS-ESS3-6 Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and	**ELA** RI.CR.11–12.1. Accurately cite a range of thorough textual evidence and make relevant connections to strongly support a comprehensive analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. RI.MF.11–12.6. Synthesize complex information across multiple sources and formats to develop ideas, resolve conflicting information, or develop an interpretation that goes beyond explicit text information (e.g., express a personal point of view, new interpretation of the concept). RI.MF.11–12.6. Synthesize complex information across multiple sources and formats to develop ideas, resolve conflicting information, or develop an interpretation that goes beyond explicit text information (e.g., express a personal point of view, new interpretation of the concept). SL.II.11–12.2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. W.WR.11–12.5. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. **Mathematics** MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. N.Q A. Reason quantitatively and use units to solve problems N.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. N.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. N.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	**CTE** 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data. 9.3.ST-ET.2 Display and communicate STEM information **Technology** 8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results. 8.1.12.A.5 Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.

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aesthetics as well as possible social,
cultural, and environmental impacts.

Sample Measurable Objectives for Lesson Planning
• Define Biodiversity • Differentiate between genetic diversity, species diversity, and ecosystem diversity • Identify benefits of having high levels of biodiversity • Find the species richness in an ecosystem • Calculate the relative abundance of individual species in an ecosystem • Describe sampling methods used to estimate the species richness and relative abundance of species in an ecosystem • Identify the 6 biggest reasons for biodiversity loss around the globe • Define what an invasive species is and identify what can be done about them • Describe the relationship between overharvesting and technological advances • Explain why climate change is a contributing factor to loss of biodiversity around the globe • Describe strategies for maintaining biodiversity around the globe

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