03 Populations

Content Area: **Science**
Course(s): **AP Environment**
Time Period: **Semester 1**
Length: **2 weeks**
Status: **Published**

Standards

CCC.1	Patterns.
CCC.2	Cause and effect: Mechanism and explanation.
CCC.7	Stability and change.
SEP.4	Analyzing and Interpreting Data
SEP.5	Using Mathematics and Computational Thinking
HS.IRE	Interdependent Relationships in Ecosystems
HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
SEP.6	Constructing Explanations and Designing Solutions
HS-LS2-8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

Enduring Understandings

Populations change over time in reaction to a variety of factors.

Human populations change in reaction to a variety of factors, including social and cultural factors.

Humans alter natural systems. Humans have had an impact on the environment for millions of years. Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.

Essential Questions

How do changes in habitats influence changes in species over time?

How is educational opportunity for women connected to human population changes?

Knowledge and Skills

Topic 3.1 Generalist and Specialist Species

Knowledge

- Specialist species tend to be advantaged in habitats that remain constant, while generalist species tend to be advantaged in habitats that are changing.

Skills

- Explain environmental concepts and processes.

Topic 3.2 K-Selected r-Selected Species

Knowledge

- K-selected species tend to be large, have few offspring per reproduction event, live in stable environments, expend significant energy for each offspring, mature after many years of extended youth and parental care, have long life spans/life expectancy, and reproduce more than once in their lifetime. Competition for resources in K-selected species' habitats is usually relatively high.
- r-selected species tend to be small, have many offspring, expend or invest minimal energy for each offspring, mature early, have short life spans, and may reproduce only once in their lifetime. Competition for resources in r-selected species' habitats is typically relatively low.
- Biotic potential refers to the maximum reproductive rate of a population in ideal conditions**.**
- Many species have reproductive strategies that are not uniquely r-selected or K-selected, or they change in different conditions at different times.
- K-selected species are typically more adversely affected by invasive species than r-selected species, which are minimally affected by invasive species. Most invasive species are r-selected species.

Skills

- Describe patterns or trends in data.

Topic 3.3 Survivorship Curves

Knowledge

- A survivorship curve is a line that displays the relative survival rates of a cohort—a group of individuals of the same age—in a population, from birth to the maximum age reached by any one cohort member. There are Type I, Type II, and Type III curves.
- Survivorship curves differ for K-selected and r-selected species, with K-selected species typically following a Type I or Type II curve and r-selected species following a Type III curve.

Skills

- Explain patterns and trends in data to draw conclusions

Topic 3.4 Carrying Capacity

Knowledge

- When a population exceeds its carrying capacity (carrying capacity can be denoted as K), overshoot occurs. There are environmental impacts of population overshoot, including resource depletion.
- A major ecological effect of population overshoot is dieback of the population (often severe to catastrophic) because the lack of available resources leads to famine, disease, and/or conflict.

Skills

- Explain what the data implies or illustrates about environmental issues.

Topic 3.5 Population Growth and Resource Availability

Knowledge

- Population growth is limited by environmental factors, especially by the available resources and space.
- Resource availability and the total resource base are limited and finite over all scales of time.
- When the resources needed by a population for growth are abundant, population growth usually accelerates.
- When the resource base of a population shrinks, the increased potential for unequal distribution of resources will ultimately result in increased mortality, decreased fecundity, or both, resulting in population growth declining to, or below, carrying capacity.

Skills

- Apply appropriate mathematical relationships to solve a problem, with work shown (e.g., dimensional analysis).

Topic 3.6 Age Structure Diagrams

Knowledge

- Population growth rates can be interpreted from age structure diagrams by the shape of the structure.
- A rapidly growing population will, as a rule, have a higher proportion of younger people compared to stable or declining populations.

Skills

- Explain patterns and trends in data to draw conclusions.

Topic 3.7 Total Fertility Rate

Knowledge

- Total fertility rate (TFR) is affected by the age at which females have their first child, educational opportunities for females, access to family planning, and government acts and policies.
- If fertility rate is at replacement levels, a population is considered relatively stable.
- Factors associated with infant mortality rates include whether mothers have access to good healthcare and nutrition. Changes in these factors can lead to changes in infant mortality rates over time.

Skills

- Describe patterns or trends in data.

