Unit 5: Human Sustainability and Populations

Content Area: **Science**
Course(s): **Environmental Science**
Time Period: **4th Marking Period**
Length: **10 Weeks**
Status: **Published**

Unit Overview

Living organisms have the capacity to produce populations of infinite size, but resources and environments are finite. Populations grow or decline through the combined effects of births and deaths and are affected by various factors, including: birth and death rates, fertility, affluence and education. Humans have a major effect on other species, thereby affecting the biodiversity that is a result of 3.5 billion years of evolution. How humans use resources such as land for agriculture affects whether human sustainability can be maintained.

Transfer

Identify how changes in populations causes stress on the environment.

Predict what will happen if the human population continues to rise.

Develop strategies that would limit populations and decrease stress on the worlds resources.

Investigate how biodiversity on earth is affected by humans and what the repercussions could be as a result of decreasing biodiversity.

Identify ways in which humans use land and identify consequences of each.

Investigate how changes in agriculture have changed the development of food production around the world.

Develop a strategy to solve starvation in developing countries.

Identify problems with Genetic Modification in livestock and crops.

For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

Students will understand that...

-What specifically do you want students to understand?

-What inferences should they make/grasp/realize?

Develop an understandning that ecosystems and species are dependant on interactions within their environment, including humans.

All populations can be increased or decreased as a result of environmental factors such as disease, resource limitations and natural disturbances.

Interactions between species can be categorized based the benefit or harm that one species causes another.

Human population growth has expanded due to improvements in living conditions and crop production.

When growing populations use resources faster than they can be renewed, the most critically used are fuelwood, water and arable land.

Some countries asttempt to reduce birth rates directly through advertising, family planning prgrams, economic incentives or legal punishments for their citizens.

Humanity both benefits and cannot do without biodiversity.

Loss of biodiversity is one of the greatest challenges in environmental science today.

Certain parts of the world contain greater diversity than others.

Major conservation efforts involve protecting entire ecosystems instead of siopen sapcengle species.

The Endgangered Species Act protects endangered and threatened species in the United States.

Urband areas contain cities while rural areas are primarily open land.

Urbanization is the migration of people from rural areas to urban areas.

Land-use planning is essential if urban areas are to be pleasant areas to live.

Farmland is for crops, rangeland for grazing animals and wilderness is untouched open space.

Grains and seeds compose the largest food production worldwide.

More food is needed each year to support the worlds growing population.

Genetic engineering is the process of transferring genes from one organism to another. Plants and animal products that have been geteically enhanced are considered GM or Genetically Modified products.

Aquaculture is the raising of aquatic animals and provides 25% of the worlds food resources.

Essential Questions

Students will keep considering...

-What thought provoking questions will foster inquiry, meaning making and transfer?

How are populations dependant on the changes and pressures in the environment?

Why are carrying capacities different for each species?

How can a species change its niche?

Why is the balance in species relationships important?

How is the human population changing currently and what affects this rate?

Why do countries around the world have differing growth rates?

Why is biodiversity important to the continuation of the human species?

How can a single species be critical to the continuing habitat they reside in?

What kind of areas around the world contain the highest levels of biodiversity?

How does the Endangered Species Act protect ecosystems and the species within them?

Why does it matter how humans use land?

Why are ecosystem services important to the continuation of not only the human species but species worldwide?

How does urbanization affect infrastructure?

In what ways can deforestation have negative effects on the environment?

What is the connection between poverty and malnutrition?

how does soil conservation provide a greater amount of fertile soil?

How is genetic engineering used in crops?

Are GM products good or bad for organisms and the environment in which they live?

How does fighting pests chemically cause future issues?

Application of Knowledge and Skill

Students will know...

Students will know...

What facts and basic concepts should students know and be able to recall?

Each population has specific properties like density, size and dispersion.

When a population has few limits on its growth , it may undergo exponential growth.

Carrying capacity is the maximum population a habitat can support over a long period of time.

A population that grows rapidly may be subject to density dependent regulation.

The niche of an organism is its role in the environment.

Competition between species happens when niches overlap.

pairs of species in close relationships often evolve adaptations that either increase the benefit or reduce the harm from the relationship.

Human growth has accelerated in the last few centuries due to improvements in food production, better medicines and more sanitary conditions.

age structure, demographics and survivorship curves are used to predict population trends.

Difference between developed and developing countries.

How infrastructure is affected by urbanization.

Use of arable land.

Biodiversity refers to the number of different species in a given area.

Humanity benefits from biodiversity.

Some species are so critical to an ecosystem that the loss of the organism collapses the entire ecosystem and food chain.

Endangered and threatened species are the result of poaching, unregulated hunting and the introduction of nonnative species.

Conservation is targeted towards protecting entire ecosystems instead of single species.

The Endangered Species Act establishes protections for threatened and endangered species.

Land is covered with forest, farm fields and pastures, roads and towns.

Unplanned growth of cities result in Urban sprawl and the stressing of the infrastructure.

Farmland is for crops and rangeland for grazing animals.

National lands are used for many purposes including lumber, mining, and recreation.

Wilderness is national land that is protected from all exploitation for the benefit of future generations.

The foods produced in the greatest amounts worldwide are grains and seeds.

The green revolution introduced new crop varieties with increased yields through the application of modern agricultural techniques.

Genetic engineering is the process of transferring genes from one organism to another.

Overharvesting has reduced the populations of many aquatic organisms worldwide.

Students will be skilled at...

Students will be skilled at...

What discrete skills and processes should students be able to use?

Identifying relationships.

Analyzing positive and negative consequences of symbiotic relationships.

Calculate growth rate and reproductive potential.

Use maps and survivorship curves to predcit population trends.

Analyze and use demographics to develop an idea about an area.

Compare and contrast developed and developing countries.

Identify Keystone species.

Build an organizer for ecotourism.

Compare and contrast threatened and endangered species.

Investigate land-use planning.

Make a correlation between poverty and malnutrition.

Investigate GM< products, both negative and positive consequences of the practice.

Academic Vocabulary

Population

Density

Dispersion

Growth rate

Reproductive potential

Exponential growth

Carrying capacity

Niche

Competition

Predation

Parasitism

Mutualism

Commensalism

Symbiosis

Demography

Age structure

Survivorship

Fertility rate

Migration

Life expectancy

Demographic transition

Infrastructure

Arable land

Urbanization

Least developed Countries

Biodiversity

Gene

Keystone species

Ecotourism

Endangered species

Threatened species

Exotic species

Poaching

Endemic species

Germ plasm

Endangered Species Act

Habitat conservation plan

Biodiversity treaty

Urban

Rural

Ecosystem services

Urbanization

Infrastructure

Urban sprawl

Heat island

Land-use planning

Geographic Information System (GIS)

Overgrazing

Deforestatioon

Reforestation

Wilderness

Famine

Malnutrition

Diet

Yield

Arable land

Topsoil

Erosion

Desertification

Compost

Salinization

Pesticide

Biological pest control

Genetic engineering

Domesticated

Overharvesting

Aquaculture

Livestock

Ruminant

Learning Goal 1

Populations increase or decrease in response to their environment.

SCI.HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
SCI.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.
SCI.HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
SCI.HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Target 1

SWBAT describe the 3 main properties of populations and explain how population sizes in nature are regulated by reproductive behaviors.

Target 2

SWBAT Explain the difference between Niche and Habitat and describe the 5 major types of interactions between species.

Learning Goal 2

Basic concepts of population ecology, extending into the more complicated human context. Predicting patterns in population growth can be seen in the economic and political development of different countries.

SCI.HS-ESS3-3	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
SCI.HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
SCI.HS-LS2-8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
SCI.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.
SCI.HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
SCI.HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

Target 1

SWBAT describe how the size and growth rate of the human population has changed in the last 200 years and describe 4 properties that scientists use to predict population size.

Target 2

SWBAT make predictions about population trends based on age structure. Describe the 4 stages of the demographic transition and explain why different countries may be at different stages of the demographic transition.

Target 3

SWBAT describe problems caused by rapid population growth and analyze strategies countries use to reduce their population growth.

Learning Goal 3

The diverse life on Earth provides humans with a variety of crops, medicines and recreational experiences. Human activities threaten many species with extinction, but people around the world are working to protect biodiversity.

SCI.HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
SCI.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.
SCI.HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
SCI.HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Target 1

SWBAT describe the diversity of species types on Earth, relating the difference between known numbers and estimated numbers. Explain four ways in which biodiversity is important to ecosystems and humans and the importance of keystone species.

Target 2

SWBAT define and give examples of engangered and threatened species, explain different types of threats and list areas of the world that have high levels of biodiversity and many threats to species.

Target 3

SWBAT List and describe four types of efforts to save individual species and explain the advantages of protecting entire ecosystems rather than individual species. The main provisions of the Endangered Species Act and describe 3 examples of worldwide efforts to prevent extinctions.

Learning Goal 4

Humans use land for many purposes, including farmland to grow crops, rangeland to feed livestock, forest land for wood, cities to live and conduct business, and parks for for recreational enjoyment. Understanding these uses and implications can make us better stewards of our environment.

SCI.HS-ESS3-5	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
SCI.HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
SCI.HS-LS2-8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
SCI.HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
SCI.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.
SCI.HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
SCI.HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

Target 1

SWBAT distinguish between urband and rural land and describe 3 major ways in which humans use land and ecosystem services.

Target 2

SWBAT describe the urban crisis and urban sprawl. Explain how scientists use the Geogrpahic Information SYstem (GIS) as a tool for land-use planning.

Target 3

SWBAT explain the benefits of preserving farmland and managing rangeland sustainably. Describe the effects of deforestation on habitats and ecosystems.

Learning Goal 5

Food production, maintenance of soil productivity, and the challenges of feeding the world including various

alternative methods of planting and harvesting crops, controlling pests and raising livestock.

SCI.HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
SCI.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.
SCI.HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

Target 1

SWBAT identify the major causes of malnutrition, poverty and the importance of the green revolution.

Target 2

SWBAT distinguish between traditional and modern farming techniques, the importance of fertile soil conservation and exaplin what is involved in integrated pest management and genetic engineering.

Target 3

SWBAT explain the effects of overharvesting, the importance of aquaculture and livestock in providing food and other human used products.

Formative Assessment and Performance Opportunities

Class discussions

Paper and pencil tests

Science notebook

Student displays and presentations

Student experiments

Student worksheets

Summative Assessment

All assessments are differentiated and aligned to the science standards and curriculum. Alternate assessments may include projects or presentations, or a common paper/pencil assessment or both. Common Assessment is administered through LinkIt.

Accommodations/Modifications

- Include extra resources to include in student notebooks
- Partner students for support
- Provide access to Albert.io online resource specific to population dynamics

Unit Resources

- Environmental Science, Holt, Reinhart & Winston, 2008
- Interactive classroom and whiteboard activities
- Internet
- Supplemental textbooks, online textbook/Teacher resources
- Videos and online videos

21st Century Life and Careers

CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
CAEP.9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education.
CAEP.9.2.12.C.6	Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business.

Interdisciplinary Connections

MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.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.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
LA.RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
LA.RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
MA.S-IC.B.6	Evaluate reports based on data.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.11-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
LA.WHST.11-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.