



Biology - Unit 2 - Populations

Unit Focus

This unit introduces students to selective pressures that affect populations that are driven by relationships among different organisms and between organisms, and nonliving factors within the biosphere. Students will explore population dynamics influenced by limiting factors such as predator-prey relationships, climate, and availability of natural resources. Students will investigate what factors lead to a balanced, healthy ecosystem and, through a case study, learn about how ecosystems become unbalanced and the factors that cause this disruption.

Stage 1: Desired Results - Key Understandings

| Standard(s) | Transfer | |
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| <p>Next Generation Science <i>High School Life Sciences: 9 - 12</i></p> <ul style="list-style-type: none"> Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. <i>HS-LS2-1</i> Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. <i>HS-LS2-2</i> 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. <i>HS-LS2-6</i> Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. <i>HS-LS2-8</i> Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. <i>HS-LS4-3</i> | <p>T1 Make observations and ask questions to define a problem based on prior knowledge and curiosity that stimulates further exploration, analysis, and discovery. T2 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.</p> | |
| | Meaning | |
| | Understanding(s) | Essential Question(s) |
| <p>U1 Environments can change over time in response to natural and human pressures U2 Earth's temperature range is predictable, and maintained through a delicate balance of atmospheric gases and water vapor that help regulate heat flow U3 The amount of available resources and limiting factors affects the growth of a population U4 The combined effect of biotic and abiotic factors determine the overall productivity of an ecosystem U5 Adaptations and behaviors in response to environmental pressures that positively affect survival are more likely to be reproduced, and thus are more common in a population U6 Biodiversity in populations is regulated through the process of Natural Selection, which leads to organisms with anatomical, behavioral, and physiological adaptations that are well suited to survival and reproduction within a particular environment</p> | <p>Q1 Why do populations change over time? Q2 What makes an ecosystem dynamic? Q3 Why are organisms so adapted to specific environments?</p> | |

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| <ul style="list-style-type: none"> Construct an explanation based on evidence for how natural selection leads to adaptation of populations. <i>HS-LS4-4</i> 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. <i>HS-LS4-5</i> | Acquisition of Knowledge and Skill | |
| <p>Next Generation Science Standards (DCI) <i>Science: 9</i></p> <ul style="list-style-type: none"> 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. <i>LS2.9.A1</i> 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 conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. <i>LS2.9.C1</i> Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. <i>LS2.9.D1</i> Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the | Knowledge | Skill(s) |
| <p>K1 Population density are numbers of organisms of the same type per unit area of living space K2 Biological influences on organisms within an ecosystem are called biotic factors. These can include living (biotic), and nonliving (abiotic) K3 Populations do not exist in isolation. They interact with other populations competing for food and resources K4 Density dependent limiting factors are specific to a population's size, while density independent limiting factors can affect all populations in similar ways regardless of their population size K5 Environments can change independent of the organisms living within it through a process called ecological succession K6 Organisms introduced into non native environment are called invasive species, and can place unexpected pressures to how populations compete for resources K7 The ability of an individual organism in a population to survive and reproduce in its specific environment is called fitness, which depends on an organism's ability to adapt to changes in its environment K8 Factors that affect population size include the number of births, the number of deaths, and the number of individuals that immigrate or emigrate the population. K9 Under ideal conditions with unlimited resources, a population will grow exponentially K10 Vocabulary: biotic factor, abiotic factor, habitat, niche, competitive exclusion principle, predation, ecological succession, primary succession, secondary succession, pioneer species, population density, immigration, emigration, exponential growth, logistic growth, carrying capacity, limiting factor, density-dependent limiting factor, predator-prey relationship, density-independent limiting factor, demography, demographic transition, age-structure diagram</p> | <p>S1 Revise a model that predicts changes in populations when stable or unstable conditions are present. S2 Evaluate 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</p> | |

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| <p>variation and distribution of traits observed depends on both genetic and environmental factors. <i>LS3.9.B2</i></p> <ul style="list-style-type: none"> • The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. <i>LS4.9.B2</i> • Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. <i>LS4.9.C2</i> • Adaptation also means that the distribution of traits in a population can change when conditions change. <i>LS4.9.C3</i> • Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline-and sometimes the extinction-of some species. <i>LS4.9.C4</i> <p>Madison Public Schools Profile of a Graduate</p> <p><i>Critical Thinking</i></p> <ul style="list-style-type: none"> • Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2) <p><i>Collaboration/Communication</i></p> <ul style="list-style-type: none"> • Product Creation: Effectively use a medium to communicate important information. (POG.3.2) | | |
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