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# JC Schools Environmental Science Yearly Standards

## Overarching Standards (Taught in all units)

### 9-12.ETS1.A.1

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

### 9-12.ETS1.A.2

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

### 9-12.ETS1.B.1

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.

### 9-12.ETS1.B.2

Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

### 9-12.ESS3.D.2

Predict how human activity affects the relationships between Earth systems in both positive and negative ways. [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere.]

### 9-12.LS2.C.2

Design, evaluate, and/or refine solutions that positively impact the environment and biodiversity. [Clarification Statement: Examples of solutions may include captive breeding programs, habitat restoration, pollution mitigation, energy conservation, agriculture and mining programs, and ecotourism.]

### 9-12.LS4.C.3

Create or revise a model to test a solution to mitigate adverse impacts of human activity on biodiversity. [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]

Unit	Priority Standards	Supporting Standards
<b>Unit 1</b>  Ecology Basics	<b>9-12.LS2.A.1</b> Explain how various biotic and abiotic factors affect the carrying capacity and biodiversity of an ecosystem using mathematical and/or computational representations. [Clarification Statement: Examples of biotic factors could include relationships among individuals (e.g., feeding relationships, symbioses, competition) and disease. Examples of abiotic factors could include climate and weather conditions, natural disasters, and availability of resources. Genetic diversity includes within a population and species within an ecosystem. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered Interdependent from simulations or historical data sets.]	<b>9-12.LS2.B.3</b> Use a model that illustrates the roles of photosynthesis, cellular respiration, decomposition, and combustion to explain the cycling of carbon in its various forms among the biosphere, atmosphere, hydrosphere, and geosphere. [Clarification Statement: The primary forms of carbon include carbon dioxide, hydrocarbons, waste, and biomass. Examples of models could include simulations and mathematical and conceptual models.]  <b>9-12.LS2.C.1</b> Evaluate the claims, evidence, and reasoning that the interactions in ecosystems maintain relatively consistent populations of species while conditions remain stable, but changing conditions may result in new ecosystem dynamics. [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.]
<b>Unit 2</b>  Population Ecology	<b>9-12.LS4.C.2</b> 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. [Clarification statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, and application of fertilizers, droughts, floods, and the rate of change of the environment affect distribution or disappearance of traits in species.]	<b>9-12.ESS2.D.1</b> Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. [Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.]  <b>9-12.ESS3.C.1</b> Create a computational simulation to illustrate the

		<p>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.]</p> <p><b>9-12.ESS3.D.1</b> Analyze geoscientific 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).]</p> <p><b>9-12.ESS3.C.2</b> Evaluate or refine a technological solution that reduces impacts of human activities on natural systems in order to restore stability and or biodiversity of the ecosystem as well as prevent their reoccurrences. [Clarification Statement: Examples of human activities could include forest fires, acid rain, flooding, urban development, pollution, deforestation, and introduction of an invasive species.]</p>
<p><b>Unit 3</b></p> <p>Environmental Disturbances</p>	<p><b>9-12.ESS3.C.2</b> Evaluate or refine a technological solution that reduces impacts of human activities on natural systems in order to restore stability and or biodiversity of the ecosystem as well as prevent their reoccurrences. [Clarification Statement: Examples of human activities could include forest fires,</p>	<p><b>9-12.LS2.C.1</b> Evaluate the claims, evidence, and reasoning that the interactions in ecosystems maintain relatively consistent populations of species while conditions remain stable, but changing conditions may result in new ecosystem dynamics. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological</p>

	acid rain, flooding, urban development, pollution, deforestation, and introduction of an invasive species.	or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]
<b>Unit 4</b>  Matter & the Environment	<b>9-12.LS2.B.2</b> Communicate the pattern of the cycling of matter and the flow of energy among trophic levels in an ecosystem. [Clarification Statement: Emphasis is on using a model of stored energy in biomass to describe the transfer of energy from one trophic level to another. Emphasis is on atoms and molecules as they move through an ecosystem.]	<b>9-12.ESS3.C.2</b> Evaluate or refine a technological solution that reduces impacts of human activities on natural systems in order to restore stability and or biodiversity of the ecosystem as well as prevent their reoccurrences. [Clarification Statement: Examples of human activities could include forest fires, acid rain, flooding, urban development, pollution, deforestation, and introduction of an invasive species.]  <b>9-12.ESS2.D.1</b> Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. [Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.]
<b>Unit 5</b>  Energy Resources	<b>9-12.ESS3.A.1</b> 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, 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. Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level,	<b>9-12.ESS3.C.1</b> 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.]

regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]

**9-12.ESS3.A.2**

Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on economic, social, and environmental 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 shale), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems — not what should happen.]