Environmental Science
Grades 11 - 12
Unit 2: Populations

New Jersey Student Learning Standards - Science

Established 2016-2017
Revised 2018-2019
Revised 2019-2020
Revised 2020-2021
Revised 2021-2022
Revised 2022-2023

Marking Period	Unit Title	Recommended Instructional Days
2	**Populations**	**30**

NJSLS - Science: ***TItle***	**NJSLS - Science:** ***Performance Expectations***	**Recommended Activities, Investigations, Interdisciplinary Connections, and/or Student Experiences to Explore NJSLS-S within Unit**
HS-LS2: Ecosystems: Interactions, Energy and Dynamics HS-ESS3: Earth and Human Activity	HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. HS-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-ESS3-2 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 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.	
FOUNDATION Disciplinary: ***Core Idea***	**FOUNDATION Disciplinary:** ***Statement***	
ESS3.A - Natural Resources	Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.	**Essential Question/s:** What are factors within an ecosystem that grow/ change a population? How do populations of organisms that interact in ecosystems both limit and assist growth of other organisms? How do economics and education change the demographics of a population? How have human populations changed ecosystems globally & locally? How does the impact of human populations on an ecosystem change based on the economies of the society?
ESS3.B - Natural Hazards	Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.	**Activity Description:** Classroom Density Students mark or rope off a corner of the room that is 2 meters on each side. Have 12 students stand within the area, and ask the class to calculate the density of the population of students. Continue each step with doubling the area and recalculating.
ESS3.C - Human Impacts on Earth Systems	Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.	**Activity Description:** *Predator Adaptations* Ask students to think about the various special adaptations that a predator might have. Start with the head, and ask students to name all possible features of a successful predator.
ETS1.B - Developing Possible Solutions	A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.	

	There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. Models of all kinds are important for testing solutions.	**Activity Description:** *Studying Population Growth* Students observe, record, and graph the decline of a population of yeast cells in an experimental environment. Predict the carrying capacity of an environment for a population. Infer the limiting resource of an environment. **Activity Description:** *Population Growth* Model the change in size of a population by applying the equation {Change in population size} = {Births} – {Deaths} Start with 5 representing the starting population or a species. Assume that each year 20% each have two offspring. Also assume 20% of the population dies each year. Continue this model for over 10years. Make a graph to represent the data.
LS2.A - Interdependent Relationships in Ecosystems	Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.	**Activity Description:** *How Will Our Population Grow* Students look at past growth trends in the US to calculate changes for a given population over a 50-year period. Predict which variable has a greater effect on population growth rates. **Activity Description:** *Fertility Rates and Female Literacy in Africa* Students use a fertility and Female literacy map of Africa to find a link.
LS2.C - Ecosystem Dynamics, Functioning, and Resilience	A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in	**Activity Description:** *Case Study: Predator – Prey Adaptations* Students study relationships in an ecosystem and interpret how these relationships help with survival.

	conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.	**Activity Description:** *Society and the Environment – Lost Populations: What Happened?* Students read an article about Easter Island and make connections between lost civilizations and the fragile dynamics of population survival. Students refine or design a technological solution that reduces the loss of populations.
LS2.D - Social Interactions and Group Behavior	Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.	**Activity Description:** *Calculating Generation Rate* Students - experiment on organism competition. (Blepharisma & Euplotes) Culture the specimen and predict the effects of competition on number differences between competing populations. Design an experiment to test the effects of competition on changing an environmental condition. Create a data table and graph of results. Extend the project – design multiple environments to test change on with the microorganisms.
FOUNDATION **Science and Engineering Practices:** ***Core Idea***	**FOUNDATION** **Science and Engineering Practices:** ***Statement***	**Activity Description:** Challenges for the People of the Future Students - Collect data on population trends from three countries. Identify the future environmental challenges for the people of those countries. Compare and contrast the data collected, projecting it towards the future. Write a three to four page report comparing and contrasting the social and environmental conditions that could be influencing the demography of your selected countries. Give suggestions for possible plans and how you think these can be implemented in the immediate future. Present your report to your classmates.
Using Mathematics and Computational Thinking	Create a computational model or simulation of a phenomenon, designed device, process, or system. Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations.	**Interdisciplinary Connections:** Content: ELA NJSLS#: RST 9-10.8/RST.11-12.1/12.2/12.7/12.8 / WHST.9-12.2/12.5/12.7 Content: Math NJSLS#: MP.2/MP.4/ HSN-Q.A.1/HSN-Q.A.2/HSN-Q.A.3/ HSS-ID.A.1/HSS-IC.A.1/B.6
Constructing Explanations and Designing Solutions	Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of	