Topic 3.8 Human Population Dynamics

Knowledge

- Birth rates, infant mortality rates, and overall death rates, access to family planning, access to good nutrition, access to education, and postponement of marriage all affect whether a human population is growing or declining.
- Factors limiting global human population include the Earth's carrying capacity and the basic factors that limit human population growth as set forth by Malthusian theory.
- Population growth can be affected by both density-independent factors, such as major storms, fires, heat waves, or droughts, and density-dependent factors, such as access to clean water and air, food availability, disease transmission, or territory size.
- The rule of 70 states that dividing the number 70 by the percentage population growth rate approximates the population's doubling time.

Skills

- Describe environmental problems.

Topic 3.9 Demographic Transition

Knowledge

- The demographic transition refers to the transition from high to lower birth and death rates in a country or region as development occurs and that country moves from a preindustrial to an industrialized economic system. This transition is typically demonstrated through a four-stage demographic transition model (DTM).
- Characteristics of developing countries include higher infant mortality rates and more children in the workforce than developed countries.

Skills

- Explain environmental concepts, processes, or models in applied contexts.

Make connections to other units by considering:

Populations change over time in reaction to a variety of factors. Human populations change in reaction to a variety of factors, including social and cultural factors.

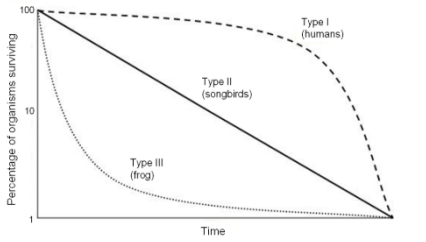
Key vocabulary you need to know

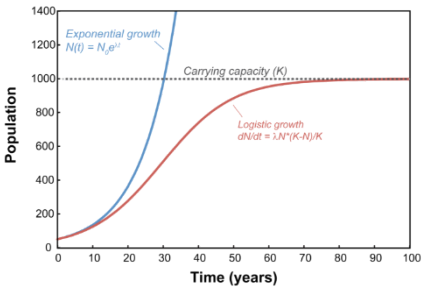
Fragmentation	K-selected species	Population
Endangered species	r-selected species	Population Density
Poaching	biotic potential,	Growth rate
Domestication	reproductive strategy	Immigration
Invasive species	survivorship curve	Emmigration
Zero Population Growth	carrying capacity	Biotic Potential

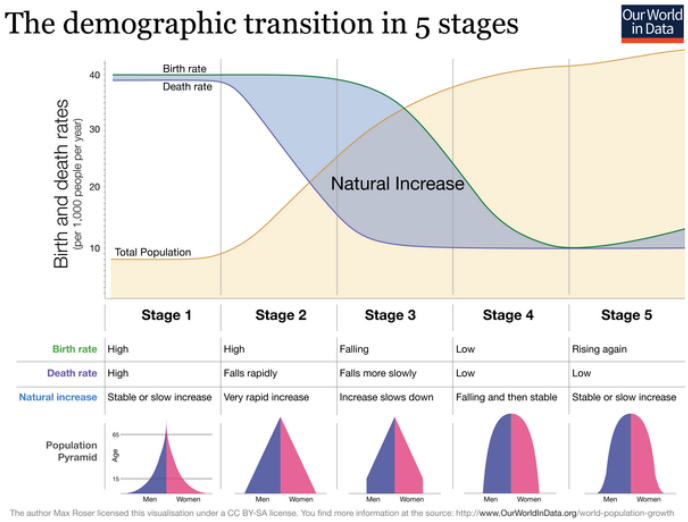
Migration	Cohort	Exponential Growth
Developed Country	birth rate	Logistic Growth
Developing Country	death rate	Limiting Factor
Moderately Developed Country	density-independent factor	Survivorship: Type I, Type II, Type III
Infant Mortality Rates (IMR)	density-dependent factor	Population Growth Momentum
Replacement Level Fertility (RLF)	rule of 70	Age Structure diagram
Total Fertility Rate (TFR)		Doubling Time
Demographic Transition		

Figures/ Equations to know

- (births+immigration)-(deaths+emigration)/total population x 100= PGR
- (CBR-CDR)/10 = PGR
- 70/PGR= doubling time
- per capita = population measurement/population size







Transfer Goals

Apply the patterns of population growth to issues like sustainability and resource limitation.

Predict impacts from changes in population growth.

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=sharing

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing