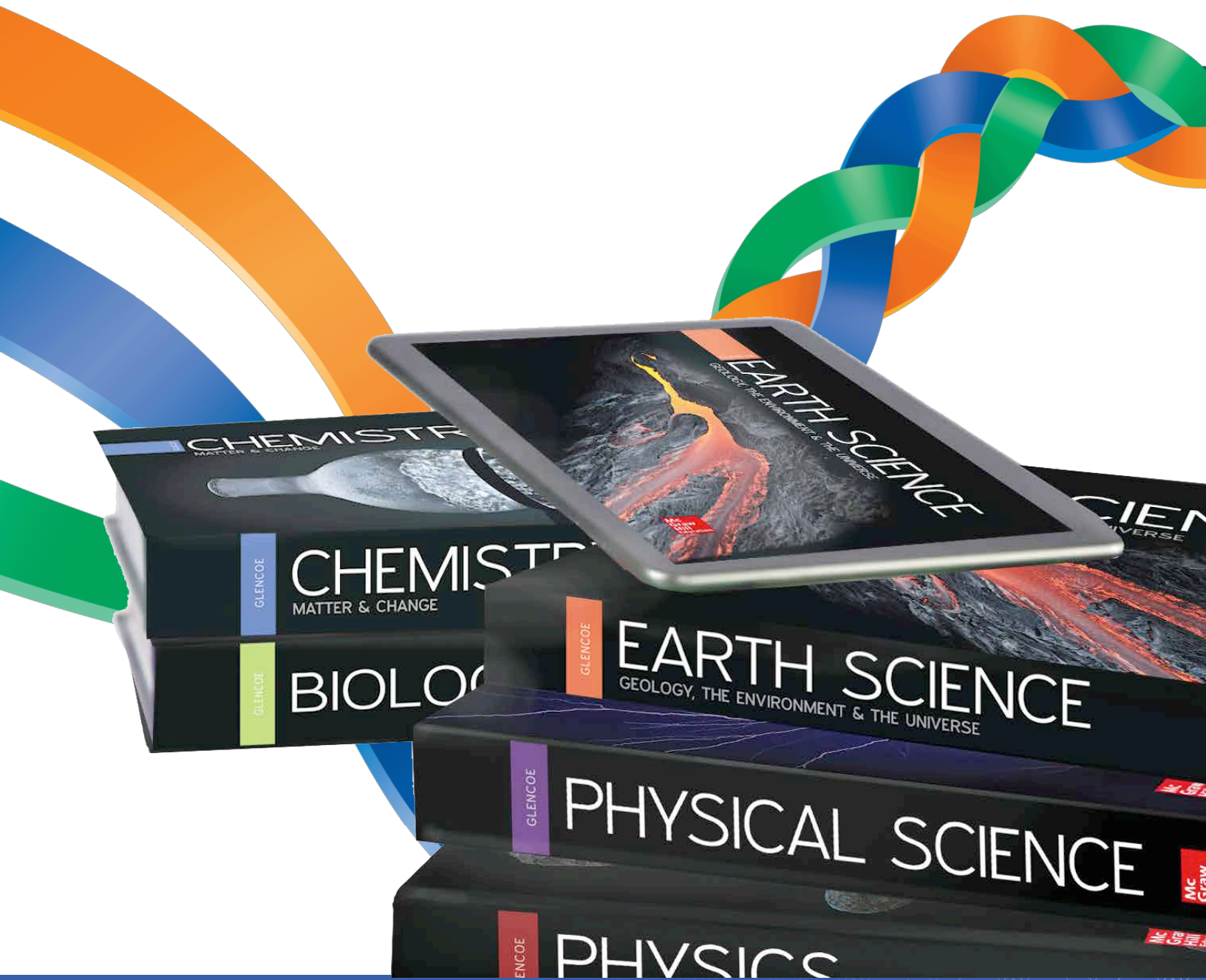
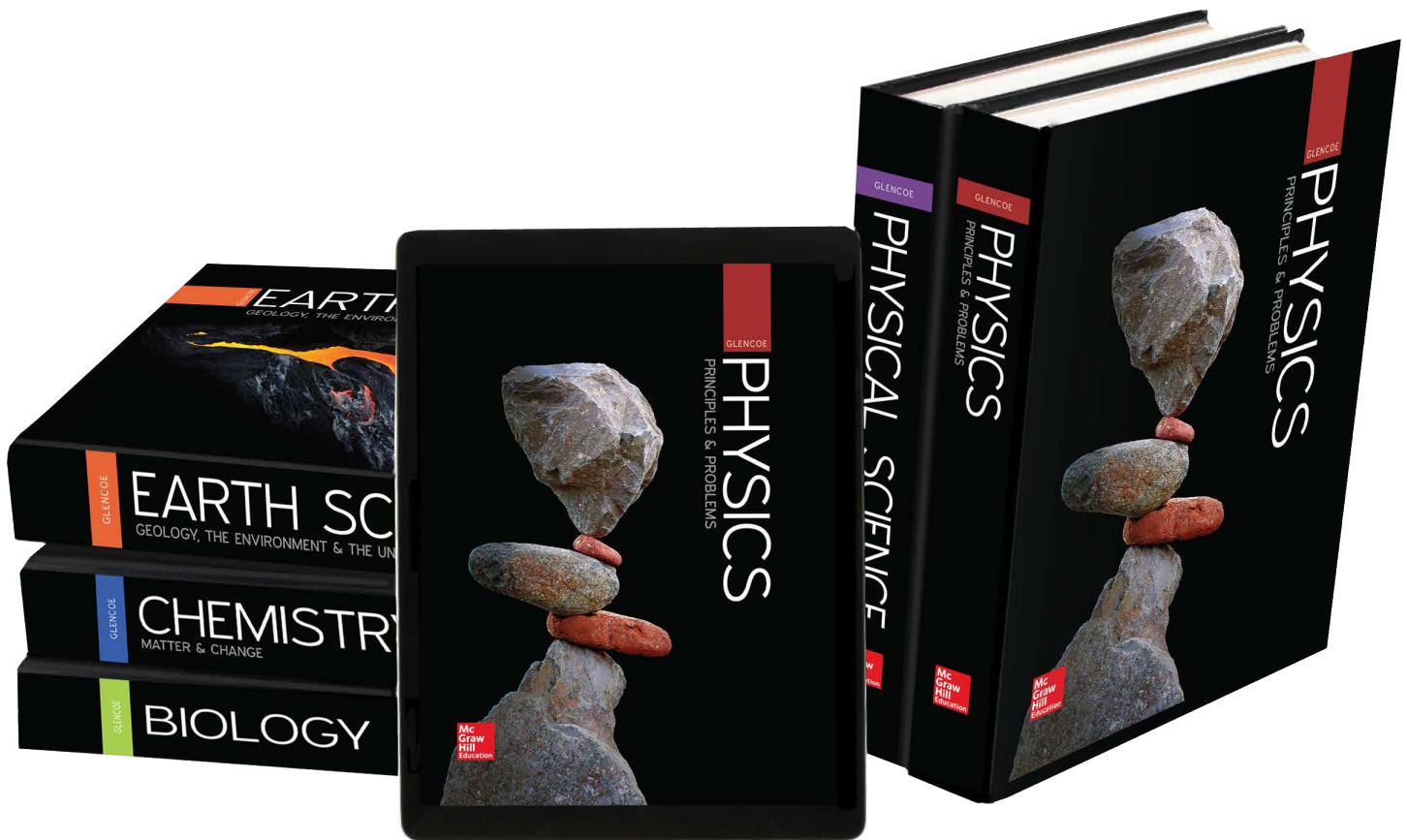




Three-Dimensional Learning Guide to High School Science



Three-Dimensional Learning Guide to High School Science



McGraw-Hill Education is your partner in delivering a balanced learning experience to meet the needs of your diverse 21st century classroom and students. This **Three-Dimensional Learning Guide** is your blueprint for a hands-on, student inquiry classroom to meet the new science standards.

This Guide will take you through the programs by highlighting how to implement **Inquiry** and **Student-led exploration**, disciplinary core ideas, crosscutting concepts, and science and engineering practices.

Each chapter starts with a visual phenomenon, online guiding questions in the Phenomenon Bank, and a Launch Lab to spark student inquiry. Multiple opportunities for Student Exploration and Investigation foster collaboration throughout each lesson. Formative assessment and student self-evaluation guide learning.

Look for these icons throughout this guide to show where to find the NGSS tools of the High School Programs.

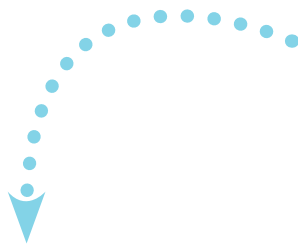


Science and Engineering Practices Handbook

The image illustrates the Science and Engineering Practices Handbook in both print and digital formats. On the left, a printed page shows the title 'Science and Engineering Practices Handbook' and a table of contents listing eight practices: 1. Asking questions, 2. Developing models, 3. Planning investigations, 4. Analyzing data, 5. Using mathematics, 6. Constructing explanations, 7. Engaging in argument, and 8. Obtaining, evaluating, and communicating information. The page is decorated with various scientific illustrations. In the center, a computer monitor displays the 'BIOLOGY TEACHER CENTER' website. The website features a search bar with the results for 'science and engineering', showing filters for 'All Resources' and 'Tools', and a resource card for the handbook. On the right, a tablet displays a 'Population Dynamics' activity from 'Bellringer 10'. The activity includes a photograph of a herd of cattle in a field and three questions: 1. 'If you wanted to describe the cattle as a population, what information would you need?', 2. 'If some cattle wandered off from the main body, would you consider them a part of the same population? Explain your answer.', and 3. 'If a larger group of new cattle were permanently introduced to the same location as this herd, would the newer animals be considered a part of the existing population? Explain your answer.'

The *Science and Engineering Practices Handbook*, found in the Student Center and Teacher Center online ConnectEd, introduces students to the skills they will use in science investigations and engineering projects. It explains the Crosscutting Concepts as well as the eight Science and Engineering Practices defined by *A Framework for K-12 Science Education*.

This useful tool eases the transition to the NGSS by providing definitions, examples, and Quick Practice activities to be used as reference while students develop their projects and meet performance expectations.



The **Big Idea** is the overarching concept for chapter. It helps provide the framework for understanding the details that follow. The **phenomenon photo** generates student interest, prompting them to ask their own questions. The **LaunchLab** provides a hands-on start to the inquiry process.

CHAPTER 4
Population Ecology

Launch Lab
A population of one?

Ecologists study populations of living things. They also study how populations interact with each other and with the abiotic factors in the environment. But what exactly is a population? Are the deer shown on these pages a population? Is a single deer a population?

FOLDABLES
Make a three-tab book using the labels shown. Use it to organize your notes on populations.

THEME FOCUS Stability and Change
Homeostasis within a population is controlled by density-dependent and density-independent limiting factors.

BIG Idea: Population growth is a critical factor in a species' ability to maintain homeostasis within its environment.

Section 1 • Population Dynamics
Section 2 • Human Population

90 Chapter 4 • Population Ecology



Start with the **Big Idea**, the hands-on **LaunchLab**, and an engaging phenomenon to spark student investigation and collaboration.

The **Reading Guide** supports student reading and literacy in science and technical subjects.

Section 1

Reading Preview

Essential Questions

- What are the characteristics of populations and how they are distributed?
- What are the differences between density-independent and density-dependent limiting factors?
- What are the similarities between the different models used to quantify the growth of a population?
- How does carrying capacity affect reproductive rates?

Review Vocabulary

population: The members of a single species that share the same geographic location at the same time.

New Vocabulary

population density
dispersion
density-independent factor
density-dependent factor
population growth rate
emigration
immigration
carrying capacity

Multilingual eGlossary

Population Dynamics

MAIN IDEA Populations of species are described by density, spatial distribution, and growth rate.

Real-World Reading Link Have you ever observed a bison or an ant farm? The population has certain characteristics that could be used to describe it. Ecologists study population characteristics that are used to describe all populations of organisms.

Population Characteristics

All species occur in groups called populations. There are certain characteristics that all populations have, such as population density, spatial distribution, and growth rate. These characteristics are used to classify all populations of organisms, including bacteria, animals, and plants.

Population density One characteristic of a population is its population density, which is the number of organisms per unit area. For example, the population density of cattle egrets, shown with the Cape buffalo in **Figure 4**, is greater near the buffalo than farther away. Near the Cape buffalo, there might be three birds per square meter. Fifty meters from the Cape buffalo, the density of birds might be zero.

Spatial distribution Another characteristic of a population is called dispersion—the pattern of spacing of a population within an area. **Figure 2** shows the three main types of dispersion—uniform, clumped groups, and random. Black bears are typically dispersed in a uniform arrangement. American lions are dispersed in clumped groups or herds. White-tailed deer are dispersed randomly with unpredictable spacing. One of the primary factors in the pattern of dispersion for all organisms is the availability of resources such as food.





Figure 4 The population density of the cattle egret is greater near the Cape buffalo. Suggest the type of dispersion you would expect these birds to have.

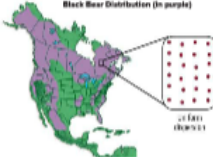
Visualizing Population Characteristics

Figure 2 Population density describes how many individual organisms live in a given area. Dispersion describes how the individuals are spaced within that area. Population range describes a species' distribution.

Black Bear




Dispersion: American black bear (black) usually are distributed uniformly within territories as large as several hundred square kilometers. Females have smaller territories. Full coverage (black) of range.



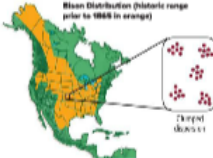
Black Bear Distribution (in purple)

Density: one bear per square hundred square kilometers

American Lion




Dispersion: American lions are found in clumped groups called herds.




Lion Distribution (historic range prior to 1988 in orange)

Density: four lions/km² in Northern Yellowstone in 2000

White-tailed Deer



Dispersion: White-tailed deer are dispersed randomly. They seek appropriate habitats.



White-tailed Deer Distribution (in blue)

Density: 10 deer/km² in some areas of the northeastern United States

Animation

Each section provides multiple opportunities for student exploration, investigation, and collaboration with:

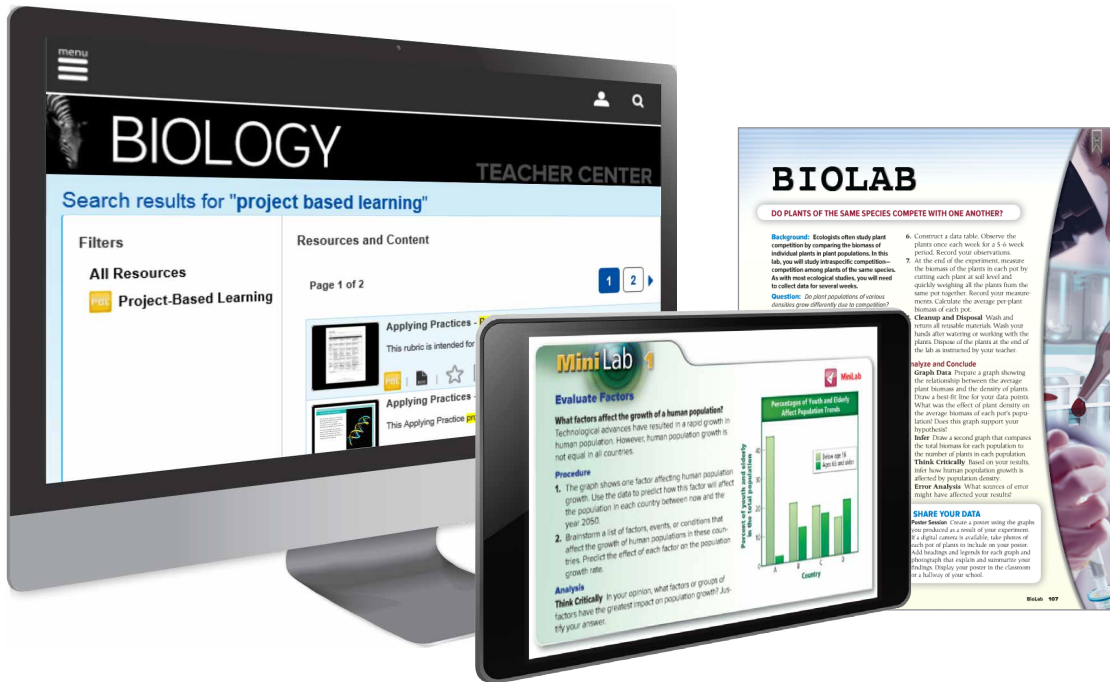
- PBLs
- Applying Practices
- WebQuests
- Mini Labs
- Labs
- Virtual Labs

Each section opener builds on the framework started by the Chapter Opener Big Idea with the Main Idea and Essential Questions. Reading begins with a link to the student's real-world or to prior knowledge.



Support three-dimensional learning with opportunities question, explore, gather evidence, conclude, and apply.

Student Investigation and Solution Design



Student exploration, investigation, and solution design options are throughout the Student Edition and the online Student Center and Teacher Center.

1. Project Based Learning
2. Applying Practices built on NGSS performance expectations
3. Labs and Mini Labs
4. Virtual Labs
5. Webquests
6. Research and writing activities on each chapter's feature
7. Document - based questions and data analysis activities

Investigation and Solution Design: PBL

Real-world student-led projects, such as the PBLs found online in ConnectED, engage students to apply three-dimensional learning. Project rubrics provide key information for assessing students' work.

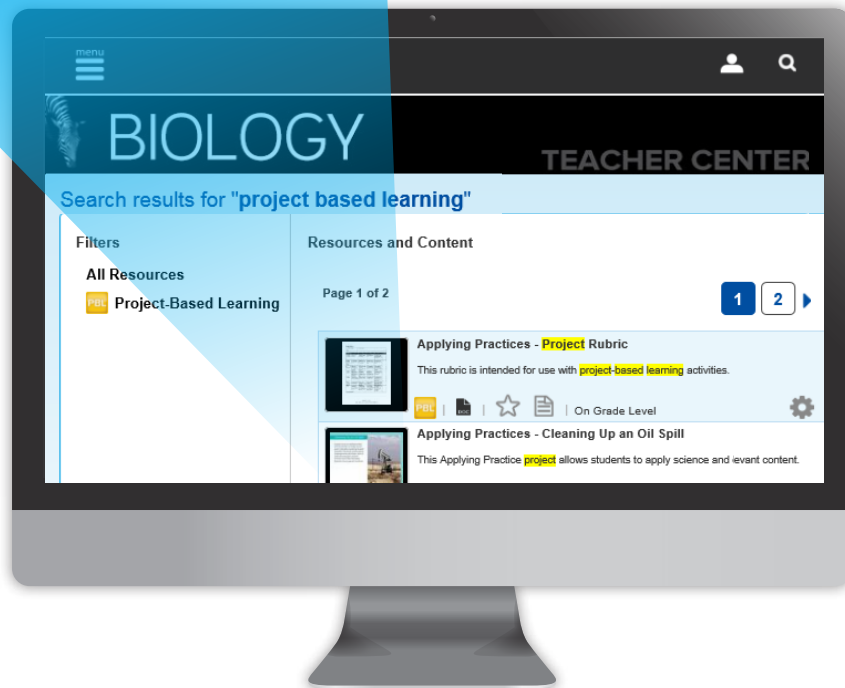
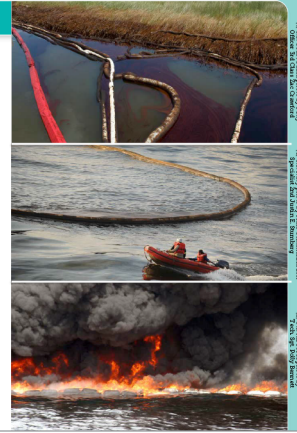
Cleaning Up an Oil Spill

A point source is pollution that can be traced to a single source and is typically caused by human activities. Factories, power plants, underground coal mines, and oil wells are examples of point sources since they discharge pollution from specific locations.



Cleaning Up an Oil Spill

Cleanup efforts for the Deepwater Horizon oil spill included controlled burns, containment booms, skimming, and pumping.



PBLs correlate to NGSS performance expectations and spark student inquiry and solutions design.

Investigation and Solution Design: Applying Practices

Name _____ Date _____ Class _____

APPLYING PRACTICES

Evaluating Impacts of Environmental Change on Populations

The Isthmus of Panama

Introduction

Anthropogenic is a term used to describe human and natural changes to the physical environment. Fertilizers, contribute to the expansion of some species, and the decline – and sometimes the extinction – experienced both natural and anthropogenic changes. Panama is currently a hot topic of debate among scientists.

The formation of the Isthmus of Panama created a barrier between South America – and a wall between the Pacific and Atlantic Oceans. The migration of land plants and animals between the two continents, and populations of marine organisms that once swam between the continents.

The year 2014 AD celebrated the centennial of the Panama Canal, a waterway constructed to help ships travel more easily between the Pacific Oceans. The canal cuts through the Isthmus, providing a shorter and safer trip around the southern tip of the continent. The canal also connected the Rio Chagres, providing an opportunity for once-isolated fish species to migrate and share the space as invasive species.

Task

Your task is to research how the natural formation of the Isthmus and the anthropogenic construction of the Panama Canal have impacted what impacts these changes had on populations of species. Examples of (1) increasing population size of a species and (2) decreasing population size of a species.

Once you have finished your research, you will create an interactive presentation to evaluate the claims of your peers regarding the argument that natural and anthropogenic changes can cause changes in populations of species.

Process

Use your resources to answer the following questions:

1. Would the separation caused by land formation have caused a gene pool over time? Make a claim and back it up with specific evidence.

Applying Practices • Evaluating Impacts of Environmental Change on Populations
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Name _____ Date _____ Class _____

Evaluating Impacts of Environmental Change on Populations *CONTINUED*

2. How might the migration of organisms have impacted land populations in terms of speciation? Make a claim and back it up with evidence.

3. What changes are currently being observed in the populations of the Rio Grande rivers? Make a claim and back it up with evidence.

Presentation: Socratic Seminar

Once you have completed your research, you will create an interactive presentation to use in response to the overall theme question: How have changes in the distribution or disappearance of species impacted the environment? Use the question to aid in preparing for your contribution to the discussion. Within a small group of your peers, to evaluate the claims of your peers, and to promote questioning.

"The aim [of a Socratic discussion] is a mutual search for an (enlarged) understanding of the ideas, issues and questions, not debate; there is no opponent save the peer who is to understand something that is both difficult and important."

The Socratic Seminar format that you will engage in because while one group is engaged in discussion to answer the question and backing those claims, the other group is sitting outside of the conversation observing, listening, and taking notes. After the first group's discussion, the observing group will join the conversation. Then, the groups switch seats and the first discussion group will observe. The key point here is that the students are engaged in the Socratic Seminar.

Common norms for Socratic Seminars include:

- Use sensitivity to take turns and not interrupt
- Monitor "air time" so that all have an opportunity to contribute
- Base claims contributed on researched evidence
- Be courageous in presenting your own thoughts and evidence
- Be willing to consider the compelling evidence of others
- Address comments to the group (not the teacher)

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Name _____ Date _____ Class _____

Evaluating Impacts of Environmental Change on Populations *CONTINUED*

Resources

Many resources can be used to assist your research. These include journal articles, websites, and scientific news and magazines. You might also visit a university, science museum, or a laboratory or interview an expert in the field.

Evaluation

Read the following rubric to see how you will be scored on your research and presentation.

Criteria	0	5	10	15	Points
Task	The tasks were not completed.	Some effort was made to complete the tasks, but the major ideas are missing.	The tasks were completed but some information was omitted or incorrect.	The tasks were completed with great attention to detail.	
Process	The process was not followed.	The process was begun but not all questions were answered.	The process was followed but some answers were incorrect.	The project showed thorough research and a deep understanding of the topic.	
Socratic Seminar	There was no attempt to participate in the Socratic Seminar.	There was minimal effort to participate in the Socratic Seminar.	Good material and ideas were contributed to the Socratic Seminar, but perhaps evidence or reasoning could have been stronger.	The contribution was excellent, showed knowledge of the topic, and used evidence and reasoning to back up claims.	
Total Score					

Applying Practices • Evaluating Impacts of Environmental Change on Populations
3
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Applying Practices activities correlate to NGSS performance expectations and apply specific science and engineering practices to DCIs.

Labs, MiniLabs, and Data Analysis Labs

require students to use the science practices to investigate, explain, and apply disciplinary core ideas and cross-cutting concepts.

BIOLAB

DO PLANTS OF THE SAME SPECIES COMPETE WITH ONE ANOTHER?

Background: Ecologists often study plant competition by comparing the biomass of individual plants in plant populations. In this lab, you will study intraspecific competition—competition among plants of the same species. As with most ecological studies, you will need to collect data for several weeks.

Question: Do plant populations of various densities grow differently due to competition?

Materials

- marigold seeds or radish seeds
- 9-cm plastic pots (6)
- clean potting soil
- rulers
- shallow tray for pots
- small garden trowels
- masking tape
- permanent markers
- balances (accurate to 0.1 g)
- watering can

Safety Precautions

Procedure

- Read and complete the lab safety form.
- Plant seeds in several pots as instructed by your teacher. Your goal should be to have pots with the following densities of plants: 2, 4, 8, 16, 32, and 64.
- Place the pots in a shallow tray near a sunny window or under a grow light. Continue to keep the soil moist—not drenched—throughout the course of the experiment.
- After the seeds have sprouted, weed out any extra plants so that you have the correct density.
- Write a hypothesis about the effect plant density will have on the average biomass of each pot's population.

- Construct a data table. Observe the plants once each week for a 5–6 week period. Record your observations.
- At the end of the experiment, measure the biomass of the plants in each pot by cutting each plant at soil level and quickly weighing all the plants from the same pot together. Record your measurements. Calculate the average per-plant biomass of each pot.
- Cleanup and Disposal** Wash and return all reusable materials. Wash your hands after watering or working with the plants. Dispose of the plants at the end of the lab as instructed by your teacher.

Analyze and Conclude

- Graph Data** Prepare a graph showing the relationship between the average plant biomass and the density of plants. Draw a best-fit line for your data points. What was the effect of plant density on the average biomass of each pot's population? Does this graph support your hypothesis?
- Infer** Draw a second graph that compares the total biomass for each population to the number of plants in each population.
- Think Critically** Based on your results, infer how human population growth is affected by population density.
- Error Analysis** What sources of error might have affected your results?

SHARE YOUR DATA

Poster Session Create a poster using the graphs you produced as a result of your experiment. If a digital camera is available, take photos of each pot of plants to include on your poster. Add headings and legends for each graph and photograph that explain and summarize your findings. Display your poster in the classroom or a hallway of your school.



BioLab 107

SUCH AS RICE AND WHEAT require population control.

For thousands of years, environment size of the human population number below the environment's supply. Technological advances led the chances of human survival from parasites and diseases in shelter have made a climatic impact.

Why rate Although the human population, the rate of its growth has been primarily to a famine in China in people died. The graph also shows that the overall population growth reached its peak at 1.2% in 2009. The decline in growth is due primarily to diseases

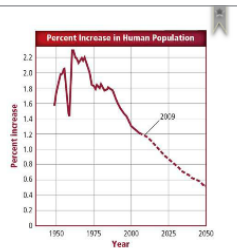


Figure 12 This graph shows the percent increase in the global human population using data from the late 1940s through 2009 and the projected percent increase to 2050. Determine the approximate population increase in the year 2025.

MiniLab 1

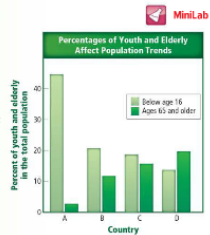
Evaluate Factors

What factors affect the growth of a human population? Technological advances have resulted in a rapid growth in human population. However, human population growth is not equal in all countries.

- Procedure**
- The graph shows one factor affecting human population growth. Use the data to predict how this factor will affect the population in each country between now and the year 2050.
 - Brainstorm a list of factors, events, or conditions that affect the growth of human populations in these countries. Predict the effect of each factor on the population growth rate.

Analysis

Think Critically In your opinion, what factors or groups of factors have the greatest impact on population growth? Justify your answer.



Section 2 • Human Population 101



Carrying capacity In Figure 8 on the previous page, notice that logistic growth levels off at the line on the graph identified as the carrying capacity. The maximum number of individuals in a species that an environment can support for the long term is the **carrying capacity**. Carrying capacity is limited by the energy, water, oxygen, and nutrients available. When populations develop in an environment with plentiful resources, there are more births than deaths. The population soon reaches or passes the carrying capacity. As a population nears the carrying capacity, resources become limited. If a population exceeds the carrying capacity, deaths outnumber births because adequate resources are not available to support all of the individuals. The population then falls below the carrying capacity as individuals die. The concept of carrying capacity is used to explain why many populations tend to stabilize.

Reproductive patterns The graph in Figure 8 shows the number of individuals increasing until the carrying capacity is reached. However, there are several additional factors that must be considered for real populations. Species of organisms vary in the number of births per reproduction cycle, in the age that reproduction begins, and in the life span of the organism. Both plants and animals are placed into groups based on their reproductive factors. Members of one of the groups are called the *r*-strategists. The *r*-strategy, or *r*-strategy, is an adaptation for living in an environment where fluctuation in biotic or abiotic factors occur. Fluctuating factors might be availability of food or changing temperatures. An *r*-strategist is generally a small organism such as a fruit fly, a mouse, or the locusts shown in Figure 8. *r*-strategists usually have short life spans and produce many offspring.

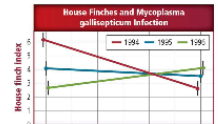
DATA ANALYSIS LAB 1

Based on Real Data*

Recognize Cause and Effect

Do parasites affect the size of a host population? In 1994, the first signs of a serious eye disease caused by the bacterium *Mycoplasma gallisepticum* were observed in house finches that were eating in backyard bird feeders. Volunteers collected data beginning three different years on the number of finches infected with the parasite and the total number of finches present. The graph shows the abundance of house finches in areas where the infection rate was at least 20 percent of the house finch population.

Data and Observations



- Think Critically**
- Compare the data from the three areas.
 - Hypothesize why the house finch abundance stabilized in 1995 and 1996.

Infer whether the parasite, *Mycoplasma gallisepticum*, is effective in limiting the size of house finch populations. Explain.

*Data obtained from Dr. Gregory R. Sibly et al. 2002. Parasites take control. *Nature* 416: 23–24.



Labs require students to use the science practices and apply claim, evidence, and reasoning skills.

Home Away from Home
A WebQuest for Ecology

Introduction
Wildlife biologists perform scientific research to study how species interact with each other and the environment. They work to protect animals and to try to maintain their populations. Wildlife biologists sometimes work with zoos to help them construct proper habitats for the animals that live there. They must take many factors into consideration when they design a habitat for an animal. In this WebQuest, you will select an animal and learn about what it needs to live. Then, you will design a zoo habitat for it.

Task
The local zoo is about to receive four animals of the same species. Your task is to design a habitat for the animals. The habitat should take into account all of the animals' needs. You will select the animal species for your project.

Process
Use the resources listed in the **Resources** section to begin your research. The Web sites listed are good starting points, but further internet research will be necessary. Record your answers to the following questions. You might want to create a chart to help you organize your information. You will use your answers to the questions to design a habitat at the end of the project.

1. What do the animals eat?
2. Do the animals live in rainforests, grasslands, or another kind of biome?
3. Do the animals fly or swim in water?
4. Do the animals live in trees or on the ground?
5. What kind of climate do the animals require?
6. Are they social animals, or do they live alone?
7. How do the animals respond to the presence of people?

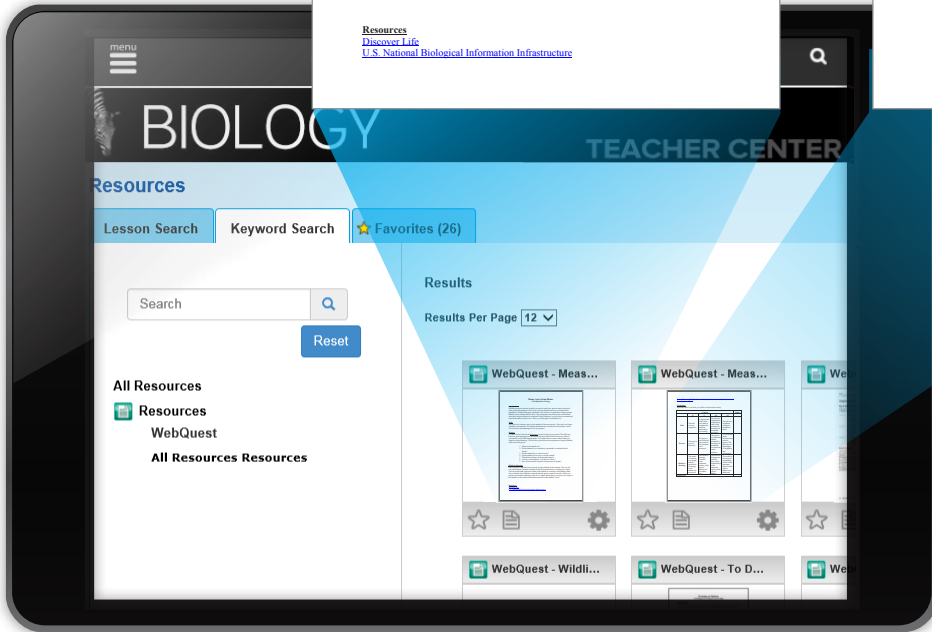
Model or Drawing
Once you have completed your research, design a habitat for the animals. The zoo will use your design to construct a habitat for the four animals that are coming to live there. You can create either a physical model of the habitat or a drawing of the habitat. Make sure to include a list of plants or animals that the species requires in its diet. When you present your model or drawing to the class, explain which species you chose, the scope of the animals' needs, and how the habitat meets all of the animals' needs.

Resources
[Discover Life](#)
[U.S. National Biological Information Infrastructure](#)

[Animal Diversity Web](#)
[The National Council for Science and the Environment's Encyclopedia of Earth](#)

Evaluation
Read this rubric to see how you will be scored on this activity.

	Criteria				Points
	0	5	10	15	
Task	The task was not completed.	It appears that some effort was made to complete the task, but major ideas are missing.	The task was completed as assigned, but some of the rationale for the design of the habitat was faulty.	The task was completed with great attention to detail.	
Process	The process was not followed.	The process was followed, but not all of the questions were answered.	The process was followed, and the rationale for the design of the habitat was based on sound evidence.	It is clear that much research went into the project. The ideas show a high degree of originality and imagination.	
Model or Drawing	The model or drawing was sloppy, and the rationale for the design of the habitat was not sound.	The model or drawing included some important aspects of the species' habitat, but left others out.	The model or drawing was carefully done, and it included most of the important aspects of the species' habitat.	The model or drawing was outstanding, and all of the important aspects of the species' habitat were addressed.	
Total Score					



WebQuests require students to apply select **Science and Engineering Practices** (SEPs), DCIs, and Cross-cutting Concepts to new situations. WebQuests also are found online within ConnectED.



WebQuests are found within our online resources in ConnectED.

Optional student activities such as Enrichment Resources, Real-World Biology, Environmental Explorations, and other help further understanding of the core disciplinary ideas..

Name _____ Date _____ Class _____

Real-World Biology: Analysis

CHAPTER 4 Population Research

Isle Royale is considered by biologists to be a unique setting for the study of population dynamics. It is a 72-km-long, 14-km-wide wilderness island located in the western part of Lake Superior and accessible to visitors only from June through August. The island can be reached only by boat or seaplane, and travel is limited to hiking on land and canoes and boats on water. Most travelers to Isle Royale are hikers and wilderness campers. Because of the island's isolated location, relatively few species have colonized Isle Royale. On the island, wolves are the only predator of moose (mostly calves and adults over ten years of age), and moose are nearly the only prey of wolves. Moose eat lichens and twigs of woody trees (almost 75 percent balsam fir), shrubs, and aquatic plants. Because the visitor season is short, and there is no hunting of wolves or moose, there is little human impact to complicate this simple terrestrial ecosystem. Another condition that favors Isle Royale as a natural laboratory is the simplification of the growth rate formula. Because there are no wolf or moose immigrations or emigrations, those variables can be eliminated from the growth rate calculations.

Part A: Bio. Distribution

The ecologist on Isle Royale by aerial survey Table 1 shows

Enrichment

CHAPTER 4 Group Project: Human Population Controls

The size of human populations can vary considerably, depending on natural factors and decisions made by humans. For example, populations might diminish significantly in nations ravaged by war or epidemics. Or they might increase significantly if governments adopt laws that encourage couples to have more children. In some nations, governments might use demographic information to decide which policies it should adopt. In other nations, the growth or decline in populations seems to be largely a chance event to which governments pay little attention.

In this activity, you will form a group of classmates to advise a national legislature about actions it should take to influence future population patterns. The table below lists population data for six different nations. Choose one nation to study in more detail.

Analyze Begin by using the data provided to calculate the nation's population growth rate. Then draw a graph that shows projected changes in population over the next decade, assuming the growth rate remains the same. Talk with other members of your group to decide whether you think the projected trend is desirable or undesirable.

Recommend Choose any one of the four variables given in the table (number of births, deaths, immigrants, or emigrants) to change. Suggest a mechanism—natural or human-made—by which that change might come about.

For example, you might want to study the effects of decreasing the number of births in the nation by one-quarter. Calculate the new birthrate from the new data, and draw a new graph (but on the same axes as the original graph) to see how the change you made alters your original projections for population growth or decline. Compare your results with those of other groups. Find out how altering one variable or another affects short-term and long-term population changes in the nations being studied.

Nation	Population Size in 2006	Population Data for 2007			
		Births	Deaths	Immigrants	Emigrants
A	100,000	4000	1000	50	100
B	100,000	4000	2000	50	50
C	100,000	4000	3000	100	50
D	100,000	4000	4000	250	50
E	100,000	4000	5000	50	300
F	100,000	4000	6000	150	100

Unit 1

CHAPTER 4 Population Ecology 117

DATA ANALYSIS LAB 1

Based on Real Data*

Recognize Cause and Effect

Do parasites affect the size of a host population?

In 1994, the first signs of a serious eye disease caused by the bacterium *Mycoplasma gallisepticum* were observed in house finches that were eating in backyard bird feeders. Volunteers collected data beginning three different years on the number of finches infected with the parasite and the total number of finches present. The graph shows the abundance of house finches in areas where the infection rate was at least 20 percent of the house finch population.

Data and Observations

Think Critically

1. Compare the data from the three areas.
2. Hypothesize why the house finch abundance stabilized in 1995 and 1996.
3. Infer whether the parasite, *Mycoplasma gallisepticum*, is effective in limiting the size of house finch populations. Explain.

*Data obtained from Gregory R. et al. 2003 Parasite take control. *Auk* 122: 33-34

These are all found online in ConnectED in the chapter and lesson resources.



Student Activities online help students foster engagement, and extend understanding.

A variety of assessment types offer “pen and paper” assessment, online quizzes and tests, and performance task assessment.

Name _____ Date _____ Class _____

Chapter Test A Biodiversity and Conservation

Part A: Multiple Choice

In the space at the left, write the letter of the phrase or sentence that best answers each question.

- Which defines extinction?
 - A. A species disappears.
 - B. An ecosystem vanishes.
 - C. Biodiversity decreases.
 - D. Genetic diversity drops.
- Which defines background extinction?
 - A. an accelerated extinction rate
 - B. extinctions of unknown species
 - C. mass extinctions in the past
 - D. the natural extinction rate
- Which is an example of habitat fragmentation?
 - A. building several roads through wetlands
 - B. cutting down an entire section of forest
 - C. dumping chemical pollutants into a lake
 - D. removing the predators from a rain forest

Part B: Matching

Place a check in the correct box to identify the type of pollution that applies to each statement. More than one box may be checked for each statement.

Statement	Acid Precipitation	Biological Magnification	Eutrophication
1. Fertilizers cause excess algae to grow, which lower aquatic oxygen levels.			
2. Sulfur dioxide reacts with water in the atmosphere to make sulfuric acid.			
3. Pesticides accumulate in the bodies of organisms higher on the food chain.			
4. The accumulation of DDT in tissues of eagles and ospreys in the 1970s.			

Essay

76. A student placed a ball of clay and a clay boat in a pan of water. The ball sank, but the boat floated. Compare the weight and the buoyant force of the clay ball and of the boat. Then, explain how shape and surface area are related to buoyant force. Then explain whether the students results would be different if she used a deeper pan of water.

ANSWER: The clay ball sinks because its weight is greater than the buoyant force. The clay boat floats because its weight is less than the buoyant force. Buoyant force is related to surface area, so changing the shape of the clay ball to form a clay boat with a greater surface area will change the relationship between weight and buoyant force. The student would not get different results in a deeper pan of water because depth does not impact buoyant force.

Score	Description
4	Student's response includes the following four elements: the buoyant force on the boat is greater than its weight; the buoyant force on the clay ball is less than its weight; increasing surface area increases the buoyant force; depth does not impact buoyant force. Student's response includes three of the following four elements: the buoyant force on the boat is greater than its weight; the buoyant force on the clay ball is less than its weight; increasing surface area increases the buoyant force; depth does not impact buoyant force. Student's response includes two of the following four elements: the buoyant force on the boat is greater than its weight; the buoyant force on the clay ball is less than its weight; increasing surface area increases the buoyant force; depth does not impact buoyant force. Student's response includes one of the following four elements: the buoyant force on the boat is greater than its weight; the buoyant force on the clay ball is less than its weight; increasing surface area increases the buoyant force; depth does not impact buoyant force. Student's response is totally incorrect or irrelevant. No student response.

Name _____ Date _____ Class _____

Evaluating Impacts of Environmental Change on Populations

Resources

Many resources can be used to assist your research. These include journal articles, websites, and scientific news and magazines. You might also visit a university, science museum, or a laboratory or interview an expert in the field.

Evaluation

Read the following rubric to see how you will be scored on your research and presentation.

Criteria	0	5	10	15	Points
Task	The tasks were not completed.	Some effort was made to complete the tasks, but the major ideas are missing.	The tasks were completed but some information was omitted or incorrect.	The tasks were completed with great attention to detail.	
Process	The process was not followed.	The process was begun but not all questions were answered.	The process was followed but some answers were incorrect.	The project showed thorough research and a deep understanding of the topic.	
Socratic Seminar	There was no attempt to participate in the Socratic Seminar.	There was minimal effort to participate in the Socratic Seminar.	Good material and ideas were contributed to the Socratic Seminar, but perhaps evidence or reasoning could have been stronger.	The contribution was excellent, showed knowledge of the topic, and used evidence and reasoning to back up claims.	
Total Score					

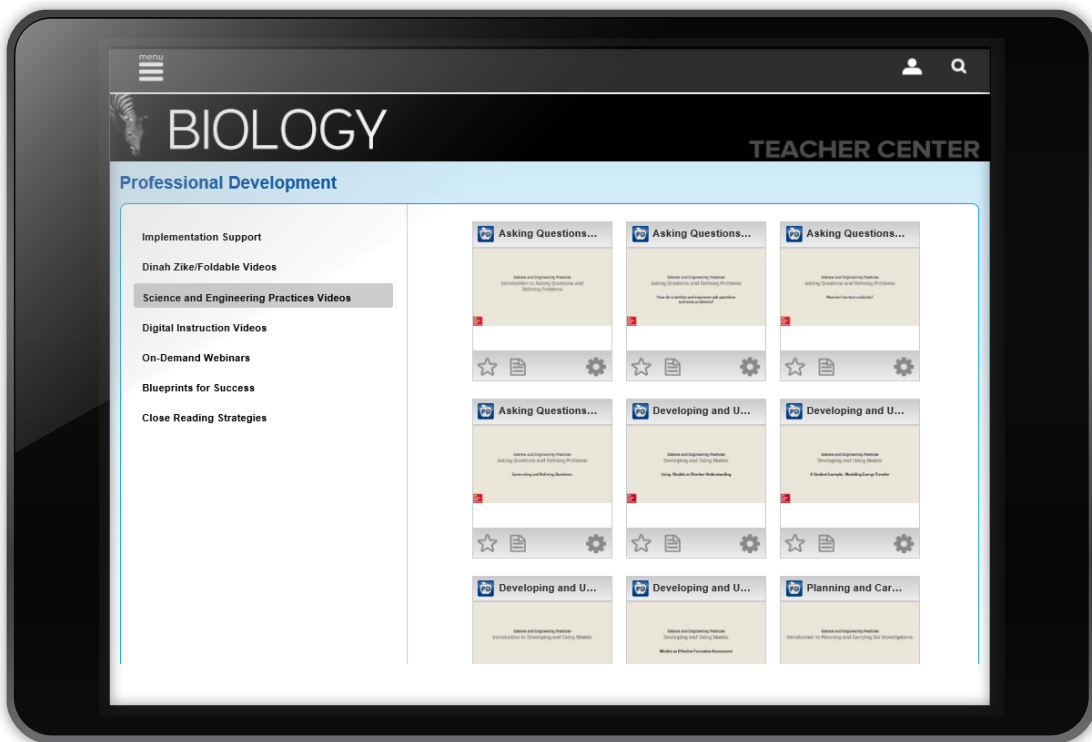
Applying Practices - Evaluating Impacts of Environmental Change on Populations

Numerous options for formative and summative assessment help provide comprehensive insight into student learning.



Built-in assessment strands throughout the High School Science programs will inform instruction and keep students on track.

Professional Development around NGSS is Found under the Professional Development menu item in ConnectED.



NGSS Implementation videos provide guidance for teaching **Science and Engineering Practices**. These valuable videos are found online within the Professional Development menu in ConnectED.



Professional development resources provide teaching strategies and implementation support.