	evidence, prioritized criteria, and tradeoff considerations.	
Engaging in Argument from Evidence	Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). Scientific argumentation is a mode of logical discourse used to clarify the strength of relationships between ideas and evidence that may result in revision of an explanation.	
Scientific Knowledge is Open to Revision in Light of New Evidence	Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence.	
FOUNDATION Crosscutting Concepts: ***Core Idea***	**FOUNDATION Crosscutting Concepts:** ***Statement***	
Cause and Effect	Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.	
Systems and System Models	When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs	

	analyzed and described using models.	
Stability and Change	Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. Feedback (negative or positive) can stabilize or destabilize a system.	
Scale, Proportion, and Quantity	The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale.	
Stability and Change	Much of science deals with constructing explanations of how things change and how they remain stable.	
Influence of Science, Engineering, and Technology on Society and the Natural World	Modern civilization depends on major technological systems. Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. New technologies can have deep impacts on society and the environment, including some that were not anticipated.	

Science is a Human Endeavor Science Addresses Questions About the Natural and Material World	Analysis of costs and benefits is a critical aspect of decisions about technology. Science is a result of human endeavors, imagination, and creativity. Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues.	
Social and Emotional Learning: ***Competencies***	**Social and Emotional Learning:** ***Sub-Competencies***	
Self-awareness Self-Management Social Awareness	Recognize one's feelings and thoughts and how they impact one's own behavior. Identify and apply ways to persevere. Recognize and identify the thoughts, feelings, and perspectives of others. Demonstrate an awareness of the differences among individuals, groups, and others' cultural backgrounds.	

Responsible Decision Making Relationship Skills	Demonstrate an understanding of the need for mutual respect when viewpoints differ. Demonstrate an awareness of the expectations for social interactions in a variety of settings. Develop, implement, and model effective problem-solving and critical thinking skills. Identify the consequences associated with one's actions in order to make constructive choices. Evaluate personal, ethical, safety, and civic impact of decisions. Establish and maintain healthy relationships.	

Assessments (Formative) ***To show evidence of meeting the standard/s, students will successfully engage within:***	**Assessments (Summative)** ***To show evidence of meeting the standard/s, students will successfully complete:***
<u>Formative Assessments:</u> ● Do Now questions ● Exit Polls ● Kahoot ● Current Event Essays	**<u>Benchmarks:</u>** ● District generated diagnostic test and four district assessments. **<u>Summative Assessments:</u>** ● Exams based on multiple choice, true/false, short answer responses ● Summative essays based on performance tasks ● Summative presentations

Differentiated Student Access to Content: Teaching and Learning *Resources/Materials*			
Core Resources	**Alternate Core Resources *IEP/504/At-Risk/ESL***	**ELL Core Resources**	**Gifted & Talented Core Resources**
• Holt Environmental Science • Basic Lab Equipment • Chromebooks • Newsela • Smartboard • biointeractive.org • nasa.gov • Crash Course video series • Kahoot	• modified tests • supplemental study guides	• modified tests • supplemental study guides • multilingual assignments • multilingual dictionary	• modified assignments • supplemental assignments
Supplemental Resources			
Technology: • Chromebooks • Smartboard Other: • NA			

Differentiated Student Access to Content: Recommended *Strategies & Techniques*			
Core Resources	**Alternate Core Resources *IEP/504/At-Risk/ESL***	**ELL Core Resources**	**Gifted & Talented Core**
• Holt Environmental Science • Basic Lab Equipment • Chromebooks • Smartboard • biointeractive.org • nasa.gov	• Utilize a multi-sensory (VAKT) approach during instruction, provide alternate presentations of skills by varying the method (repetition, simple explanations, additional examples,	• Extend time requirements, preferred seating, positive reinforcement, check often for understanding/review, oral/visual directions/prompts when necessary, supplemental materials including use of an	• Create an enhanced set of introductory activities, integrate active teaching/learning opportunities, incorporate authentic components, propose interest-based extension activities, and

	modeling, etc.), modify test content and/or format, allow students to retake tests for additional credit, provide additional times and preferential seating as needed, review, restate and repeat directions, provide study guides, and/or break assignments into segments of shorter tasks	online bilingual dictionary, and modified assessment and/or rubric.	connect students to related talent development opportunities.

New Jersey Legislative Statutes and Administrative Code (place an "X" before each law/statute if/when present within the curriculum map)									
	Amistad Law: *N.J.S.A. 18A 52:16A-88*		Holocaust Law: *N.J.S.A. 18A:35-28*		LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35*		Standards in Action: *Climate Change*		Diversity and Inclusion *N.J.S.A. 18A:35-4.36a*