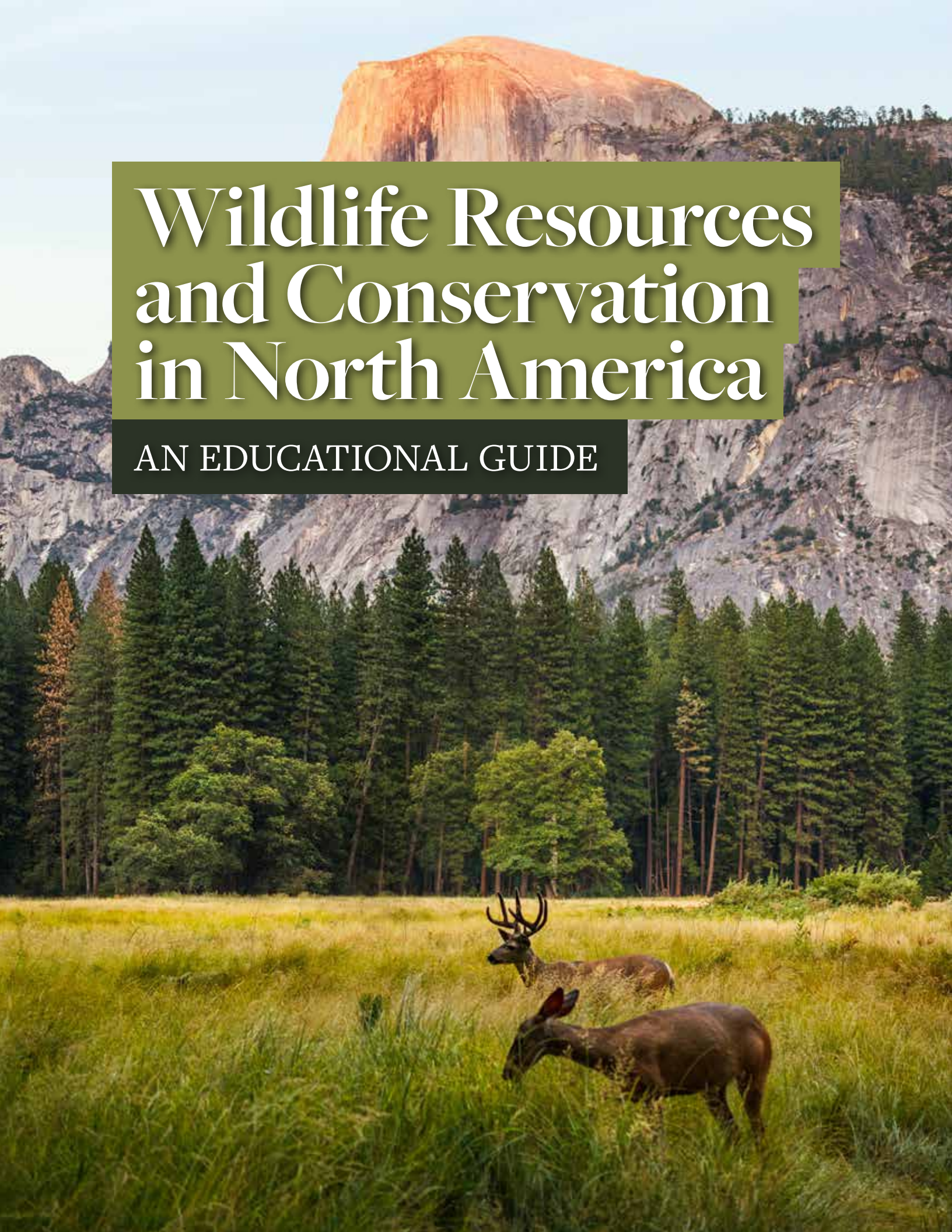


Wildlife Resources and Conservation in North America

AN EDUCATIONAL GUIDE

Yosemite Valley, California. *Pablo Fierro/Unsplash.com*

Wildlife Resources and Conservation in North America

AN EDUCATIONAL GUIDE

ON THE COVER

Yosemite Valley, United States: Two deer in front of Half Dome in Yosemite Valley at sunset. *Johannes Andersson/Unsplash.com*

Sharon McCutcheon/Unsplash.com

The Big Picture

GUIDED CLASSROOM DISCUSSION

Ask your students to think about some of their favorite snack foods:
1. Who is in charge of snacks in their house?
2. Is there a procedure to go about when you would like a snack?
3. Is there someone in the house who needs to give permission before you can get a snack?
4. Are certain snacks off limits at different times of the day?
5. How long would the snacks last if there were no rules, and they could be eaten at any time?

Let the students know that much like how snacks can be "valuable resources" in their houses, land, wildlife, and other natural resources are valuable resources for the people living in the United States, and without a set of rules for people to follow that includes when and how often those resources can be used, those resources could potentially run out very quickly. That is why the idea of conservation is so important in our everyday lives.

CONTENT IN CONTEXT

It's Fall Break, and Alivia is excited. Alivia and her family are headed to Turkey Run State Park, located in Parke County, Indiana.

Turkey Run is a 2,382 acre state park that was established in 1916. It was Indiana's second established state park, and it includes miles and miles of some of Indiana's most gorgeous trails that guide hikers through dense forests, tall prairie grasses, and deep sandstone gorges that are over 300 million years old!

When Alivia and her family check in at the Nature Center, she meets with Ranger Chris, who shares some of the park's unique history.

"In 1916, most of this land was actually sold to a lumber company based out of Indianapolis who planned to harvest almost all of the old growth trees found in the park today," states Ranger Chris. Alivia can't believe that anyone would ever want to remove something as beautiful as all of the trees that she sees around her!

"You also have to keep in mind that this was at a time when natural resources such as timber weren't often viewed or managed as sustainable resources that need to be used wisely," Ranger Chris continues. "But thanks to the efforts of conservationists such as Richard Lieber," Ranger Chris continues, "the land was purchased from the lumber company and is still preserved for families to enjoy today."

"What's a conservationist?" inquires Alivia. Alivia learns that a conservationist is someone who advocates or acts for the protection and preservation of the environment and the wildlife found in it. "Wow!" says Alivia, "I had no idea that the hard work of just a few people could have such a big impact on our environment!"

Later, as Alivia and her family are hiking down one of Turkey Run's beautiful trails, she is

turkeyrunstatepark.com

struck by the fact that hundreds of thousands of people almost missed out on enjoying these beautiful sites, if not for the efforts of local conservationists.

"I think I would like to become a conservationist when I grow up, and help save my state's beautiful natural resources so that they will always be here for people to enjoy," declares Alivia.

"Lucky for you, many local colleges such as Purdue University offer degrees in wildlife biology, so that future generations can learn all about wildlife and the steps that need to be taken to conserve it, says Ranger Chris.

Alivia leaves Turkey Run State Park with a smile on her face, hopeful that someday her actions will have such a large impact on the people living around her.

DISCUSSION QUESTIONS: *How do the efforts of conservationists such as Richard Lieber help to save resources for future generations? What might happen to resources if conservationists didn't exist?*

LESSON ONE

The North American Model of Wildlife Conservation

GRADE LEVEL
Upper Elementary and Middle School

CONTENT AREAS
English/Language Arts, Science, Environmental Education, Social Studies

METHOD
Students read and discuss an informational article about conservation topics

MATERIALS
North American Model article, lined paper, pencil

ACTIVITY TIME
One 45-minute session

PEOPLE POWER
Any

SETTING
Any

TERMS TO KNOW
conservation, extinction, market hunters, tenets, excise tax

OBJECTIVES

Students will (1.) gain an understanding of what the North American Model of Wildlife Conservation is, (2.) describe and elaborate the ways the model provides examples of successful conservation practices and policies, and (3.) be able to explain how this model has positively impacted wildlife found in North America today.

ASSESSMENT

Using the RACE method (Restate, Answer, Cite, Explain), write a paragraph describing how wildlife policy has evolved in North America.

Name three ways North America's natural resources, including wildlife, were exploited before 1900.

What does the notion of natural resources as a "public trust" mean?

List and explain in your own words the seven tenets from the North American Model of Wildlife Conservation.

In your opinion, which tenet is most valuable and why? Justify your answer with evidence from the article.

A print shows Native Americans engaged in fur trading in 1820 on the banks of a river or lake at the settlement of Chicago. *Chicago Lithographing Co., c. 1867; Library of Congress, Prints and Photographs Division*

BACKGROUND

Throughout history, people have depended on wildlife for survival: as a source of food, clothing, and even tools. While many people throughout history have taken responsibility as stewards of wildlife, at times there have also been examples of wasteful human actions. North America reached a tipping point in the late 1800s as extinction and near-extinction of species rose dramatically due to human actions.

Losses of habitat from deforestation, mining, and water pollution began to impact many species. Wildlife was considered an inexhaustible commodity, and there were few limits on harvest. Abundant wildlife species dwindled, and some became extinct.

Many people began to see these losses of wildlife and grew concerned about the future of these animals. By the early 1900s, hunters and conservationists rallied to support policies and legislation that would sustain North America's wildlife populations. Hunters, members of local garden clubs, and people involved in the industry worked to pass laws in the United States to fund wildlife research and conservation through taxes on hunting, shooting, fishing equipment, and even motor boat fuel. (See **Lesson Three: Modern Conservation Funding** for more information on this topic). Wildlife research and management evolved as a sound science to guide conservation and promote the "wise use" of wildlife.

Over time, a list of seven developed, interconnected tenets have evolved and shaped wildlife conservation and management practices in the United States and Canada and are now known as the North American Model of Wildlife Conservation. These seven tenets have shaped wildlife management practices in the United States and Canada, contributing significantly to efforts to sustain species.

PROCEDURE

Prior to reading the Lesson One text, complete the guided classroom discussion found in "The Big Picture" section of this unit. Completing this discussion will help place these complex ideas into a context that the students will more easily understand.

After the guided classroom discussion, read the "Content in Context" section with the students. Discuss the following:

- How do the efforts of conservationists help to save resources for future generations?
- What might happen to these resources if conservationists didn't exist?
- Are wildlife and natural resources exploited today? If so how?

Read the text titled "The North American Model of Wildlife Conservation." Depending on the skill level of your class, this can either be done together as a group, which will give you the ability to pause often and check for understanding, or assigned individually for more independent readers.

Use the items found in the "Assessment" section to help check for understanding. You could:

- Use the items provided as a means of starting a classroom discussion about the material.
- Assign some or all of the items provided for students to complete independently.

Transformation masks like the Namgis Thunderbird Transformation Mask above were inspired by wildlife and the spiritual connection thought to exist between different groups of indigenous peoples and nature. *Brooklyn Museum*

The North American Model of Wildlife Conservation

Throughout time, humans have depended on wildlife for survival: as a source of food, clothing, and tools. Wildlife inspired art, spirituality, and discovery about the natural world. While many people throughout history have taken responsibility as stewards of wildlife, at times there have also been examples of wasteful human actions. North America reached a tipping point in the late 1800s as extinction and near-extinction of species rose dramatically due to human actions. Extinction is the process of a species dying of in such great numbers that they can no longer be found on Earth. Could people achieve a "wise use" of wildlife resource sustainability?

A GROWING THREAT

To understand current processes of wildlife conservation, we must look back at how wildlife policy grew and changed in North America over time. **Conservation** is the prevention of the wasteful use of natural resources. Early European explorers found North America teeming with wildlife, seemingly boundless and unregulated. The first stories from North America were tales of limitless bounty. "I think in all the world the like abundance is not to be found," stated Arthur Barlowe, an agent who worked with Sir Walter Raleigh during Raleigh's trip to Virginia in 1584. As the population of people greatly expanded in the 1800s, much of North America's natural resources, including wildlife, were exploited.

Losses of habitat from deforestation, mining, and water pollution began to impact many species. Market hunters and pothunters had little to no restrictions and harvested as much wildlife as they could sell for meat, fur, and animal parts. A **market hunter** was a professional hunter that hunted animals as an occupation. A pothunter was a person who hunted all wildlife for profit as well food. As North America's prosperity grew, harvesting wildlife was no longer just for survival. People bought fur hats decorated with bird feathers for fashion. Market hunters were paid to harvest bison for advancing railway communities. Citizens and the government set their sights on predators and any wildlife that was seen as a threat to human progress. Wildlife was considered an inexhaustible commodity, and there were few limits on harvest.

Sir Walter Raleigh, above, and Arthur Barlowe drew maps that showed the abundance settlers could find in North America. *Hubbard Collection, Library of Congress, Prints and Photographs Division*

Abundant wildlife species dwindled, and some, such as the passenger pigeon, suffered **extinction**, unable to overcome the extreme changes in land use and overharvesting of their populations.

Many people began to see these losses of wildlife and grew concerned about the future of these animals. Several forward-thinking conservationists and hunters realized the effects of unregulated hunting. They saw the need to set limits to sustain wildlife populations and assume responsibility for the stewardship of our natural resources on behalf of present and future generations.

North American Bison Population Over Time

YEAR	1830	1870	1880	1900	1951	2019
POPULATION	40,000,000	5,500,000	395,000	300	23,340	500,000

The North American bison was almost wiped out in the early 1900s, but thanks to conservation efforts, their numbers are once again on the rise.

Bryce Olsen/Unsplash.com

NECESSARY REFORMS

By the early 1900s, hunters and conservationists rallied to support policies and legislation that would restore North America's wildlife populations. Thanks to the pioneering efforts of visionaries such as President Theodore Roosevelt, and the commitment of hunters and conservationists, wildlife conservation took a dramatic and life-saving turn. In 1900, the Lacey Act eliminated market hunting by prohibiting the sale of wildlife.

Hunters and people who fish worked to pass laws in the United States to fund wildlife research and conservation through taxes on hunting, shooting, fishing equipment, and even motor boat fuel. Wildlife research and management evolved as a sound science to guide conservation and promote the "wise use" of wildlife.

President Theodore Roosevelt returning to Glenwood Springs, Colorado, after a bear hunt. Roosevelt was an early and vigorous proponent of wildlife conservation. *Library of Congress, Prints and Photographs Division*

SEVEN TENETS FOR CONSERVATION

The seven **tenets** listed below form the **North American Model of Wildlife Conservation.** Over time, these interconnected tenets have evolved and shaped wildlife conservation and management practices in the United States and Canada.

1. Wildlife resources are a public trust. The government manages wildlife on behalf of the public today and for future generations. States make and enforce most management regulations.

2. Markets for game animals have been eliminated. Laws prevent the selling of certain wild game meats or animal parts to unregulated markets. There are a number of cases in which products such as fish, furs, and certain game animals may be sold; however, these markets are monitored and heavily regulated to ensure that harvest is sustainable. Laws also prohibit the sale of nongame, threatened, or rare species.

3. Allocation of wildlife is by law. Governments use a process of public rulemaking to decide which species may be hunted or controlled in the public interest, and which species may be collected, hunted, or processed by people. These rules are based on the needs of the people and the impact on wildlife.

4. Wildlife may only be killed for legitimate purposes. This tenet is subject to local, state, and regional needs, but its intention is to avoid the wasteful and indiscriminate killing of wildlife. Legitimate purposes include food, fur, and defending a person or property.

5. Wildlife is an international resource. Many wildlife species regularly move across national borders, such as waterfowl and song birds. International agreements, agencies, and organizations help protect and manage these species. Federal agencies, in cooperation with state agencies, are legally responsible for managing wildlife that affects national interests, such as threatened and endangered species and migratory wildlife.

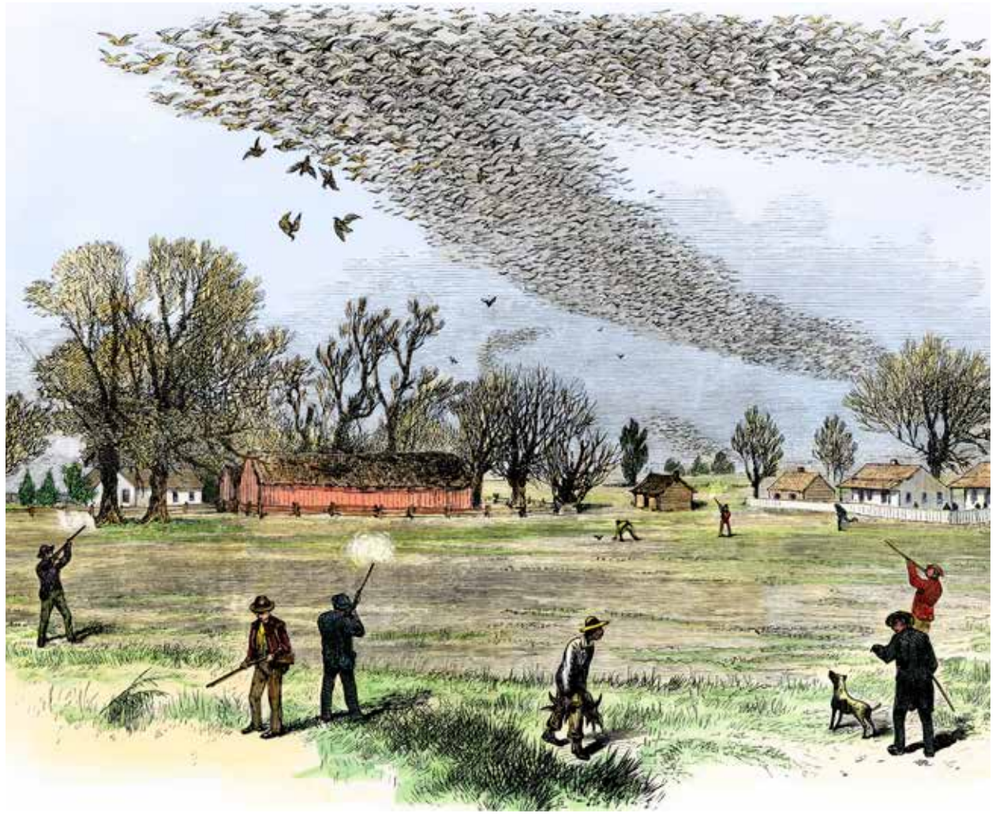
6. Wildlife policy is science-based. Science informs decision-makers when making wildlife policy and structuring management plans.

7. Hunting is a democracy. Laws offer the opportunity to hunt and fish to all people, not just those who are privileged.

These seven tenets have shaped wildlife management practices in the United States and Canada, contributing significantly to efforts to sustain fish and wildlife species. Wildlife species are now monitored, populations are managed, and hunters and people who fish, through the license fees that they pay, **excise tax** on sporting goods and motor boat fuels, and even voluntary contributions to conservation organizations, provide nearly $3 billion annually to support habitat and wildlife conservation. Excise taxes and license fees are not part of the seven tenets, but the money provided directly benefits wildlife conservation (see Lesson Three, p. 16)

The public participates in judicial, legislative, and regulatory processes to influence laws and rulemaking. Challenges still exist for wildlife and those who help manage their populations, but thanks to the North American Model of Conservation, wildlife levels in the United States will be sustainable for generations to come.

Etching of a passenger pigeon flock hunt in Lousiana, published July 3, 1875. The commercial killing of wildlife by "market hunters" significantly threatened some species, many to the point of extinction, like the passenger pigeon. *The Illustrated Shooting and Dramatic News, Wikimedia Commons*



LESSON TWO

The Public Trust Doctrine

GRADE LEVEL
Upper Elementary and Middle School

CONTENT AREAS
English/Language Arts, Science, Environmental Education, Social Studies, Expressive Arts

METHOD
Students read and discuss an informational article about conservation topics. Students model healthy and unhealthy hunter/wildlife relationships

MATERIALS
Public Trust article, lined paper, pencil, Extension activity: See materials for "Oh, Deer"

ACTIVITY TIME
One 45-minute session for article and discussion, one 20-minute session for "Oh, Deer" variation pt. 2

PEOPLE POWER
Any

SETTING
Any

TERMS TO KNOW
natural resources, trust, trustee, beneficiary, conservationists, preservation

OBJECTIVES

Students will (1.) gain an understanding of what The Public Trust Doctrine is, (2.) gain knowledge that both fish and wildlife are viewed as universally important resources that everyone should have access to, (3.) be able to explain how the Public Trust Doctrine helps to ensure wildlife populations stay at a healthy level.

EXTENSION

See Project WILD activity "Oh, Deer!" Variations part 2 (edited version) on page 48.

ASSESSMENT

How are the Public Trust Doctrine and the North American Model of Conservation interconnected? Cite two details from the article to support your answer.

In a paragraph, use the following vocab words: natural resources, trust, trustee, beneficiary, sustainability, and conservationists to briefly describe public trust.

When was the model of conservations put in place? Why was it necessary? Cite two details from the article to support your answer.

Who oversees the public trust and why? Cite one detail from the article to support your answer.

Casey Horner/Unsplash.com

BACKGROUND

All over the world, natural resources play an important role in people's everyday lives. It is important to ensure that all people have access to important resources, but different governments around the world address this issue in different ways. In the United States and other countries, the system that is implemented is called the Public Trust Doctrine.

Under the Public Trust Doctrine some resources such as fish and wildlife are viewed as resources that belong to everyone. Not only do these resources belong to all members of the public, they belong to future generations as well. This means that sustainability is a key aspect of the public trust. To make sure that all people have access to these important resources and to ensure that these resources are managed sustainably, the government helps to manage these resources to the benefit of all people living in our country. Under this system, these resources do not belong to the government. The government simply carries out the important task of keeping these resources safe, sustainable, and accessible to the public.

Early conservationists saw the need to put into place rules and regulations so that future generations would be able to enjoy the wildlife found in North America. From 1941 to 1995, scientists put into place key ideas or tenets that would guide conservation efforts in the United States and all of North America. In 2012 this list of tenets was officially named The North American Model of Conservation. One of the key components of this model is the idea that wildlife is a public trust resource. Without government oversight, resources like fish and wildlife could quickly disappear.

PROCEDURE

Read the text titled "The Public Trust Doctrine." Depending on the skill level of your class, this can either be done together as a group, which will give you the ability to pause often and check for understanding, or assigned individually for more independent readers.

Find a space that allows you to complete the "Oh, Deer!" activity and the included "Public Trust" variation. Using this variation will allow you to concretely observe and discuss the complex roles found in the public trust such as trust, trustee, and beneficiary. As you play the different rounds, pause to check for the understanding of these terms.

Use the items found in the "Assessment" section to help check for understanding. To do this, you could:

- Use the items provided as a means of starting a classroom discussion about the lesson one material.
- Assign some or all of the items provided for students to complete independently.

Clean waterways give us access to fishing, boating, and other fun outdoor recreational activities. *Filip Mroz/Unsplash.com*

The Public Trust Doctrine

All over the world, natural resources play an important role in people's everyday lives. **Natural resources** are anything created in nature that is used by humans. Resources like fish and wildlife provide food and fiber through hunting, fishing, and trapping. Waterways like lakes and rivers provide access to fresh water, important travel routes, and provide exciting recreational opportunities. But, how do we ensure that all people have access to these important resources? In the United States and other countries around the world, the answer is something called the Public Trust Doctrine.

WHAT IS THE PUBLIC TRUST DOCTRINE?

Dating back to ancient Roman law, the Public Trust Doctrine has been used to try and make sure that all citizens have access to universally important resources. A **trust** is a collection of assets entrusted to someone to be managed or cared for in the interest of another. The group to whom the assets are committed is commonly referred to as the **trustee**. The group for whom the assets are being managed is known as the **beneficiary**.

In the United States and elsewhere, some resources such as fish and wildlife are viewed as resources that belong to everyone. Not only do these resources belong to all people, they belong to future generations as well.

To make sure that everyone has access to these important resources and to ensure that these resources are managed sustainably, meaning in a way that they will last for generations to come, the government acts as the trustee to the benefit of all the citizens living in our country. Under this system, these resources do not belong to the government. The government simply carries out the important task of keeping these resources safe, sustainable, and accessible to the public beneficiary.

THE ROLE OF THE PUBLIC TRUST DOCTRINE IN THE NORTH AMERICAN MODEL OF CONSERVATION

As the United States grew from the 13 original states and began and spread westward, the once abundant resources that could be found almost everywhere began to grow scarce. Unregulated wildlife harvesting, or hunting, and an economic system that only found value in wildlife as a product brought several game species to the verge of extinction. A game species is an animal that has been or still is typically hunted by humans. An age of abundance that lasted from 1600 to roughly 1850 was replaced by an age of wildlife exploitation that would last for nearly fifty years.

Early **conservationists**, championed by then President Theodore Roosevelt, saw the need to put into place rules and regulations in order to stop this period of exploitation so that future generations would be able to enjoy the wildlife and game found in North America.

From 1941 to 1995, scientists put into place key ideas or tenets that would guide conservation efforts in the United States and all of North America. A tenet is a key idea or belief. In 2012 this list of tenets was officially named The

The North American Model of Conservation

Wildlife is a public trust resource

Elimination of unregulated markets for wildlife

Allocation of wildlife by law

Wildlife can only be killed for legitimate reasons

Wildlife is an international resource

Science is the proper tool for creating wildlife policy

Democracy of hunting

North American Model of Conservation. The term “model” was used to describe the tenets as a representation of ideas, not in the sense of a recipe, blueprint, or predictive formula. One of the key components of this model is the idea that wildlife is a public trust resource. Without government oversight, resources like fish and wildlife could quickly disappear.

CONTINUED EFFORTS

By implementing the Public Trust Doctrine and viewing both wildlife and fish as universally important resources, it is hoped that conservationists can continue to protect wildlife as a resource in our country. A conservationist is someone who advocates or acts for the protection and **preservation** of the environment and wildlife. With the guidance of case law and both federal and state statutes, regulations are created to ensure that natural resources are both protected and sustained over time. By understanding the role of Public Trust and the other six tenets of the North American Model it is hoped that students will better understand how we may continue to have an abundance of wildlife.

Kev Kindred/Unsplash.com

ACTIVITY

Oh, Deer! Public Trust Variation

Oh Deer!, which has been provided in partnership by the Project WILD K-12 Curriculum and can be found in the included appendix, teaches students about the important components of a habitat and the carrying capacity of a habitat to support specific wildlife populations. The variation found below can be used to help illustrate how the Public Trust Operates and aids in the sustainability of wildlife populations in North America.

Variation Part Two: Importance of the Public Trust Doctrine

1. After students have participated in multiple rounds of “Oh, Deer!” and the variation rounds included in the Project WILD Activity Guide, discuss how understanding the public trust might change how this activity could be conducted.

2. Divide your students into a population of deer and a smaller population of hunters.

3. Once you have selected your group of hunters, further divide them into two separate groups. The first group of hunters will be given a head start in this round, and will be released ahead of the second group of hunters. Use an appropriate head start based on your group size and spacing.

4. Explain to the hunters that they have no restrictions put into place on their hunting, and they can tag as many deer as they can catch.

5. Once a deer has been tagged and “harvested” by a hunter it is removed from play. Students will quickly see that without restrictions and protections put into place, the deer population is quickly wiped out.

6. Also discuss with your class the difference between the number of deer harvested by hunters in the first group released versus the second group. Was it fair to the second group of hunters that the first group got a head start without any restrictions?

7. Now conduct another round in which hunters are only allowed to tag one or two deer. How quickly do you see the deer population decreasing in the first round vs the second round? Discuss the importance of harvest limitations in hunting and why having wildlife as a public trust resource is necessary for populations of wildlife and hunters. This round also demonstrates how hunting under the North American Model is a democracy, where everyone is given equal access to wildlife.

LESSON THREE

Conservation Funding Today: User-Pay, Public Benefit

GRADE LEVEL
Upper Elementary and Middle School

CONTENT AREAS
English/Language Arts, Science, Environmental Education, Social Studies

METHOD
Students read and discuss an informational article about conservation topics

MATERIALS
User-Pay Public Benefit article, paper, pencil

ACTIVITY TIME
One 45-minute session

PEOPLE POWER
Any

SETTING
Any

TERMS TO KNOW
ethics, endangered species, threatened species, wildlife management, license, charity

OBJECTIVE

Students will (1.) gain an understanding of what the User-Pay, Public Benefit System is and (2.) how the actions of hunters and people who fish help to protect both wildlife and the habitats they call home safe for future generations to enjoy.

ASSESSMENT

How are wildlife research and conservation funded? Using details from the article, why do you think wildlife research and conservation are important?

What kind of training do all states require before you get a hunting license?

What types of animals benefit from protected habitats that are purchased with hunter dollars?

What conclusions can you draw from the benefits of user-pay, public benefit?

Can you predict any potential drawbacks of not having user-pay, public benefits?

How is user pay, public benefit related to public trust and the North American Model?

Sticker Mule/Unsplash.com

BACKGROUND

Since the early 1900s, wildlife management and conservation programs that include the hunting of wildlife have helped to significantly increase the populations of game animals. These programs are funded using something called the User-Pay, Public Benefit System of conservation funding.

Although wildlife is considered to be a universally important resource that everyone has the right to access, not just anyone can go into the outdoors to harvest an animal. Legal hunting is highly regulated by wildlife agencies, requires a license, and is enforced by specially trained wildlife law officers. Even after acquiring a license to hunt a specific game animal, hunters have very strict guidelines they must follow including where and when they hunt and how many of a specific animal they may harvest in a given hunting season.

In order to obtain a hunting licence for a specific game animal, a hunter or person who fishes is required to pay a small fee for the opportunity to pursue those species. That money is then used to help fund wildlife conservation efforts and education and law enforcement programs that benefit all wildlife and people. Some of this money is used to support natural resource programs that include purchasing public lands, protecting critical habitats, and helping to restore some endangered or threatened wildlife species. Because hunters and people who fish are the ones "using" the wildlife through their harvest, yet all people benefit from the conservation efforts that hunting funds create, this is known as the User-Pay, Public Benefit System of funding conservation.

It is important to point out that all people "use" or impact wildlife through their everyday actions and decisions. People's actions and choices impact their local ecosystems and wildlife. This can range from accidentally striking an animal with a car, polluting water through the use of pesticides, or the clearing of forest and wetlands for highways or construction projects. These actions and outcomes are often unintentional and not inherently "bad" or intended to harm wildlife, however they can and do have a negative impact on affected wildlife populations. When referring to "use" by hunters in this section the use of wildlife through hunter harvest is regulated, scientifically predictable, and sustainable.

PROCEDURE

Read the text titled "Conservation Funding Today: User-Pay, Public Benefit." Depending on the skill level of your class, this can either be done together as a group, which will give you the ability to pause often and check for understanding, or assigned individually for more independent readers.

Find a space that allows you to complete the "Oh, Deer!" activity and the included "Public Trust" variation. Using this variation will allow you to concretely observe and discuss the complex roles found in the public trust such as trust, trustee, and beneficiary. As you play the different rounds, pause to check for the understanding of these terms.

Use the items found in the "Assessment" section to help check for understanding. You could:

- Use the items provided as a means of starting a classroom discussion about the lesson one material.
- Assign some or all of the items provided for students to complete independently.

Not just anyone can go to the outdoors and harvest an animal. Legal hunting is highly regulated by wildlife agencies, requires a license, and is enforced by specially trained wildlife law officers. *Fredrik Öhlander/Unsplash.com*

Conservation Funding Today: User-Pay, Public Benefit

Since the early 1900s, **wildlife management** and conservation programs that include the hunting of wildlife have helped to significantly increase the populations of game animals such as whitetail deer, moose, wild ducks, and even turkeys. But, where do these programs get the money needed to support wildlife conservation? The answer is the User-Pay, Public Benefit System of conservation funding.

Hunting and Personal Growth

Participation in hunting can cultivate personal traits and attitudes that are fundamental to healthy community and family relationships. These include:

A greater sense of responsibility
Increased respect for the land and life it supports
A spirit of cooperation and sharing of wild food
Development of diverse personal skills
Exposure to socially and ecologically responsible standards
Appreciation for land ownership and rights
Heightened sensory awareness

HUNTING IN THE UNITED STATES

Although wildlife is considered to be a universally important resource that everyone has the right to access, not just anyone can go into the outdoors to harvest an animal. Legal hunting is highly regulated by wildlife agencies, requires a license, and is enforced by specially trained wildlife law officers. A **license** is a permit from a government controlled agency that allows a person to own or use something, perform a specific job, or do a particular task such as hunting. All states have laws in place that require training before a person can qualify for a license that allows them to hunt independently. Almost all of this training focuses on safety, ethics, and the law. **Ethics** are the moral principles and social constructs that guide a person's behavior during an activity.

Even after acquiring a license to hunt a specific game animal, hunters have very strict guidelines they must follow including where and when they hunt and how many of a specific animal they may harvest in a given hunting season. Science serves as the driving force to the creation of these guidelines that establish harvest quotas, laws dealing with specific game animals, and the regulation of hunting practices. All of these ensure that hunted populations of wildlife remain at a sustainable level year after year.

HUNTING PROVIDES FUNDS FOR CONSERVATION

In order to obtain a hunting license for a specific game animal, a hunter or person who fishes is required to pay a small fee for the opportunity to pursue those species. That money is then used to help fund wildlife conservation efforts that benefit all wildlife and people.

Since 1937, state wildlife agencies across the country have raised over 7.6 billion dollars from the sale of hunting and fishing licenses. This money is then used to support natural resource programs that include purchasing public lands for all to enjoy, protecting critical habitats, and helping to restore some **endangered or threatened** wildlife species. An endangered species is an animal or plant that is seriously at risk for extinction. If a species becomes extinct, then it can no longer be found on planet Earth. Hunting and fishing are both highly regulated

Many threatened or nearly extinct species of birds such as trumpeter swans, bald eagles (above), and whooping cranes benefit from the protected habitats purchased from hunting dollars. *Mathew Schwartz/Unsplash.com*

and sustainable systems in North America, however the illegal killing and trading of wildlife remains a key problem today. People that break these regulations and hunt endangered or protected wildlife illegally are called poachers. Poachers violate the laws and steal wildlife resources from the public trust by engaging in illegal activity.

The funding that comes from hunting to purchase habitats doesn't just benefit commonly harvested wildlife such as deer, ducks, and fish. Many threatened or nearly extinct species of birds such as trumpeter swans, bald eagles, and whooping cranes benefit from the protected habitats purchased from hunting dollars. Since hunters and people who fish are the ones "using" the wildlife through their harvest, yet all citizens benefit from the conservation efforts that hunting funds create, this is known as the User-Pay, Public Benefit Model of funding conservation.

OTHER BENEFITS OF HUNTING

Hunting provides other benefits than simply securing the funds needed to protect wildlife. For some species, hunting is used as a tool to help reduce conflicts between humans and wildlife such as collisions between deer and vehicles on roadways, the destruction of crops by wildlife, and threats to livestock and pets.

Many hunters choose to hunt because they believe that the wild game they harvest is a healthy alternative to meat purchased in store. Over 97% of active hunters say they and their families eat the animals that they kill, providing them with a healthy diet alternative.

In addition to their own families, hunters annually donate almost 2.8 million pounds of game meat to charitable organizations to help feed those in need. This act of **charity** highlights the important role that hunted wildlife plays as a sustainable source of food in society.

USER-PAY, PUBLIC BENEFIT

It is through the actions of hunters and their activities in nature that funds are secured for conservation. Generations of future Americans will be able to enjoy both wildlife and the habitats they call home thanks to the user-pay, public benefit system that is in place today in the United States.

Activities

Unit Assessment

DIRECTIONS

Select any three tasks from the Tic Tac Toe board found below to complete three in a row up and down, left to right, or diagonally.

NEWS BROADCAST You will be recording a news broadcast relating to either public trust, the North American Model, or user-pay, public benefit. Inform your viewers on the importance of the topic you chose. Be creative, informative, and professional.	**ART TIME** Create a comic strip or poster outlining the history of one of the three topics covered in this chapter. Be sure you are describing and drawing the timeline of events in each window of your strip or somewhere on your poster.	**RESEARCH** The Public Trust Doctrine came about because of the exploitation of animals. Research an instance where an animal was exploited. Use the 5Ws (who, what, when, where, why) when writing an article about this instance.
BUILD ME The National Parks are a part of the public trust. Create a 3 dimensional model of a famous landform from one of these National Parks. Create a plaque to along with your model that shares important information about the park and landform you have selected.	**MATH** Create and organize a spreadsheet or Google Sheets document showing the money that has been made from the purchase of hunting and fishing licenses in your state for the past 10 years. https://www.fws.gov/wsfrprograms/subpages/licenseinfo/hunting.htm	**MULTIMEDIA** Create some form of multimedia to inform you viewers on public trust, the North American Model, or user-pay, public benefit.. This can be in the form of video, slideshow, etc. that includes visuals, sounds, music. Be sure to include public trust, the North American Model, and user-pay, public benefit.
LETTER TO THE EDITOR Write a response to a letter to the editor that explains the importance of hunting limits as a key part in the conservation efforts in the United States. Persuade others to accept your viewpoint.	**BE THE TEACHER** Take the information you have learned, create anchor charts for public trust, the North American Model, and user-pay, public benefit, and teach your peers the most important information from each of these.	**VIRTUAL FIELD TRIP** Go to a National Wildlife Refuge or other museum website that is related to the topic of modern conservation. Document your "trip" with photos, information, and activities that can be enjoyed while on this trip.

News Broadcast

ACTIVITY INSTRUCTIONS

1. You will make a short news broadcast that relays the importance of one of these topics: the North American Model of Conservation, the Public Trust, or the User-Pay, Public Benefit Funding Model.

2. Other students who select this option could be group together in such a way that the following roles could be filled:

Anchor: Introduces the news story and gives a little bit of background information about why the story in important.
Reporter: Gives more information about the importance of the story from a specific location important to the story. The reporter also interviews people who might have insight about the story.
Interviewee: A specialist or someone else who can otherwise provide the reporter with key facts and details about the story. This person could also be someone who was historically important in the area of conservation.

3. Write out a script for each of the students in your group. Your script will serve as a rough draft of your project and help you in the creation of the actual recording of your newscast.

4. Your newscast can include costumes and props to help get your story across to the viewers.

Work Assessed	Score of 3: Exceeds Expectations	Score of 2: Meets Expectations	Score of 1: Approaches Expectations
Script	The script is very well written, and includes several key details and information about the topic selected that clearly show why the topic is important.	The script is well written, and includes many important details about the topic.	The script is not creative and is poorly written. It includes very few facts and may also include inaccuracies.
Newscast Presentation	The newscast is accurate and well organized, and thoroughly explains key details about the topic. The presentation was fun to watch.	The newscast is accurate and explains key details about the topic selected.	The information in the newscast is incomplete, has some inaccuracies.
Group Work	Members of the group worked well together. All members of the group contributed to the creation of the script and the presentation.	Members of the group worked together. Nearly all members of the group contributed to the creation of the script and the presentation.	The group did not work well together. Work was mainly completed by one or two individuals.

Art Time

ACTIVITY INSTRUCTIONS

1. Go back and look at the important information found in this section about the North American Model, Public Trust, and the User-Pay, Public Benefit Model of funding. You will create a poster/comic strip that shows the timeline of key events that relate to your topic.

2. Present your poster/comic strip to the class outlining the important information you decided to include.

3. When you are almost finished, ask yourself these questions: Does the poster/comic strip provide key facts about the topic? Have many important events been listed in a timeline of your topic? Is your presentation exciting and informative? Use your answers to help you edit your poster/comic strip.

Work Assessed	Score of 3: Exceeds Expectations	Score of 2: Meets Expectations	Score of 1: Approaches Expectations
Poster/ Comic Strip	Poster/Comic Strip is informative, creative, and accurate.	Poster/Comic Strip is informative and accurate, but could be more creative.	Poster/Comic Strip is not informative, accurate, or creative.
Presentation	Presentation of the Poster/Comic Strip is engaging and highlights key details of the topic. The presentation is lively and seems well rehearsed.	Presentation focuses on the key details of the topic selected. The presentation is on target but could be more interesting.	Presentation is disorganized and lacks focus. The presentation is off target or inappropriate for the task or setting.

Research

YOUR WRITING ASSIGNMENT

Research a time when an animal in North America was exploited by humans and steps were taken by either citizens or the government to protect this animal. Remember to include the 5 Ws (Who, What, When, Where, and Why) as you come up with information to share in this informational report.

Remember, a well written informative essay:

1. Has an introduction that catches the reader's attention.
2 States main idea of the essay
3. Uses facts and information about a specific issue that have been put in the writer's own words
4. Provides a conclusion
5. Uses language that is appropriate for the task
6. Follows the standard rules for spelling and grammar

SCORE OF 4	**Does the writing…** • Fully accomplish the task? • Include many relevant ideas? • Organize ideas logically? • Exhibit very good word usage? • Demonstrate very good writing technique? • Demonstrate effective adjustment of language and tone to task and reader?
SCORE OF 3	**Does the writing…** • Accomplish the task? • Include relevant ideas? • Organize ideas logically? • Exhibit good word usage? • Demonstrate good writing technique? • Demonstrate an attempt to adjust language and tone to task and reader?
SCORE OF 2	**Does the writing…** • Minimally accomplish the task? • Include some relevant ideas? • Exhibit an attempt to organize ideas logically? • Exhibit ordinary word usage? • Demonstrate adequate writing technique? • Demonstrate an attempt to adjust language and tone to task and reader?
SCORE OF 1	**Does the writing…** • Only partially accomplish or fail to accomplish the task? • Include few relevant ideas? • Exhibit a minimal attempt to organize ideas logically? • Exhibit minimal word usage or language inappropriate to the task given?

Build Me

ACTIVITY INSTRUCTIONS

1. You will make a three dimensional model of a famous landmark from one of the National Parks found in the United States.

2. Draw a picture of your landmark on a piece of paper as a rough draft. Then use materials such as clay, cardboard, etc. to make your model.

3. Create an informational plaque to go with your model. Include information such as:

- What is the name of the landmark you selected?
- What is the name of the National Park this landform can be found in?
- What year was this National Park founded?
- How many square miles is your National Park?
- What are the main species of animals that can be found around this landmark or in the park?

Use an index card or cardboard that your teacher gives to you to create the plaque.

4. Prepare a short oral presentation about the landmark and National Park, using your completed plaque as a guide.

Work Assessed	Score of 3: Exceeds Expectations	Score of 2: Meets Expectations	Score of 1: Approaches Expectations
Model	The model is very creative, and well constructed.	The model is well constructed.	The model is not creative and is poorly constructed.
Plaque	The information on the plaque is accurate and well organized, and thoroughly explains many key details about the park.	The information on the plaque is accurate and explains key details about the park.	The information on the plaque is incomplete, has some inaccuracies.
Presentation	The presentation offers insightful and accurate information about the park and landmark.	The presentation offers accurate information about the park and landmark.	The information presented fails to explain the importance of the park or landmark.

Math Time

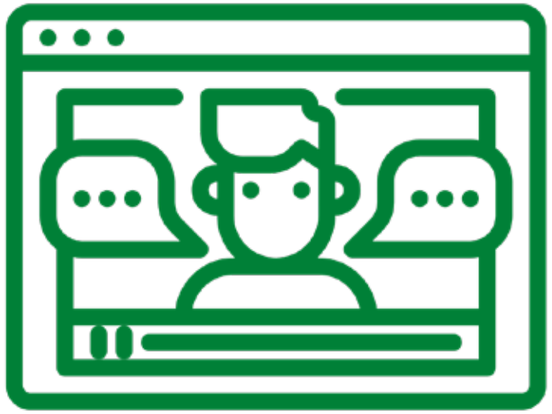
ACTIVITY DIRECTIONS

You will create and organize a spreadsheet or Google Sheets document showing the money that was made from the purchase of hunting and fishing licenses in your state for the past 10 years. You will receive one point for each of the following items you include in your spreadsheet:

- Main title found at the top of the page
- Subtitles for hunting information
- Subtitles for fishing information
- Subtitles for specific years
- Profit made for each year's licenses sold
- The sum of all the profits for the 10 year period for both hunting and fishing

Multimedia Presentation

ACTIVITY INSTRUCTIONS



1. You will make a multimedia presentation that informs the viewer of the key pieces of information that relate to either the North American Model of Conservation, the Public Trust, or the User-Pay, Public Benefit Model of Funding. You can use programs such as PowerPoint, Google Slides, iMovie, etc. To create your presentation.

2. You can include visual graphs, movie clips you record or from sites such as YouTube, sounds, and music to help make your presentation more exciting for the viewer.

3. Once you have completed your presentation, you will deliver it to your classmates and teacher.

Work Assessed	Score of 3: Exceeds Expectations	Score of 2: Meets Expectations	Score of 1: Approaches Expectations
Multimedia Project	The project is informative, creative, and accurate. The presentation includes examples of graphs, sounds, and movie clips that enhance the presentation.	The project is informative and accurate, but could be more creative. There are a few examples of graphs, sounds, movie clips, ect. That help to enhance the presentation.	Project is not informative, accurate, or creative. Few enhancements can be found throughout the project.
Presentation	Presentation of the project is engaging and highlights key details of the topic. The presentation is lively and seems well rehearsed.	Presentation focuses on the key details of the topic selected. The presentation is on target but could be more interesting.	Presentation is disorganized and lacks focus. The presentation is off target or inappropriate for the task or setting.

Be the Teacher

ACTIVITY DIRECTIONS

Taking the information you have learned, create anchor charts for public trust, the North American Model, and User-Pay, Public Benefit, and teach your peers the most important information from each of these.

A great anchor chart does the following:

• Sketch it out! When you can use pictures or sketches instead of words to convey your information, it makes your anchor chart a little more engaging to your class.

• Rough drafts are important! You need to create a smaller version of your anchor chart before you create your larger, final version. This will hopefully keep you from making mistakes on your final.

• Use Sticky Notes! Showing all of the information on your anchor chart at once can be overwhelming for your class. Use sticky notes to cover up information. That way you can reveal small pieces of information at a time.

• Use color effectively! Using different colors can help make different topics and pieces of information stand out to your class.

Work Assessed	Score of 3: Exceeds Expectations	Score of 2: Meets Expectations	Score of 1: Approaches Expectations
Anchor Chart	The chart is informative, creative, and accurate. The chart uses things like different colors, pictures, and sticky notes that enhance the presentation of the information to the “class”.	The chart is informative and accurate, but could be more creative. There are a few examples of different colors, pictures, and sticky notes that help to enhance the presentation of information to the “class.”	The chart is not informative, accurate, or creative. Few enhancements can be found throughout the creation of the anchor chart.
Presentation	Presentation of the project is engaging and highlights key details of the topic. The presentation is lively and seems well rehearsed.	Presentation focuses on the key details of the topic selected. The presentation is on target but could be more interesting.	Presentation is disorganized and lacks focus. The presentation is off target or inappropriate for the task or setting.

Letters to the Editor

THE SAMPLE LETTER

Hunting Limitations Must Be Lifted

Dear Editor:

Recently I have observed a great increase in the number of deer in and around my house, and for the most part, this increase has had a very negative impact on my life. Because of this, it seems like the perfect time to argue for the lifting of hunting limits for these animals in my state.

Last week, while driving to my job, I struck a deer with my car. This accident resulted in thousands of dollars in damage to my car. Since then, I have noticed many other dead deer on the side of the road, no doubt the result of other accidents that also cost drivers money. It seems to me that if hunters were just allowed to hunt as many deer as they would like to, then this would lead to a decrease in the number of deer, leading to less accidents on the road and saving people thousands of dollars.

I have also recently found great joy in gardening and have placed a giant garden in my backyard. The deer raid my garden almost daily, eating many of the plants before I even get a chance to enjoy them. This is not only a nuisance, but it also costs me money, as I must either replace the plants in my garden or buy the vegetables in a store. Again, I must argue that if hunting restrictions were lifted, these deer would be removed from my area by local hunters and my garden would go back to looking beautiful. I have talked to many of my friends, and almost all of them feel the same way. It is time that our state and the Department of Natural Resources lifts the hunting restrictions that have been burdened on the poor hunters so that we can finally get rid of these nuisance animals.

Sincerely yours,

Dakota Daniel

Mishawaka, Indiana

YOUR WRITING ASSIGNMENT

Dakota Daniel has written a letter to the editor of their local newspaper. The letter calls for the lifting of the restrictions that limit the number of deer a hunter may harvest in a given season.

Write a response to Dakota Daniel in the form of a persuasive essay with the viewpoint that hunting restrictions are an important part of the Public Trust Doctrine, the North American Model of Conservation, and help preserve wildlife for future generations.

Be sure to clearly state your opinion about the topic at the beginning of your letter and support your opinion with facts and information from the articles you have read in this section about The North American Model of Conservation and the Public Trust Doctrine.

LETTERS TO THE EDITOR, CONTINUED

Remember, a well written persuasive essay:

- States an opinion
- Gives reasons that support the opinion
- Uses facts and information in an attempt to change someone else's opinion about a specific issue
- Provides a conclusion
- Uses language that is appropriate for the task
- Follows the standard rules for spelling and grammar

SCORE OF 4	**Does the writing…** • Fully accomplish the task? • Include many relevant ideas? • Organize ideas logically? • Exhibit very good word usage? • Demonstrate very good writing technique? • Demonstrate effective adjustment of language and tone to task and reader?
SCORE OF 3	**Does the writing…** • Accomplish the task? • Include relevant ideas? • Organize ideas logically? • Exhibit good word usage? • Demonstrate good writing technique? • Demonstrate an attempt to adjust language and tone to task and reader?
SCORE OF 2	**Does the writing…** • Minimally accomplish the task? • Include some relevant ideas? • Exhibit an attempt to organize ideas logically? • Exhibit ordinary word usage? • Demonstrate adequate writing technique? • Demonstrate an attempt to adjust language and tone to task and reader?
SCORE OF 1	**Does the writing…** • Only partially accomplish or fail to accomplish the task? • Include few relevant ideas? • Exhibit a minimal attempt to organize ideas logically? • Exhibit minimal word usage or language inappropriate to the task given?

Virtual Field Trip

ACTIVITY DIRECTIONS

1. Select a state park, national park, wildlife refuge, or other museum or scientific institution that is a part of one of the three topics covered in this chapter: the North American Model of Conservation, the Public Trust, or the User-Pay, Public Benefit Funding Model.

2. Create a short presentation that outlines all of the things that could be seen, done, and enjoyed if someone were to take a field trip to this location. You can include pictures of landmarks and wildlife that could be seen there, activities that can be done there, and other information that you'd learn if you visited the site.

3. Be sure to include information about cost for entering the park or museum you selected as well as the cost for different activities people can do while visiting this site.

4. Also be sure to include why your park or museum is a key part of either the North American Model of Conservation, the Public Trust, or the User-Pay, Public Benefit Model of Funding Conservation.

5. Once finished, you will present your project to the class.

Work Assessed	Score of 3: Exceeds Expectations	Score of 2: Meets Expectations	Score of 1: Approaches Expectations
Virtual Field Trip	The virtual field trip is informative, creative, and includes accurate information. The "trip" includes many photos and examples of activities. It also includes cost information and fully explains why this site is important to the topics available.	The virtual field trip is informative and includes accurate information. The "trip" includes photos and examples of activities. It also includes most of the cost information and explains why this site is important to the topics available.	The virtual field trip is not informative, accurate, or creative. It includes few photos and examples of activities. Cost information and explanation of importance is inadequate or missing.
Presentation	Presentation of the project is engaging and highlights key details of the topic. The presentation is lively and seems well rehearsed.	Presentation focuses on the key details of the topic selected. The presentation is on target but could be more interesting.	Presentation is disorganized and lacks focus. The presentation is off target or inappropriate for the task or setting.

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THE AUTHORS

Jeff Sankey is an elementary educator with nearly two decades of classroom experience. He has focused primarily on teaching social studies and language arts and creating thoughtful tools that support student growth and engagement. He received his degree in elementary education from Indiana University. When not in the classroom, Jeff enjoys educating youth in both water safety and swimming as a private instructor.

Megan Sankey has been a leader in elementary school education in science and math for over two decades. Her areas of expertise extends to reading and comprehension and she focuses on challenging students' to prepare for their future success. She received her degree in elementary education from Indiana University. Megan enjoys reading and spending time with her family when she is able to step away from the classroom each summer.

TECHNICAL EDITOR

Zachary Lowe, Ph.D. is the Executive Director of the Western Association of Fish and Wildlife Agencies. His primary career responsibilities have been to develop partnerships, identify key conservation needs, and deliver results-based programing. Dr. Lowe has a diverse professional background within the disciplines of land management, wildlife science, conservation education, and program administration. His early career started as an Extension Habitat Specialist, and he was the Director of the Conservation Leaders for Tomorrow Program at the Max McGraw Wildlife Foundation for over a decade. He holds B.S. degrees in Wildlife Science and in Fisheries and Aquatic Science and a Ph.D. in restoration ecology from Purdue University. Zach enjoys a life spent with his family in wild places working to bridge the gap between humans, sustainability, and nature.

SPECIAL THANKS

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Elena Takaki, *Project WILD, Director. The Association of Fish and Wildlife Agencies*
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Kim Morris-Zarneke, *Georgia Department of Natural Resources, Wildlife Resources Division*
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About the Organizations

The Max McGraw Wildlife Foundation of Dundee, Illinois, is a nonprofit organization that aims to secure the future of hunting, fishing and land management through programs of science, education, demonstration and communication. Its Conservation Leaders for Tomorrow is the leading hunting-awareness program for natural-resources students and professionals, having graduated more than 2,400 individuals in the past 17 years. McGraw also is a leading research facility for wildlife and fisheries management and has been the launching ground for scores of wildlife biologists and other scientists at the outset of their careers.

The Association of Fish and Wildlife Agencies of Washington D.C., represents North America's fish and wildlife agencies to advance sound, science-based management and conservation of fish and wildlife and their habitats in the public interest. The Association represents its state agency members on Capitol Hill and before the Administration to advance favorable fish and wildlife conservation policy and funding and ensure that all entities work collaboratively on the most important issues. Project WILD is a national K-12 education program within AFWA that provides wildlife-based conservation and environmental education that acts to foster responsible actions toward wildlife and related natural resources.

Appendix

Oh, Deer! A study in population dynamics

"Oh, Deer!" used with permission from the Association of Fish & Wildlife Agencies.

Oh, Deer!

Grade Level: Upper Elementary, Middle School, High School

Content Areas: Science, Environmental Education, Mathematics, Physical Education

Method: Students represent deer and habitat components in a physical activity that demonstrates population fluctuations, carrying capacity, and limiting factors.

Materials: An area—either indoors or outdoors—large enough for students to run (e.g., playing field), chalkboard or flip chart; writing materials; **OPTIONAL:** Props for variations such as masks, vests, etc.

Activity Time: one or two 45-minute sessions

People Power: 15 and larger recommended

Setting: indoors or outdoors; large area for running needed

Conceptual Framework Topic Reference: WPIIA, WPIIA2, WPIIA2a, WPIIA2a1, WPIIA2a2a, WPIIA2a2b, WPIIA2a2ci, WPIIA2a2cii, WPIIA2b2, WMIIIB, IDIA, IDIIB, ECIIC

Terms to Know: habitat, limiting factors, carrying capacity, cultural carrying capacity, predator, prey, population, balance of nature, ecosystem, overshoot

Appendices: Simulations, The Ecosystem Concept and Project WILD, Early Childhood Extensions

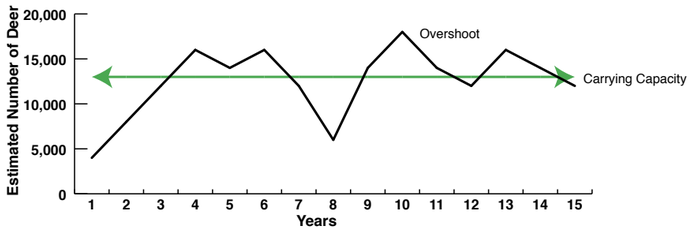
A study in population dynamics.

Objectives

Students will (1) identify and describe food, water, and shelter as three of four essential components of habitat; (2) describe factors that influence carrying capacity; (3) define "limiting factors" and differentiate between natural and human-caused limiting factors; and (4) recognize that some fluctuations in wildlife populations are natural as ecological systems undergo constant change.

Background

Carrying capacity is the maximum population size of a particular species a habitat can sustain for a period of time. This is based on a dynamic balance between the availability of habitat components and the number of animals occupying an area. Carrying capacity of a sample deer population might look something like the graph below.



A variety of factors related to carrying capacity affect the ability of wildlife species to successfully reproduce and to maintain their populations over time. The most fundamental of life's necessities for any animal are food, water, shelter, and space in a suitable arrangement. Without these essential components, animals cannot survive. Often a population will overshoot the carrying capacity, depleting available resources. The population will naturally decrease to a more suitable size for that habitat, allowing the resources to recover. However, some natural and human-caused limiting factors also prevent wildlife populations from reproducing in numbers greater than their habitat can support.

Disease, predator-prey relationships, wildfires, and varying impacts of weather conditions from season to season (e.g., early freezing, heavy snows, flooding, drought) are naturally caused limiting factors, while vehicle collisions, environmental pollution, and habitat destruction and degradation are human-caused limiting factors. An excess of such limiting factors can lead to threatening, endangering, and eliminating whole species of animals. The long-term carrying capacity of a habitat may be diminished if its resources are damaged to an extent that prohibits them from replenishing at a sustainable rate.

This activity illustrates that

- good habitat is the key to wildlife survival,
- a population will continue to increase in size until some limiting factor(s) occur,
- limiting factors contribute to fluctuations in wildlife populations, and
- nature is never in perfect balance, but is constantly changing.

Wildlife populations are not static. They continuously fluctuate in response to a variety of stimulating and limiting factors. We tend to speak of limiting factors as applying to a single species, although one factor may affect many species. For example, a habitat change may increase the habitat's carrying capacity for one species while decreasing that of another. Carrying capacity limitations can result in competition among domestic animals, wildlife, and humans. "Cultural carrying capacity" refers to the largest number of a wildlife species that humans will tolerate in their community.

Natural limiting factors, or those modeled after factors in natural systems, tend to maintain populations of species at levels within predictable ranges. This kind of "balance in nature" is not static but is more like a teeter-totter than a balance. Some species fluctuate over a five- or ten-year period (see the example of lynx and snowshoe hair populations in the "Extensions" section), while other species cycle annually. Quail, for example, may start with a population of 100 pairs in early spring, grow to a population of 1,200 birds by late spring, and decline slowly to a winter population of 100 pairs again. This cycle appears to be almost totally controlled by the habitat components of food, water, shelter, and space, as well as natural predators, which are also limiting factors. Habitat components are the most fundamental and the most critical of limiting factors in most natural settings.

While this activity is a simple simulation of fluctuations in a deer population, it is a powerful way for students to grasp several basic ecological concepts: 1) everything in natural systems is interrelated; 2) populations of organisms are continuously affected by elements of their environment; and 3) populations of animals are continually changing in a process of maintaining dynamic equilibrium in natural systems.

WILD Work

Wildlife Biologists study and manage wildlife populations and their habitats. **Wildlife Technicians** conduct fieldwork such as capturing and tagging wildlife or modifying habitat. **Foresters** study and manage the forest ecosystem. **Reproductive Physiologists** research breeding and animal behavior. These professions use math to determine population dynamics and carrying capacity, factors that inform management decisions. To find out more about these related careers, visit ***www.projectwild.org***.

Disease, predator-prey relationships, wildfires, and varying impacts of weather conditions from season to season (e.g., early freezing, heavy snows, flooding, drought) are naturally caused limiting factors, while vehicle collisions, environmental pollution, and habitat destruction and degradation are human-caused limiting factors.

Procedure

1. Tell students they will be participating in an activity that emphasizes the most essential things animals need in order to survive. Review the essential components of habitat with the students: food, water, shelter, and space in a suitable arrangement. This activity emphasizes three of those habitat components—food, water, and shelter—but the students should not forget the importance of the animals having sufficient space in which to live, and that all the components must be in a suitable arrangement for wildlife populations to be maintained.

2. Ask students to count off in fours. Mark two parallel lines on the ground or floor 10 to 20 yards apart. Have the ones line up behind one line; the rest of the students line up behind the other line, facing the ones.

3. The ones become "deer." All deer need good habitat to survive. Again ask the students what the essential components of habitat are (food, water, shelter, and space in a suitable arrangement). For this activity, assume that the deer have enough space in which to live. The deer (the ones) need to find food, water, and shelter to survive. A deer can choose to look for any one of its needs during each round or segment of the activity; the deer cannot, however, change what it is looking for (e.g., when it sees what is available during that round). It can change what it is looking for in the next round, if it survives.

4. The twos, threes, and fours are food, water, and shelter—components of habitat. Each student is allowed to choose at the beginning of each round which component he or she will be during that round.

5. The activity starts with all players lined up behind their respective lines (deer on one side, habitat components on the other side)—and with their backs facing the students along the other line.

6. Explain to the students that they will represent their choices using hand signals. Have the students at each end turn away from each other with closed eyes, and give the students a few moments to put their hands in place—hands on stomach is food, hands together over head is shelter, and hands over mouth is water. Instruct students that once the round begins they cannot change their sign. Students will then turn to face each other to see what their choices are. As the activity proceeds, sometimes the students confer with each other and all make the same sign. For example, all students in the habitat might decide to be shelter. (That could represent a drought year with no available food or water, similar to the third option in the "Variations" section. While this is okay, do not encourage it.) **OPTION:** Instead of hand signals, use color tokens or card necklaces to represent the components of habitat. Have three habitat tokens or cards per student to represent food, water, and shelter.

7. When students are ready, say, "Oh Deer!" Each deer and each habitat component turn to face the opposite group, holding their hand signals clearly.

8. When deer see the habitat component they need (a student with the same hand sign), they should safely hurry to get it. Each deer that reaches its necessary habitat component takes the "food,""water," or "shelter" back to the deer side of the line. "Capturing" a component represents the deer successfully meeting its needs and successfully reproducing as a result. Any deer that fails to find its food, water, or shelter dies and becomes part of the habitat. That is, any deer that died will be a habitat component in the next round and so is available as food, water, or shelter to the deer that are still alive.

NOTE: When more than one deer reaches a habitat component, the student who arrives there first survives. Habitat components stay in place until a deer chooses them. If no deer needs a particular habitat component during a round, the habitat component just stays where it is in the habitat. The habitat component can, however, change which component it is from round to round.

9. Record the number of deer at the beginning of the activity and at the end of each round. Continue the activity for approximately 15 rounds using "limiting factors" suggested below after several rounds.

10. At the end of the 15 rounds, bring students together to discuss the activity. Encourage them to talk about what they experienced and saw. For example, they saw a small herd of deer (7 students in a class size of 28) begin by finding more than enough of its habitat needs. However, because the population of deer expanded over two to three rounds of the activity until it exceeded the carrying capacity of the habitat, there was not sufficient food, water, and shelter for all members of the herd. At that point, deer starved or died of thirst or lack of shelter, and they returned as part of the habitat. Such things happen in nature also.

NOTE: In real life, large mammal populations might also experience higher infant mortality and lower reproductive rates as a result of limited resources.

11. After several rounds, explain that the deer population has been naturally limited by available habitat components when the number of deer rises above the carrying capacity of the habitat. Define "limiting factor," and ask students for examples of what other factors might naturally limit a wildlife population (changes in precipitation, early freezing, disease, predator-prey relationships, fire, etc.). What examples of human-induced or human-caused limiting factors can they give (vehicle collisions, poaching, habitat alterations, environmental pollution, etc.)? Before graphing the results from the previous rounds, perform one or more of the options listed in the "Variations" section. Each of the options represents an additional limiting factor. Have students identify whether the variation represents a natural or human-caused limiting factor. Record the number of deer at the end of each round.

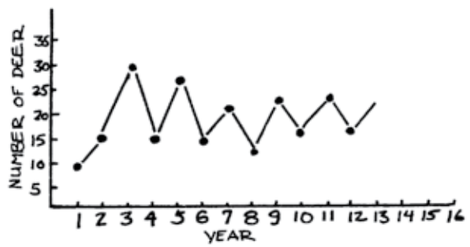
12. Using a flip chart pad or whiteboard, post the data recorded during the activity in a T-chart. The numbers of deer at the beginning of the activity and at the end of each round represent the numbers

In Step with STEM

- Instead of graphing the data for students as described in Step 12 of the "Procedure" section, have students create their own graphs using graph paper or computer software.
- Use a calculator to determine the area of the game field. Compare space available per deer for each round. How do these numbers compare to the actual area required by a white-tailed deer?
- Determine the mean, median, and mode for the deer population for all of the rounds combined. Based on these numbers, what might be the carrying capacity of your class's deer "habitat"?
- Calculate the percent increase or decrease in the deer population from one round to the next. What is the average rate of increase and decrease? Does this rate change when a predator or other limiting factor is introduced?
- Consider analyzing another wildlife species population. Have students graph the population changes over time. For a data set on the Indiana bat, visit ***www.projectwild.org***. (The data set online will allow students to generate a graph identical to the graph in Step 5 of the "Assessment" section). Students can make graphs using graph paper or graphing software on a computer.

of deer in a series of years. That is, the beginning of the activity is year one; each round is an additional year. For example, the start of a T-chart would look something like the table on the left:

Year	*Number of Deer*
1	*10*
2	*15*
3	*30*
4	*15*
5	*27*
6	*15*



From this chart, graph the data and recall any limiting factors that were present during a round and how that affected the population. Students will see that the deer population fluctuated over a period of years. This process is natural as long as the factors that limit the population do not become excessive to the point that the animals cannot successfully reproduce. The wildlife populations will tend to peak, decline, and rebuild, peak, decline, and rebuild—as long as there is good habitat and sufficient numbers of animals to reproduce successfully. Although the numbers from year to year fluctuate, the overall population trend is stable around the carrying capacity. Based on the data points, about how many deer can the habitat support? Just as the population size varies year to year, the carrying capacity will change in response to overall habitat changes. What might cause the carrying capacity to increase? What might cause the carrying capacity to decrease?

NOTE: In the graph shown above, the points represent discrete data collected each round during the simulation. It is important for students to understand that when drawing lines to connect the data points, the lines do not represent continuous data. Rather, the lines are used to show incremental changes from round to round that illustrate an overall trend.

13. What is realistic and unrealistic about this simulation? (Deer that do not survive do become recycled as nutrients, but it is not instantaneous. Deer need all habitat components to survive. Poor habitat usually results in a weakened individual that succumbs to disease, not instant death.)

14. In discussion, ask students to summarize some of the things they learned from this activity. What do animals need to survive? How do these components influence carrying capacity? What are some limiting factors that affect the survival of animals? How do factors that limit carrying capacity affect the health, numbers, and distribution of animals? How do these factors affect competition within a species? Why is good habitat important for animals? Are wildlife populations static, or do they tend to fluctuate as part of an overall balance of nature? Is nature ever really in balance, or are ecological systems involved in a process of constant change? Why are state and federal government agencies (acting on the behalf of their citizens) interested in maintaining balanced wildlife populations?

Variations

1. After students have played several rounds of "Oh Deer!," introduce a predator such as a mountain lion or wolf into the simulation. The predator starts in a designated "predator den" area off to the side. The predator has to skip or hop. This impediment reduces the possibility of violent collisions between deer and predator. The predator can tag deer only when they are going toward the habitat and are between the habitat and deer lines. Any tagged deer are "eaten," meaning the predator has successfully met its needs and successfully reproduced as a result. The tagged deer move to the predator den and will return as predators in the subsequent round. Predators that fail to tag someone die and become habitat. That is, in the next round the predators that died join the habitat line. They will become available to surviving deer as food, water, or shelter. During each round, keep track of the number of predators as well as the number of deer. Incorporate the data into the graphs and interpret the results of introducing the predator.

2. Poker chips or candy can be used to demonstrate how diseases such as Epizootic Hemorrhagic Disease (EHD) or Chronic Wasting Disease (CWD) affect deer populations. At the beginning of a round, discreetly hand a poker chip to some of the students representing habitat components; instruct them to keep the chip in their pockets or otherwise hidden. At the end of the round, ask students who had poker chips to identify themselves. Different-colored chips can represent different diseases, or the focus can be kept on one disease. (The types of diseases and number of chips distributed can be based on local diseases and their distribution.) The total number of infected deer for the round depends on the disease contracted. Lyme disease is typically transmitted by ticks; EHD is transmitted by biting insects such as midges and gnats. The deer who captured the habitat component with a chip will die and return to the habitat. CWD can be spread from one deer to another by close proximity of the deer, so the captured habitat component will count as an infected deer for the next round. The spread of CWD can also be illustrated by placing a pile of wrapped candy in the middle of the open space without telling students why it is there. Some students will pick up a piece or two during the activity. At the end of the round, explain that the students who picked up candy from the "bait pile" have contracted the disease and have infected any habitat component collected. After the activity, discuss different ways that diseases spread, such as via ticks (Lyme disease), gnats and midges (EHD), habitat contaminations or close contact with other deer (CWD), and so on.

3. During a drought year, there is less water available and consequently less vegetation for browsing. Tell all students to represent shelter, except for a couple of students who will represent vegetation.

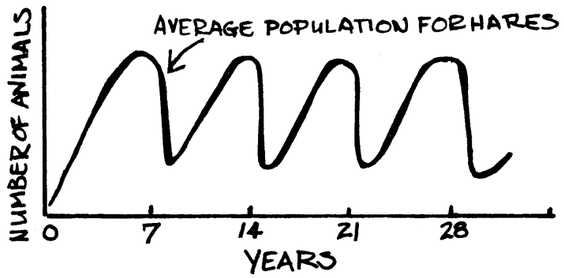
4. Tell students that a major highway has been built across the habitat. Have a student spread his or her arms out wide and drive across the habitat while the deer are crossing, representing deer-vehicle collisions. This can reinforce the importance of the arrangement of components of habitat.

Natural limiting factors, or those modeled after factors in natural systems, tend to maintain populations of species at levels within predictable ranges. This kind of "balance in nature" is not static but is more like a teeter-totter than a balance. Some species fluctuate over a five- or ten-year period, while other species cycle annually.

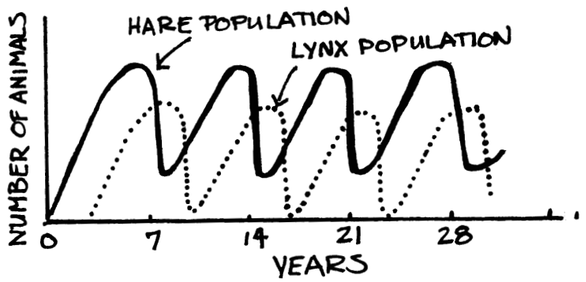
5. To demonstrate bag limits (i.e., hunting restrictions), the predator can be a hunter. The hunter will only be allowed to harvest one doe, for example. The limits can be set based on local hunting regulations. After introducing a legal hunter, have one student be a poacher who takes as many deer as possible.

Extensions

1. When students have finished tabulating, graphing, and discussing the data, ask them if they have ever heard of the Hudson Bay trappers in American history. Tell students briefly who the trappers were and explain that there are a hundred years or more of records of their activities. In these records are some interesting data that refer to pelts shipped from America to Europe, particularly the pelts of snowshoe hares and lynx. Researchers have found that snowshoe hare populations seem to peak about every seven to nine years and then crash, repeating the process over each comparable time period. A snowshoe hare population graph would look like this:



It also has been discovered that lynx populations do the same thing— except that they do it one year behind the hare populations. The combined graph would look like this:



Plot both sets of data on a graph, adding first the hares and then the lynx. Ask the students these questions:

- Which animal is the predator? Which is the prey?
- Are predators controlling the prey, or are prey controlling the predators? (The number of prey animals available is an indicator of how many predators can live in the area.)
- How is this graph similar to the one created in the deer habitat activity? Who or what controls the population fluctuations? (Sometimes the habitat—when the deer population is not too large; sometimes the deer—when the deer population destroys the vegetative food and cover.)

2. Additional research has added a new dimension to the story of the snowshoe hares and the lynx. It has been found that a major winter food of the hare is a small willow. As the hare population grows, the use of the willow plants grows too. However, when the willow plant has been "hedged" or eaten back too far, the plant generates a toxin (poison) so the hare cannot eat it. That is when the hare population crashes, followed by the crash of the lynx population about a year later. Then the willow is able to grow again. The hare population begins to grow in response, and last of all, within a year or so, the lynx population follows. And the cycle has begun again—over and over—every seven to nine years.

3. Discuss the balance of nature. Is it ever in balance? Explain.

Aquatic Extension

Do the activity in exactly the same fashion, except substitute an aquatic species of wildlife. The essentials are the same. In this case, rather than assuming all the necessary space is available, assume all the water is available, but oxygen is needed, as is food and shelter. Then conduct the activity in the same fashion. The objective remains the same, except that now food, shelter, and oxygen are the three essential components of habitat that students will represent. Manatees, salmon, and frogs are examples of possible aquatic species to use in this extension.

Assessment

1. Identify three of the four essential components of habitat.

2. Define "limiting factors." Identify three examples and state whether they are caused by humans or natural limiting factors. Explain how both types of factors may play a role in wildlife population fluctuations.

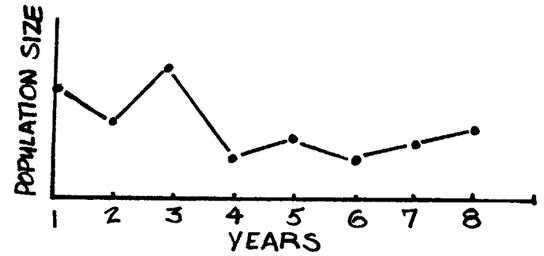
3. Examine the graph at right. What factors may have caused the following population changes:

a. between years 1 and 2?

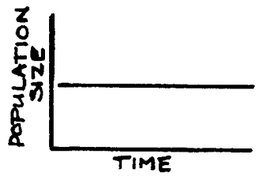
b. between years 3 and 4?

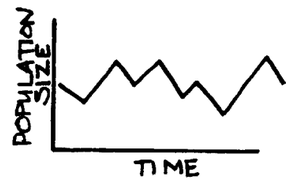
c. between years 4 and 5?

d. between years 7 and 8?

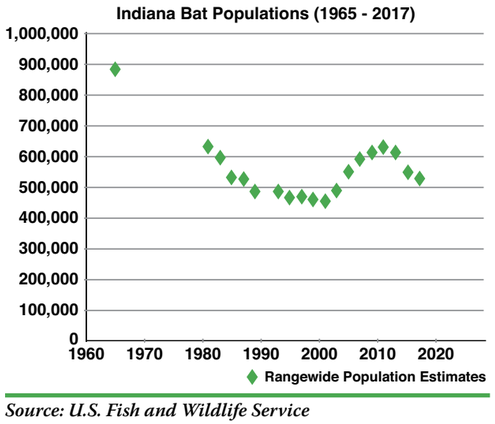


4. Which of the graphs at right represents the more typically balanced population?





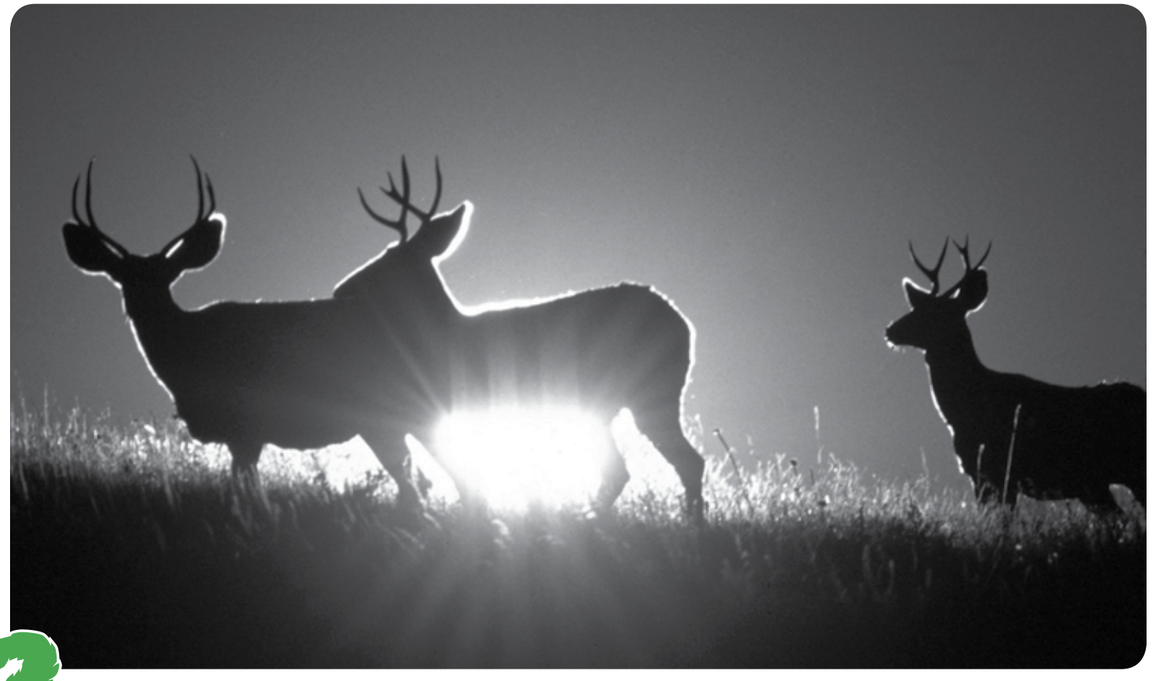
5. The graph on the following page shows the population of the Indiana bat, which was listed in 1967 as endangered according to the Endangered Species Act. Some of the factors that caused the Indiana bat population to decline include people disturbing bat caves, particularly during hibernation; loss of summer habitat; pesticides; and disease. Which of these limiting factors are natural? Which are human-caused? Indiana bats roost in large numbers in a relatively small number of caves, making their populations especially vulnerable when those caves are disturbed. If a cave is disrupted or altered, how will the carrying capacity of the Indiana bat's habitat be affected? Certain areas were protected as critical habitat for the Indiana bat in 1976. Based on the graph, when does the data indicate the bat population began to recover?



Source: U.S. Fish and Wildlife Service

6. Instead of yearly data, consider population fluctuations that happen within a year's time. Research local species that have many young, such as birds or rodents. What happens to their population during a year's time? If all the young survived, would they exceed their habitat's carrying capacity? Are there seasonal patterns? Why or why not? (For example, certain seasons may bring plentiful food, cover, and good weather, but many do not survive a harsh winter.) Are there other factors common to these species—relative size, whether it is a predator or prey, the amount of habitat resources it requires, etc.? (For example, some species need many young to survive predation.) Graph your findings and discuss the species' population variations as a survival strategy.

7. Discuss how living in a suburban area could influence population size of a deer herd. For example, if deer find plentiful food through tasty landscape plants or artificial feeding, the deer may give birth to twins and triplets. How would that affect the population in a suburban setting? Consider the availability of other components of habitat in a suburban setting such as cover and space, the existence or lack of predators, and human-wildlife conflict in your discussion. (**OPTION:** Conduct several rounds as if in a suburban setting, allowing the deer to take two food components back to simulate having twins. Limit predation in limiting factors. What happens with a high birth rate, few predators, and no hunting allowed?) Is there a difference between biological carrying capacity of an area and human tolerance for a species? What are some methods being used by municipalities to control deer populations? Are some methods more acceptable or successful than others? What are some of the biological, economic, and ethical considerations when managing suburban deer populations?



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